VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

Autonomous Institute, Affiliated to JNTUH

Approved by AICTE, Accredited by NAAC and ISO 9001:2015 Certified

Shamshabad - 501 218, Hyderabad, Telangana State, India.

www.vardhaman.org

BACHELOR OF TECHNOLOGY

MECHANICAL ENGINEERING

(Accredited by NBA)

CURRICULUM AND SYLLABI (VCE R18)

UNDER CHOICE BASED CREDIT SYSTEM

B. Tech. - Regular Four Year Degree Program

(For batches admitted from the Academic Year 2018 - 2019)

&

B. Tech. - Lateral Entry Scheme

(For batches admitted from the Academic Year 2019 - 2020)

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

PROGRAM CURRICULUM STRUCTURE
B. TECH - MECHANICAL ENGINEERING

REGULATIONS: VCE-R18

I YEAR I SEMESTER

Induction Program for Three Weeks

Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4001	Linear Algebra and Ordinary Differential Equations	BSC	3	1	0	4	30	70	100
A4005	Oscillations, Waves and Optics	BSC	4	0	0	4	30	70	100
A4501	Programming for Problem Solving	ESC	3	1	0	4	30	70	100
A4301	Engineering Graphics and Computer Aided Drafting	ESC	0	0	3	1.5	30	70	100
A4006	Oscillations, Waves and Optics Laboratory	BSC	0	0	2	1	30	70	100
A4502	Programming for Problem Solving Laboratory	ESC	0	0	3	1.5	30	70	100
A4021	Social Innovation	ESC	0	0	2	1	30	70	100
	TOTAL		**10**	**02**	**10**	**17**	**210**	**490**	**700**

I YEAR II SEMESTER

Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4002	Advanced Calculus	BSC	3	1	0	4	30	70	100
A4007	Engineering Chemistry	BSC	4	0	0	4	30	70	100
A4303	Engineering Mechanics	ESC	3	1	0	4	30	70	100
A4009	Functional English	HSMC	3	0	0	3	30	70	100
A4302	Engineering Workshop	ESC	0	0	3	1.5	30	70	100
A4008	Engineering Chemistry Laboratory	BSC	0	0	2	1	30	70	100
A4304	Engineering Mechanics Laboratory	ESC	0	0	3	1.5	30	70	100
A4010	English Language Communication Skills Laboratory	HSMC	0	0	2	1	30	70	100
A4022	Engineering Exploration	ESC	0	0	2	1	30	70	100
	TOTAL		**13**	**02**	**12**	**21**	**270**	**630**	**900**

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

PROGRAM CURRICULUM STRUCTURE
B. TECH - MECHANICAL ENGINEERING

REGULATIONS: VCE-R18

II YEAR I SEMESTER

Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4025	Managerial Economics and Financial Analysis	HS	3	0	0	3	30	70	100
A4206	Basic Electrical and Electronics Engineering	ES	3	0	2	4	30	70	100
A4305	Mechanics of Solids	PC	3	1	2	5	30	70	100
A4306	Thermodynamics	PC	3	1	0	4	30	70	100
A4307	Metallurgy and Material Science	PC	3	0	2	4	30	70	100
A4019	Verbal Ability and Logical Reasoning	HS	1	0	0	1	30	70	100
A4013	Gender Sensitization	MC	2	0	0	0	-	100*	100*
		TOTAL	**18**	**02**	**06**	**21**	**180**	**420**	**600**

II YEAR II SEMESTER

Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4012	Probability and Statistics	BS	3	0	0	3	30	70	100
A4308	I.C. Engines and Gas Turbines	PC	3	0	2	4	30	70	100
A4309	Kinematics of Machinery	PC	3	0	0	3	30	70	100
A4310	Fluid Mechanics and Hydraulic Machines	PC	3	0	2	4	30	70	100
A4311	Manufacturing Processes	PC	3	0	2	4	30	70	100
A4312	Machine Drawing	PC	0	0	4	2	30	70	100
A4017	Quantitative Aptitude	HS	1	0	0	1	30	70	100
A4014	Environmental Science	MC	2	0	0	0	-	100*	100*
		TOTAL	**18**	**0**	**10**	**21**	**210**	**490**	**700**

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

PROGRAM CURRICULUM STRUCTURE
B. TECH - MECHANICAL ENGINEERING

REGULATIONS: VCE-R18

III YEAR I SEMESTER									
Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4313	Dynamics of Machinery	PC	3	0	2	4	30	70	100
A4314	Metrology and Machine Tools	PC	3	0	2	4	30	70	100
A4315	Design of Machine Elements	PC	3	1	0	4	30	70	100
A4316	Applied Thermodynamics	PC	3	1	0	4	30	70	100
	Professional Elective – I	PE	3	0	0	3	30	70	100
A4317	Internship – I	PW	0	0	4	2	100	-	100
A4018	Engineering Design Thinking	ES	0	0	2	1	30	70	100
A4015	Essence of Indian Traditional Knowledge	MC	2	0	0	0	-	100*	100*
	TOTAL		**17**	**02**	**10**	**22**	**280**	**420**	**700**

III YEAR II SEMESTER									
Code	**Course**	**Category**	**Periods per Week**			**Credits**	**Assessment Tools Maximum Marks**		
			L	**T**	**P**		**CIE**	**SEE**	**Total**
A4318	Machine Design	PC	3	1	0	4	30	70	100
A4319	Heat Transfer	PC	3	0	2	4	30	70	100
A4320	CAD/CAM	PC	3	1	2	5	30	70	100
	Open Elective – I	OE	3	0	0	3	30	70	100
	Professional Elective – II	PE	3	0	0	3	30	70	100
A4020	Product Realization	ES	0	0	2	1	30	70	100
A4321	Mini Project	PW	0	0	4	2	100	-	100
A4016	Indian Constitution	MC	2	0	0	0	-	100*	100*
	TOTAL		**17**	**02**	**10**	**22**	**280**	**420**	**700**

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

PROGRAM CURRICULUM STRUCTURE
B. TECH - MECHANICAL ENGINEERING

REGULATIONS: VCE-R18

IV YEAR I SEMESTER									
Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4322	Finite Element Methods	PC	3	0	2	4	30	70	100
A4323	Robotics	PC	3	0	0	3	30	70	100
	Open Elective – II	OE	3	0	0	3	30	70	100
	Professional Elective – III	PE	3	0	0	3	30	70	100
A4325	Internship - II	OE	0	0	4	2	100	-	100
A4324	Project Work Phase – I	PW	0	0	8	4	100	-	100
	TOTAL		**12**	**0**	**14**	**19**	**320**	**280**	**600**

IV YEAR II SEMESTER									
Code	Course	Category	Periods per Week			Credits	Assessment Tools Maximum Marks		
			L	T	P		CIE	SEE	Total
A4026	Management Science	HS	3	0	0	3	30	70	100
	Open Elective – III	OE	3	0	0	3	30	70	100
	Professional Elective – IV	PE	3	0	0	3	30	70	100
A4326	Project Work Phase – II	PW	0	0	16	8	100	100	100
	TOTAL		**9**	**0**	**16**	**17**	**190**	**310**	**500**

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

PROGRAM CURRICULUM STRUCTURE
B. TECH - MECHANICAL ENGINEERING

REGULATIONS: VCE-R18

Professional Elective Course - I			
Code	**Course**	**Code**	**Course**
A4351	Additive Manufacturing	A4352	Automobile Engineering
A4353	Solid Mechanics		
Professional Elective Course – II			
A4354	Composite Materials	A4355	Energy Conservation and Management
A4356	Tribology		
Professional Elective Course – III			
A4357	Automation in Manufacturing	A4358	Power Plant Engineering
A4359	Process Planning and Estimation		
Professional Elective Course – IV			
A4360	Total Quality Management	A4361	Refrigeration and Air Conditioning
A4362	Micro Electro Mechanic Systems		
Open Electives			
Code	**Course**	**Code**	**Course**
A4131	Project Planning and Management	A4531	Fundamentals of JAVA
A4132	Environmental Pollution and Management	A4532	Operation Research
A4133	Disaster Management	A4533	Fundamentals of DBMS
A4231	Transducers and Measurements	A4534	Fundamentals of Operating Systems
A4232	Solar Energy and Applications	A4631	Principles of Software Engineering
A4233	Energy Management and Audit	A4632	E-Commerce Trends
A4331	Basic Mechanical Engineering	A4633	Fundamental of Cyber Security
A4332	Introduction to 3D Printing	A4031	Numerical Techniques
A4333	Fundamentals of Robotics	A4032	Mathematical Programming
A4431	Fundamentals of IoT	A4033	Special Functions
A4432	Principles of Analog and Digital Communications	A4034	Entrepreneurship Development
A4433	Introduction to Signal Processing	A4035	Human Resource Management
		A4036	Logistics and Supply Chain Management

SYLLABI FOR I YEAR I SEMESTER

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4001-LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course Overview

This course offers more advanced topics of mathematics required to analyze the problems in engineering. Topics to be covered in this course include: Solution of system of linear equations, Eigen values and Eigen vectors, Quadratic forms, Differential equations and their applications, Laplace transforms and its applications to ordinary differential equations. The mathematical skills derived from this course provides necessary base to analytical and theoretical concepts occurring in the program.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4001.1 Solve system of linear equations using rank of a matrix

A4001.2 Examine the nature of Quadratic form using Eigen values and Eigen vectors

A4001.3 Solve the first and higher order linear ordinary differential equations

A4001.4 Make use of ordinary differential equations to solve, Rate of growth/decay, Newton's law of cooling, Electrical circuits and Simple harmonic motion problems

A4001.5 Apply Laplace transforms to solve ordinary differential equations

3. Course Syllabus

Theory Of Matrices: Real, Complex matrices and their properties, Rank of a matrix by reducing to Echelon form and Normal form, Inverse of a matrix by Gauss-Jordan method, Consistency of system of linear equations using the rank of a matrix.

Eigen Values, Eigen Vectors And Quadratic Forms: Linear dependence and independence of vectors, Linear transformation, Eigen values and Eigenvectors of a matrix, Properties of Eigen values and Eigen vectors of real and complex matrices, Cayley-Hamilton theorem (statement and verification), Inverse and powers of a matrix using Cayley-Hamilton theorem, Diagonalization of a matrix, Quadratic forms up to three variables: Rank, index, signature and nature of quadratic forms, Reduction of quadratic form to canonical form by orthogonal transformation.

Ordinary Differential Equations Of First Order: Differential equations of first order and first degree: Exact equations and equations reducible to exact form using integrating factors, Linear and Bernoulli's equations. Equations not of first degree: Equations solvable for p , Equations solvable for y , Equations solvable for x and Clairaut's equation, Applications: Newton's law of cooling, Law of natural growth and decay.

Higher Order Linear Ordinary Differential Equations: Linear differential equations of second and higher order with constant coefficients, Non-homogeneous term of the type

$Q(x) = e^{ax}$, $\sin(ax+b)/\cos(ax+b)$, x^n, $e^{ax}V(x)$, $x^nV(x)$. Equations reducible to linear equations with constant coefficients: Cauchy's homogeneous linear equation, Legendre's linear equation, Method of variation of parameters, Applications: $L-C-R$ Circuits and Simple Harmonic Motion.

Laplace Transforms: Laplace transforms of elementary functions , First shifting theorem, Change of scale property, Multiplication by t^n , Division by t , Laplace transforms of derivatives and integrals, Laplace transform of unit step function, Second shifting theorem, Laplace transform of periodic function, Evaluation of some kind of integrals by Laplace transforms, Inverse Laplace transforms, Finding inverse Laplace transforms by different methods, Convolution theorem(without proof), Solving ordinary differential equations by Laplace transform method.

4. Books and Materials

Text Books:

1. B S Grewal, *Higher Engineering Mathematics*, 43rd Edition, Khanna Publishers, New Delhi, 2014.
2. B V Ramana, *Engineering Mathematics*, 23rd Reprint, Tata Mc Graw Hill Education Private Limited, New Delhi, 2015.

Reference Book(s)

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, 2010.
3. D. Poole, *Linear Algebra: A Modern Introduction*, 2nd Edition, Brooks/Cole, 2005.

COURSE STRUCTURE

A4005- OSCILLATIONS, WAVES AND OPTICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
4	0	0	42	14	0	4	30	70	100

1. Course Description

Course Overview

This course promotes an understanding of the nature and essence of physical principles and fosters implementation of the scientific approach in the analysis of real life situations. The student is encouraged to develop problem solving techniques and appreciate the influence of physics in everyday life. To achieve this one should have strong knowledge over simple harmonic motion, harmonic oscillators, transverse and longitudinal waves. Certainly this course is worthy to understand the principles of optics. This course also cover concepts related to wave optics and lasers.

Course Pre/Co-Requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4005.1: Solve for the solutions and describe the behavior of a damped and driven harmonic oscillator
A4005.2: Construct travelling and standing solutions to the wave equation
A4005.3: Use the geometrical approximation, including Fermat's principle, the ray equation and paraxial matrix formalism for refractive and reflective surfaces
A4005.4: Apply wave optics and diffraction theory to a range of problems
A4005.5: Estimate the properties of various lasers and the propagation of laser beams

3. Course Syllabus

Simple Harmonic Motion, Damped and Forced Simple Harmonic Oscillator: Mechanical and electrical simple harmonic oscillators, complex number notation and phasor representation of simple harmonic motion, damped harmonic oscillator – heavy, critical and light damping, energy decay in a damped harmonic oscillator, quality factor, forced mechanical and electrical oscillators, electrical and mechanical impedance, steady state motion of forced damped harmonic oscillator, power absorbed by oscillator.

Non-Dispersive Transverse and Longitudinal Waves in One Dimension and Introduction to Dispersion: Transverse wave on a string, the wave equation on a string, Harmonic waves, reflection and transmission of waves at a boundary, impedance matching, standing waves and their eigen frequencies, longitudinal waves and the wave equation for them, acoustics waves and speed of sound, standing sound waves. Waves with dispersion, water waves, superposition of waves and Fourier method, wave groups and group velocity.

The Propagation of Light and Geometric Optics: Fermat's principle of stationary time and its applications e.g. in explaining mirage effect, laws of reflection and refraction, Light as an electromagnetic wave and Fresnel equations, reflectance and transmittance, Brewster's angle, total internal reflection, and evanescent wave. Introduction to Optical fibres, Acceptance angle, Numerical aperture, step and graded index fibre, losses in optical fibres.

Wave Optics: Huygens' principle, superposition of waves and interference of light by wavefront splitting and amplitude splitting; Young's double slit experiment, Newton's rings, Michelson interferometer, Mach-Zehnder interferometer. Farunhofer diffraction from a single slit and a circular aperture, the Rayleigh criterion for limit of resolution and its application to vision; Diffraction gratings and their resolving power.

Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; amplification of light by population inversion, different types of lasers: gas lasers (He-Ne, CO_2), solid-state lasers (ruby, Neodymium), semiconductor laser (homo-junction); Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, applications in science, engineering and medicine.

4. Books and Materials

Text Books:

1. H. J. Pain. *The Physics of Vibrations and Waves*, 6th edition, Wiley, India, 2006.
2. G. Main. *Vibrations and Waves in Physics,* Cambridge University Press, England, 2012.
3. N. Bajaj. *The physics of Waves and Oscillations*, 1st edition, McGraw Hill Education, India, 2017.
4. A.Ghatak. *Optics*, 5th edition, India: McGraw Hill Education, 2012.

Reference Books:

1. B.K. Pandey and S. Chaturvedi, *Engineering Physics,* Cengage Learning India Pvt. Ltd., New Delhi, 2014.
2. R. Fitzpatrick. *Oscillations and Waves: An Introduction*. CRC Press (Taylor & Francies Group), United States, 2017.
3. Trager and Frank. *Handbook of Lasers and Optics*. Springer, India, 2012.

COURSE STRUCTURE

A4501 – PROGRAMMING FOR PROBLEM SOLVING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course overview

The course is a Basic Engineering course for all computation aspiring students. It is designed to provide a comprehensive study of the C programming language that covers the fundamental principles of computer programming, with an emphasis on problem solving strategies using structured programming techniques. The syntax and constructs of data types, control statements, arrays, functions and pointers are elaborated. The derived data types like structures are discussed. It stresses the strengths of C, which provide students with the means of writing efficient, maintainable and reusable code to solve mathematical, engineering and simple data processing problems.

Course Pre/co-requisites

"This course has no specific prerequisite and co requisite".

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4501.1: Select right identifiers, data types and operators for effective computation.
A4501.2: Write programs using control statements.
A4501.3: Write programs demonstrating use of arrays, strings and their applications.
A4501.4: Demonstrate the applications of function andrecursion.
A4501.5: Write programs for simple real life problems using pointers andstructures.

3. Course Syllabus

Introduction To Programming: Introduction to components of Computer Systems. Steps to solve logical and numerical problems. Representation of Algorithm, Flowchart and Pseudo code with examples. INTRODUCTION TO THE C LANGUAGE: program structure, identifiers, and data types, Formatting input/output, Syntax and Logical Errors in compilation, object and executable code.

Operators, Expressions And Control Statements: Arithmetic, Logical, Relational, Conditional, Assignment, Increment and Decrement operators. EXPRESSIONS: Arithmetic Expressions, Operator precedence and Associativity. DECISION MAKING AND LOOPING:Writing and evaluation of decision making, branching and looping.

Arrays, Sorting And Searching: Definition, Types of Arrays, declaration and Initialization of n-Dimensional Arrays and Character array, String manipulation. SEARCHING AND SORTING:Linear search, Bubble sort and Selection sort.

Functions And Recursion: Functions, Parameter passing in functions through call by value, passing arrays to functions, storage classes. RECURSION:Recursion as a different way of solving problems. Example programs, such as finding factorial, Fibonacci series.

Pointers And Structures: Definition, Declaration, Pointer arithmetic, Pointer to Pointer, Pointer to an array (base pointer), Dynamic memory allocation, Command Line arguments, idea of call by reference in functions. STRUCTURES: Defining, Declaring and initialization of structures, nested structures, Array of Structures.

4. Books and Materials

Text Book:

1. B. A. Fouruzan and R. F. Gilberg, C Programming & Data Structures, 3rd Edition, CENGAGE, Learning, India, 2014.

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, *The C Programming Language*, 2nd Edition, Prentice Hall of India,2015.
2. E. Balagurusamy, *Programming in ANSI C*, 7th Edition Tata McGraw-Hill,2017.

COURSE STRUCTURE

A4301 – ENGINEERING GRAPHICS AND COMPUTER AIDED DRAFTING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

1. Course Overview:

This course is an introduction to the students about Engineering drawings that are usually created in accordance with standardized conventions for layout, nomenclature, interpretation, appearance. The drawing technique is emphasized in how to draw an object graphically and projection drawing from different point of view. In the end, the student is capable of drawing different components. Rather than using conventional tools for drawing, students are made to use CAD software. The use of CAD process provides enhanced graphics capabilities which allows any designer to conceptualize his ideas, modify the design very easily, perform animation and use colors, fonts and other aesthetic features.

Prerequisite (s): Nil

3. Course Outcomes:

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

A4301.1. Construct various types of scales and curves commonly used in engineering practice.
A4301.2. Distinguish between first, second, third and fourth angle projections of systems.
A4301.3. Estimate sheet metal requirement for making regular solids.
A4301.4. Compare isometric and orthographic views of an object.
A4301.5. Select CAD tools for modelling regular solids.

4. Course Syllabus

Introduction To Engineering Drawing: Introduction to engineering drawing:Principles of Engineering Graphics and their significance, usage of Drawing instruments, Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epi-cycloid, Hypocycloid; Scales – Plain, Diagonal.

Orthographic Projections And Projections Of Regular Solids: Principles of Orthographic Projections-Conventions - Projections of Points and lines inclined to both planes; Projections of planes inclined to both Planes; Projections of Regular Solids: Prism, Cylinder, Pyramid, Cone-inclined to both planes.

Sectional Views And Development Of Surfaces Of Right Regular Solids: Sectional views of right regular solids: Prism, Cylinder, Pyramid, Cone-Development of surface of right regular solids: Prism, Cylinder, Pyramid, Cone.

Isometric Projections: Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa.

Computer Based Drawingoverview Of Computer Graphics: Overview of Computer Graphics, Customisation, Demonstration of a simple team design project: listing the computer technologies that impact on graphical communication, Demonstrating knowledge of the theory of CAD software; Customisation& CAD Drawing: consisting of set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and

tolerancing; Orthographic constraints, Snap to objects manually and automatically; Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles; **Annotations, layering & other functions:** applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings ; **Demonstration of a simple team design project:** Geometry and topology of engineered components: creation of engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids.

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., *Engineering Drawing*, Charotar Publishing House, 2014.
2. Basant Agrawal B. & Agrawal C. M., *Engineering Graphics*, TMH Publication, 2016.

Reference Books:

1. Narayana, K.L. & P Kannaiah, *Text book on Engineering Drawing*, Scitech Publishers, 2016.
2. K. Balaveera Reddy et al, *Computer Aided Engineering Drawing*, CBS Publications, 2017.
3. Shah, M.B. & Rana B.C., *Engineering Drawing and Computer Graphics*, Pearson Education, 2008.

COURSE STRUCTURE

A4006-OSCILLATIONS, WAVES AND OPTICS LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

This laboratory course deals with understanding the fundamental physics concepts like frequency, oscillations, wave optics and lasers. This course helps to learn the methodology of investigating problems in physics and also provides to gain knowledge in different techniques and working principles related to waves and light propagation. This course also makes the students familiar with instrumental methods and various material properties. This basic knowledge will enable the scientific fervor to solve the societal issues.

Course Pre/Co-Requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

1. A4006.1: Evaluate the rigidity modulus and spring constant of the given materials to interpret the material properties
2. A4006.2: Estimate the acceleration due to gravity (g) and frequency of AC power supply
3. A4006.3: Determine the wavelength of a given light source and thickness of a wire by using interference mechanism
4. A4006.4: Estimate the dispersive power and refractive index of various light sources
5. A4006.5: Apply the principles of optics to evaluate the characteristics of lasers and optical fibres

3. Course Syllabus

1. Rigidity modulus of the material of a given wire using Torsional Pendulum.
2. Spring constant by using coupled oscillator.
3. Frequency of an AC supply using Sonometer.
4. Acceleration due to gravity (g) by a compound pendulum.
5. Numerical aperture and acceptance angle of the given optical fibre.
6. Bending and transmission losses in a given optical fibre.
7. Dispersive Power of the material of a given prism using Mercury Light.
8. Refractive Index of The Material If a given Prism Using Sodium Light.
9. Wavelength of sodium light using Newton's Rings.
10. Thickness of thin wire using Air Wedge method
11. Wavelength of a given source of Laser light using diffraction grating.
12. Angular divergence of the laser beam

4. Laboratory Equipment/Software/Tools Required

1. Torsional pendulum set-up
2. Sonometer Set-up

3. Coupled oscillator set-up
4. Compound pendulum set-up
5. Regulated Power Supply (DC and AC)
6. Newton's Ring Set up
7. Spectrometer
8. Air Wedge Method set-up
9. Sodium & Mercury Vapour Lamp
10. Semiconductor Laser Source
11. Plane diffraction grating
12. Optical Fiber trainer kit
13. Meters - Ammeter, Voltmeter, Digital Multimeter

5. Books and Materials

Text Books:

1. Geeta Sanon. *B.Sc. Practical Physics*. 1st edition, S. Chand and Company, India, 2007.
2. S. D. Gupta, N. Ghosh and A. Banerjee. *Wave Optics,* CRC Press (Taylor & Francies Group), United States, 2015.
3. M. Nelkon and J. M. Ogborn. *Advanced Level Practical Physics*. 4th edition, Heinemann Educational Publishers, London, 1985.

Reference Books:

1. M. Ghosh and D. Bhattacharya. *A Textbook of Oscillations, Waves and Acoustics*. 3rd edition, S. Chand Publisher, India, 2006.
2. D. Meschede. *Optics, Light and Lasers: The Practical Approach to Modern Aspects of Photonics and Laser Physics*. 2nd edition, Wiley-VCH, Germany, 2007.

COURSE STRUCTURE

A4502 – PROGRAMMING FOR PROBLEM SOLVING LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

1. Course Description

Course Overview

The course is a Basic Engineering course for all computation aspiring students. It is designed to provide a comprehensive study of the C programming language that covers the fundamental principles of computer programming, with an emphasis on problem solving strategies using structured programming techniques. The syntax and constructs of data types, control statements, arrays, functions and pointers are elaborated. The derived data types like structures are discussed. It stresses the strengths of C, which provide students with the means of writing efficient, maintainable and reusable code to solve mathematical, engineering and simple data processing problems.

Course Pre/co-requisites

No Pre requisites and co requisites.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4502.1: Select right identifiers, data types and operators for effective computation.
A4502.2: Write programs using control statements.
A4502.3: Write programs demonstrating use of arrays, strings and their applications.
A4502.4: Demonstrate the applications of function and recursion.
A4502.5: Write programs for simple real life problems using pointers and structures.

3. Course Syllabus

Theory

Practice

Week-1: Programs using I/O statements and various operators.
Week-2: Programs using expression evaluation and precedence.
Week-3: Programs using decision making statements and branching statements.
Week-4: Programs using loop statements.
Week-5: Programs to demonstrate applications of n dimensional arrays.
Week-6: Programs to demonstrate searching and sorting.
Week-7: Programs to demonstrate use of string manipulation functions.
Week-8: Programs using user-defined functions.
Week-9: Programs to demonstrate parameter passing mechanism.
Week-10: Programs to demonstrate recursion
Week-11: Programs to demonstrate use of pointers.
Week-12: Programs to demonstrate command line arguments. Programs to demonstrate dynamic memory allocation.

Week-13: Programs to demonstrate applications of structures.

Week-14: Programs to demonstrate file operations.

3. Laboratory Equipment/Software/Tools Required

- A computer system with Linux/Ubuntu Operating System, C- Compiler

4. Books and Materials

Text Book

1. *B. A. Fouruzan and R*. F. Gilberg, C Programming & Data Structures, 3rd Edition, CENGAGE, Learning, India, 2014.

Reference Book:

1. *YashavantKanetkar,* Let Us C, 15th Edition, BPB Publications, 2017

COURSE STRUCTURE

A4021-SOCIAL INNOVATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

SocialInnovationisanopenendedcoursetodevelopsocialconnectednessinengineeringstudents throughsocialawarenessandsocialconsciousness.Thiscanbedonethroughlivefieldexposurealong withfacultyledconceptualpresentations,realcasereviews;self-studyassignments,literatureand fieldsurvey.Throughthiscourse,thestudentsareexpectedtousetheirengineeringknowledgeto provideinnovativesolutionstoexistingsocialproblems.Thiscoursealsodevelopscriticalthinking abilityamong the Students.

Course Pre/Co-Requisites

To create innovative solutions/approaches to existing social problems by using basic engineering knowledge.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4021.1.Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.

A4021.2. Apply various titrations for the estimation of strengths of solutions and hardness of water.

A4021.3. Identify different samples from a mixture by using various separation techniques.

A4021.4. Estimate rate constants of reactions from concentration of reactants/products as a function of time.

A4021.5 Evaluate the percentage of yield of chemical substances by organic synthesis.

2. Course Syllabus

Introduction to Social Innovation: Core definitions, core elements and common features of social innovation, a typology of social innovation, Awakening social consciousness.

Create Mindsets: Seven mindsets– Empathy, Optimism, Iteration, Creative confidence, Making it, Embracing ambiguity, Learning from failures.

Wicked Problems: Distinguish between simple, complicated and complex problems; describe the characteristics of wicked problems, breakdown a given problem by unpacking its complexity..

Critical Thinking for Social Innovation: Definition, engineering thinking and learning, distinguishbetween creativity and innovation.

Models for Creative Thinking: Appreciative Inquiry (AI), Asset Based Community Development (ABCD) and Concept of Bricolage.

Process of Social Innovation: Community study, develop questionnaire, identifying the causes of a particular problem.

Process of Social Innovation: Identify needs, record your learning's.

Process of Social Innovation: Generate ideas, selectpromising ideas,prototypingandtesting.

Social Innovation across Four Sectors - The non-profit sector, publicsector,theprivatesector, the informal sector, linksbetween and cross sectors.

Stages of Innovation: Social organizations and enterprises, social movements, social software and open source methods, common patterns of success and failure.

4. Books and Materials

Text Books:

1. RobinMurray,JulieCaulier-Grice,GeoffMulgan,"Theopenbookofsocialinnovation:Waysto Design,DevelopandGrowSocialInnovation",TheYoungFoundation,2010.
2. Julie Caulier-Grice, Anna Davies, Robert Patrick & Will Norman, The Young Foundation (2012)SocialInnovationOverview:Adeliverableoftheproject:"Thetheoretical,empirical and policy foundations for building social innovation in Europe" (TEPSIE), European Commission– 7thFrameworkProgramme,Brussels:EuropeanCommission,DGResearch.

Reference Books:

1. GeoffMulgan,"SocialInnovation:Whatitis,WhyitmattersandHowitcanbeaccelerated", TheYoungFoundation,2007.
2. Asset Based Community Development (ABCD) Model –
3. http://www.nurturedevelopment.org/asset-based-community-development/.
4. Diana Whitney & Amanda Trosten-Bloom, "The Power of Appreciative inquiry – A Practical Guide to Positive Change", 2nd Edition, Berrett-Koehler Publishers, Inc, 2010.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

SYLLABI FOR I YEAR II SEMESTER

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4002-ADVANCED CALCULUS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course Overview

This course offers more advanced topics of mathematics required to analyze the problems in engineering. Topics to be covered in this course include: Evaluation of improper integrals, functions of single, several variables and their applications, Multiple integrals, Vector differential and integral calculus, Fourier series and Fourier transforms. The mathematical skills derived from this course provides necessary base to analytical and theoretical concepts occurring in the program.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4002.1.Evaluate improper integrals and examine the extremum of a function of several variables
A4002.2. Make use of multiple integrals to find the area and volume of a solid
A4002.3. Determine scalar potential function for irrotational force fields
A4002.4. Evaluate line, surface and volume integrals using vector integral theorems
A4002.5. Develop Fourier series and Fourier transforms of a function

3. Course Syllabus

Calculus: Evaluation of improper integrals: Beta and Gamma functions and their properties, Rolle's Theorem, Lagrange's mean value theorem and Cauchy's mean value theorem, Taylor's and Maclaurin's series. Functions of several variables: Limit, continuity and partial derivatives of functions of two variables (not to be examined), Jacobians, Functional dependence, Maxima and minima of functions of two variables, Lagrange's method of undetermined multipliers.

Multiple Integrals: Double integrals, Change of order of integration, Change of variables, Area enclosed by plane curves, Triple integrals, Change of variables, Area, volume, mass and centre of gravity (constant and variable densities).

Vector Differentiation: Scalar and vector point functions, Gradient, Directional derivative, Tangent plane and normal line to the surface, Divergence, Curl and their related properties, Scalar potential function, Laplacian operator, Vector identities.

Vector Integration: Line integral, work done, Surface integrals, Volume integrals. Vector integral theorems: Green's theorem in a plane, Stoke's theorem and Gauss divergence theorem (without proof) and related problems, Irrotational fields.

Fourier Series And Fourier Transforms: Euler's formulae, Dirichlet's conditions, Fourier series for functions having period $2l$, Fourier series for even and odd functions, Half range Fourier Sine And Cosine

Series. Fourier Integral Theorem (Without Proof), Fourier Sine And Cosine Integrals, Fourier Transforms, Fourier Sine And Cosine Transforms, Inverse Fourier Transforms.

4. Books and Materials

Text Book:

1. B.S. Grewal, *Higher Engineering Mathematics*, 43rdEdition, Khanna Publishers, New Delhi, 2014.
2. B.V. Ramana, *Higher Engineering Mathematics*, 23rdReprint, Tata Mc-Graw Hill Education Private Limited, New Delhi, 2015.

Reference Books:

1. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006.
2. N.P. Bali and Manish Goyal, *A text book of Engineering Mathematics*, Laxmi Publications, 2010.
3. G.B. Thomas and R.L. Finney, *Calculus and Analytic Geometry*, 9thEdition, Pearson Education, 2002

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4007-ENGINEERING CHEMISTRY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
4	0	0	42	0	0	4	30	70	100

1. Course Description

Course Overview

This course emphasizes a strong base in physical chemistry and organic chemistry to spread over an orientation towards the materials and drug synthesis. This course also focuses on the general applications of chemical principles to the analysis and evaluation of engineering problems such as Water and its treatment, batteries and fuel cells.

Course Pre/Co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4007.1: Apply knowledge of three - dimensional arrangements of atoms, molecules and their effects on chemical reactions

A4007.2: Identify differences and similarities of the Batteries

A4007.3: Evaluate the behaviour and interactions between matter and energy at both the atomic and molecular levels

A4007.4: Make use of different methods for softening hardness of water

A4007.5: Apply major chemical reactions in the synthesis of various drugs

3. Course Syllabus

Atomic And Molecular Structure: Introduction, Concept of atomic and molecular orbitals, Molecular orbital theory, and Molecular orbital energy level diagrams of diatomic molecules - O_2 and N_2.Crystal field theory – crystal field splitting in Octahedral, Tetrahedral and Square planar complexes.

Stereochemistry Of Carbon Compounds: Isomerism**:** Definition and their classification: Constitutional isomers: Definition, examples of chain, functional and positional isomers. Stereoisomers: Definition, examples of enantiomers and diastereomers. Optical activity: Definition, chiral centres. Chiral molecules: Definition and criteria - asymmetric and dissymmetric molecules. Examples of asymmetric molecules (Glyceraldehyde, Lactic acid, Alanine) and dissymmetric molecules (trans-1, 2-dichlorocyclopropane). R, S nomenclature, Cahn-Ingold-Prelog rules. Geometrical isomerism of alkenes– cis, trans and E, Z configuration.

Electrochemistry And Batteries: Electrochemical cells -Types, cell notation, cell reaction and cell emf - concentration cells – Electrode and Electrolyte concentration cells, numerical problems. Electrochemical series and its applications. Electrode potential, standard electrode potential, types of electrodes – Hydrogen, Calomel and Quinhydrone electrode. Batteries**:** Primary battery (Zinc- Carbon Battery) and Secondary battery (lead acid and lithium ion battery) - Applications. Fuel cells**:** Concept of Fuel-Cells. Hydrogen –Oxygen fuel cell – advantages and applications.

Organic Reactions, Drug Molecules And Spectroscopy: Introduction, Types of organic reactions, reactions involving substitution (S_N^1, S_N^2), addition of H_2, X_2 andHX to C-C double bond – Markownikoff

and Anti-Markownikoff rule, elimination (E1 and E2), reduction: Hydrogenation by H_2 by Nickel and Pd/C (any two examples for each). Drugs: Introduction and classification. Structure, preparation and uses of commonly used drug molecules- paracetamol, aspirin and ibuprofen. Spectroscopy: Introduction. Principle, selection rules and applications of Vibrational, rotational and electronic spectroscopy.

Water Technology: Introduction, Hardness of water, causes of hardness and types of hardness: temporary and permanent – expression and units of hardness. Numerical problems. Potable water and its specifications. Treatment of water for drinking-filtration, sedimentation, chlorination and ozonization. Boiler troubles**:** Causes and effects. Sludges, scales and caustic embrittlement. Internal treatment of boiler feed water – Calgon conditioning, Phosphate conditioning, Colloidal conditioning – Softening of water by ion- exchange process. Desalination of water – Reverse osmosis.

4. Books and Materials

Text Books:

1. Jain & Jain. *Engineering Chemistry:* Dhanapathrai Publications., 2015.
2. Prsanta Rath, B. Rama Devi, Ch. Venkata Ramana Reddy & Subhendu Chakroborty, *Engineering Chemistry:* Cengage Publications., 2018.
3. B. H. Mahan, Rollie. J. Meyers. *University chemistry*: Pearson publications, 4th edition, 2009.
4. C. N. Banwell. *Fundamentals of Molecular Spectroscopy:* McGraw Hill Education India, 4th edition, 2016.
5. GL David Krupadanam, Vijaya Prasad, Varaprasad Rao K. *Drugs: Universities Press (India) Limited.*

Reference Books:

1. B. L. Tembe, Kamaluddin and M. S. Krishnan. *Engineering Chemistry (NPTEL Web-book)*
2. Peter Atkins, Julio de Paula's *Physical Chemistry*, Oxford University Press, Tenth Edition, 2014.
3. D. Nasipuri, *Stereochemistry of Organic Compounds – Principles and Applications*, 3rd Edition, New Age International (P) Limited.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4303 – ENGINEERING MECHANICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	0	28	4	30	70	100

1. Course Overview:

Course Overview

Engineering Mechanics is the branch of science for analyzing force systems that acts upon the bodies at either at rest or in motion. The knowledge of mechanics helps us in designing the various parts of machine elements. The course content is designed in such a way that the balancing of various mechanical systems could be achieved by the calculations of centre of gravity and moment of inertia. The effects of friction and the consequences of frictional forces on the mating parts will be analyzed to design various systems with negligible effort loss.

2. Course Outcomes(COs)

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

A4303.1 : Apply the laws of mechanics to evaluate the resultant force.

A4303.2 : Solve the problems using equations of equilibrium through free body diagram

A4303.3 : Analyze the frictional forces to maintain the equilibrium of system.

A4303.4 : Identify the centroid and centre of gravity of a body by using principle of moments and calculate area moment of inertia and mass moment of inertia of a body.

A4303.5 : Utilize the basic concepts of kinematics and kinetics to solve the problem

3. Course Syllabus

Introduction To Engineering Mechanics: Introduction to Engineering Mechanics – Basic Concepts. Resultants of Force System: Parallelogram law –Forces and components- Resultant of coplanar Concurrent Forces – Components of forces in Space – Moment of Force – principle of moments – Coplanar Applications – Couples – Resultant of any Force System. Equilibrium of Force Systems: Free Body Diagrams, Equations of Equilibrium – Equilibrium of planar Systems.

Friction: Types of Friction – Limiting Friction – Laws of Friction – Angle of repose- Equilibrium of body lying on rough inclined plane – Ladder friction – Wedge friction- screw jack.

Centroid And Centre And Gravity:

Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections, Pappus theorems.

Centre of Gravity and its implications, centre of gravity of composite sections.

Moment Of Inertia: Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections.and Momentum principle-direct central collisions-coefficient of restitution.

Dynamics Of Particles: Displamecents, Velaocity and acceleration, their relationship-Rectilinear motion-curvilinear motion- Newton's laws of motion- work energy Equation-conservation of energy impulse and momentum principle – derect central collisions- coefficient of restitution.

Text Books:

1. Fedinand L. Singer (1998)- Engineering Mechanics- Harper – Collins Publishers- NewDelhi.
2. A.K. Tayal (2012)- Engineering Mechanics- Umesh Publications- NewDelhi.

Reference Books:

3. Timoshenko & Young (2013)- Engineering Mechanics- Mc Graw Hill-India.
4. K. L Kumar (2009)- Engineering Mechanics- Tata Mc Graw Hill- NewDelhi.
5. Irving. H. Shames (2004)- Engineering Mechanics- Prentice-Hall-India.
6. S. S. Bhavikatti- J. G. Rajasekharappa (2014)- Engineering Mechanics- New Age
7. International-India.S Chand & Co. Ltd, New Delhi.

WEB REFERENCES:

W1. https://www.youtube.com/watch?v=2-R0erl1cVw
W2. https://www.youtube.com/watch?v=7kt9AoxZlLo
W3. https://www.youtube.com/watch?v=IiiWgjTg8WI
W4. https://www.youtube.com/watch?v=zOBjurNOoY8
W5. https://www.youtube.com/watch?v=lGiKpZP0_TI

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4009-FUNCTIONAL ENGLISH

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

In view of the growing importance of English as a tool for global communication and the consequent emphasis on training students to acquire language skills, the syllabus of English has been designed to develop linguistic and communicative competencies of Engineering students. In English classes, the focus should be on the development of competence in the areas of grammar and vocabulary and skills development in terms of reading and writing. For this, the teachers should use the prescribed text for detailed study. The students should be encouraged to read the texts/poems silently leading to reading comprehension. Reading comprehension passages are given for practice in the class. The time should be utilized for working out the exercises given after each excerpt, and also for supplementing the exercises with authentic materials of a similar kind. For instance, newspaper articles, advertisements, promotional material etc could be deployed as supplementary material to enhance their communication skills. The focus of the syllabus is on language acquisition and skill development.

Course Pre/co-requisites

"This course has no specific prerequisite and co requisite".

2. Course Outcomes (COs)

A4009.1: Demonstrate an understanding of the significance of humanity, love and service to mankind
A4009.2: Utilize appropriate vocabulary in the given contexts
A4009.3: Build competence in grammar
A4009.4: Develop effective academic reading skills
A4009.5: Develop effective academic writing skills

3. Course Syllabus

Theory

Vocabulary: Word Formation – Prefixes – Suffixes – Guessing the meanings of the words using prefixes and suffixes- Standard Abbreviations

Grammar: Articles

Reading:Presidential Address by APJ Abdul Kalam: Techniques for effective comprehension -S kimming and Scanning-Types of texts – Summarizing

Writing: Sentences–Paragraphs – Cohesion – Coherence – Logical, Lexical and GrammaticalDevices – Punctuation – Types of Paragraphs: Description – Definition – Classification.

Vocabulary: Synonyms – Antonyms

Grammar: P repositions

Reading: The Road Not Taken (Robert Frost): Reading using different strategies: Types of Reading – Extensive and Intensive-Do's and Dont's of reading

Writing: Letter Writing – Formats, Styles, Parts – Letters of Requisition, Letters of Inquiry, Letters of Apology.

Vocabulary: Homonyms, Homophones, Homographs, Foreign Words - Redundancies – Clichés

Grammar – Changing words from one form to another – Concord – Tenses: Present, Past and Future Active and Passive Voice.

Vocabulary: Idiomatic Expressions - One Word Substitutes

Grammar: Noun-Pronoun Agreement – Misplaced Modifiers

Reading: Good Manners (J C Hill): Practice in reading different types of texts efficiently - Predicting the Content – Understanding the gist - Note Making- Understanding Coherence- Sequencing Sentences

Writing: Information Transfer: Bar Charts – Flow Charts – Tree Diagrams**.**

Reading: Exercises for practice

Writing: Essay writing: Introduction – Conclusion- Précis Writing: Introduction – Steps to Effective Précis writing – Guidelines.Reading material from Text Books:and Reference books

3. Books and Materials

Text Books:

1. *Fluency in English – A Course book for Engineering Students* (by Board of Editors: Orient BlackSwan Pvt. Ltd, Hyderabad, 2016.
2. Raman, Meenakshi , Sharma, Sangeeta, *Technical Communication- Principles and Practice,* 3rd Edition, Oxford University Press, New Delhi. Print, 2015.

Reference Books:

1. Green, David *Contemporary English Grammar –Structures and Composition,* MacMillan India, 2014.
2. Rizvi, M. Ashraf, *Effective Technical Communication,* Tata Mc Graw –Hill, 1995.
3. Michael Swan, *Practical English Usage,* 3rd Edition, Oxford University Press, 1995.
4. Wood F. T, *Remedial English Grammar for Foreign Students,* Macmillan, 2007.
5. Zinsser William, *On Writing Well,* Harper Resource Book, 2001.
6. Liz Hamp- Lyons, Ben Heasley, *Study writing,* Cambridge University Press, 2006.

COURSE STRUCTURE

A4302-ENGINEERING WORKSHOP

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	28	1.5	30	70	100

1. Course Description

Course Overview

The course is intended to familiarize students to all workshops including civil, mechanical, and electrical and electronics engineering. In each of these workshops, the students are exposed to basic understanding Components,equipment,tradesandmethods.Civilengineeringworkshopfocusesonsurveyinginstrumentsandtypesofbuildingmaterialsanditsidentification.Mechanicalengineering workshop focuses on fitting and carpentry trades, Tin-Smithy, foundry and plumbing. Electronic workshop focuses on basic electronic components, measuring equipment and Multisim software. Electricalworkshopfocusesonbasicelectricalwiringandinstallations.

Course Pre/Co-Requisites

The course aims to facilitate the students with the basic familiarization to all engineering streams and basic knowledge over civil, electrical, mechanical and electronics.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4302.1.Identify various surveying tools and choose building materials according to field conditions

A4302.2.Analyze the basic circuit connections, maintenance and troubleshooting of house hold equipments

A4302.3.Make use of various electrical and electronic components to constructsimplecircuitsandmeasurevariousphysicalquantities.

A4302.4 Explain basic components used in different trades.

A4302.5 Identify the associated tools used in different trades.

3. Course Syllabus:

Part – A (Trades For Lectures & Videos)

1. Note: 1. Minimum one Hour Lecture on each Trade, to be discussed by any class room teaching technique in following trades.
2. Manufacturing Methods: 1. Casting, Forming, Joining, Machining, Advanced Manufacturing Methods
2. CNC machining , Additive Manufacturing
3. Fitting Operation & Power Tools , Carpentry , Plastic Molding , Glass Cutting, Metal Casting
4. Welding (Arc Welding & Gas Welding), Brazing, Sheet Metal Forming

Part-B (Trades For Practice)

1. Fitting Trade: a. L -Fitting Joint b. V- Fitting Joint c. Square - Fitting Joint d. Semicircular - Fitting Joint
2. Carpentry Trade: a. Lap Joint (Two Experiments) b. Bridle Joint (Two Experiments)

3. House wiring Trade: a. House Wiring (5 Experiments)
4. Welding Trade: a. Arc Welding (Two Experiments) b. Gas Welding (Two Experiments)
5. Foundry Trade: a. Single Piece Pattern b. Multiple Piece Pattern
6. Tin Smithy Trade: a. Open Scoop b. Funnel c. Rectangular Tray d. Square & Cylindrical Pipes
7. Black Smithy Trade: a. Round to Square and Vice Versa b. S - Hook c. O - Ring

Note: Minimum one experiment from each Trade with total of 12 Experiments.

4. Books and Materials

Text Books:

1. B. L. Juneja, "Workshop Practice", 1st Edition,Cengage Learning India Private Limited, New Delhi, 2015.
2. H.S. Bawa, "Workshop Practice", 3rd Edition, Mc Graw Hill Education, New Delhi, 2017.
3. S.K.Garg, "Workshop Technology (Manufacturing process)" 4thEdition, Laxmi Publications (P) Ltd., New Delhi, 2017.

Reference Books:

1. 1.K.Venkata Reddy," Workshop Manual", 6th Edition Reprint, BSP Publications, Hyderabad, 2018.
2. 2.S Gowri & T Jeyapoovan, Engineering Practices Lab Manual, 5th Edition, Vikas Publishing House Private Limited, New Delhi, 2017.
3. Singh, Rajender, Introduction to Basic Manufacturing Process & Workshop Technology, 2nd Edition, New Age International (P) Ltd. New Delhi, 2014.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4008-ENGINEERING CHEMISTRY LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

This course emphasizes a strong background to carryout chemical analysis. The objective of engineering chemistry laboratory is to understand various instrumental techniques, physical properties of organic liquids, separation techniques, and organic synthesis to inculcate the knowledge of engineering chemistry discipline. The experiments on water treatment are proved to be vital in engineering applications on industrial level.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4008.1: Measure molecular/system properties such as surface tension, viscosity, conductance of solutions and redox potentials.

A4008.2: Apply various titrations for the estimation of strengths of solutions and hardness of water.

A4008.3: Identify different samples from a mixture by using various separation techniques.

A4008.4: Estimate rate constants of reactions from concentration of reactants/products as a function of time.

A4008.5: Evaluate the percentage of yield of chemical substances by organic synthesis.

3. Course Syllabus

Estimation of strength of hydrochloric acid by conductometric titration.

1. Estimation of strength of hydrochloric acid by potentiometric titration.
2. Estimation of Iron in Mohr's salt by potentiometric titration.
3. Estimation of hardness of water by complexometry using EDTA
4. Determination of chloride content in water by Argentometry.
5. Determination of viscosity of a given fluid by Ostwald's viscometer.
6. Determination of surface tension of a given liquid by using Stalagmometer
7. Synthesis of Aspirin and Paracetamol.
8. Thin layer chromatography calculation of R_f values. Eg. ortho and para nitro phenols.
9. Verification of Freundlich adsorption isotherm of acetic acid on Charcoal.
10. Determination of partition coefficient of acetic acid between butanol and water.
11. Determination of the rate constant of acid catalyzed hydrolysis of methylacetate.

4. Laboratory Equipment/Software/Tools Required

1. Digital Conductometer
2. Digital Potentiometer
3. Electrical Water Heater

4. Wall Mount Distillation Plant
5. Analytical/Digital Weighing Balance
6. Ostawald's Viscometer
7. Stalagnometer
8. Stop watch
9. Thermometer
10. RB Flask condenser
11. TLC Plates (silica coated)
12. TLC Chambers
13. Magnetic Stirrer
14. Iodine Blowers

5. Books and Materials

Text Book: NIL

Reference Books:

1. S.S.Dara, *Experiments and Calculations in Engineering Chemistry,* S-Chand Publications, Revised edition., 2008.
2. Dr.M.P.S Murali Krishna and M.Gopala Krishna, *Chemistry Lab Manual*, VGS Publications.
3. Dr. A.Ravi Krishnan, Dr.T.Syeda Jeelani Basri, and Mrs.M.B.Lakshmi, *Engineering Chemistry Laboratory Manual.*

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4304 – ENGINEERING MECHANICS LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	3	0	0	42	1.5	30	70	100

1. Course Overview:

Course Overview

The Engineering Mechanics Laboratory is well equipped with various instruments as per syllabus. Engineering Mechanics Lab is primarily dedicated to make the student to understand some basic concepts through experiment.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4304.1. Examine basic laws of Mechanics by using experiment setup.

A4304.2. Determine the co-efficient of friction between wood and various surface.

A4304.3. Apply the basic concepts of mechanics to find the Mechanical Advantage, velocity ratio and mechanical efficiency.

A4304.4. Calculate moment of Inertia of an irregular body using Computation method.

A4304.5. Analyze the different force systems by using graphical method.

3. Course Syllabus

Exp. No.1. To verify the law of Force Polygon with the help of force polygon apparatus.

Exp. No.2. To verify the law of Moments using Parallel Force apparatus. (simply supported type)

Exp.No.3. To determine the co-efficient of friction between wood and various surface (like Leather, Wood, Aluminum) on an inclined plane.

Exp. No.4. To determine the mechanical advantage, Velocity ratio and efficiency of a screw jack.

Exp.No.5. To determine the mechanical advantage, Velocity ratio and Mechanical efficiency of the Wheel and Axle.

Exp. No.6. To determine the Mechanical Advantage, Velocity Ratio of worm and Worm Wheel.

Exp. No.7. To verify the law of moments using Bell crank lever.

Exp. No.8. To determine the centre of Gravity by graphical Method.

Exp. No.9. Verification of Lami's Theorem.

Exp. No.10. To Determine the resultant of Coplanar force system by graphical Method.

Exp. No.11. To Determine the resultant of concurrent force system by graphical Method.

Exp. No.12. To determine the Moment of Inertia of Flywheel.

Exp. No.13. To determine the co-efficient of friction for different materials.

Exp. No.14. To determine the natural frequency, radius of gyration and mass moment of inertia of the given rectangular rod experimentally.

Exp. No.15. To determine the radius of gyration and the moment of Inertia of a given circular plate.

Exp. No.16. To find the forces in the members of Jib Crane.

4. Books and Materials

Text Books:

1. Timoshenko and Young2017., *Engineering Mechanics*-Mc-Graw Hill-India.
2. F. P. Beer and E. R. Johnston 2017., *Vector Mechanics for Engineers,* Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill.
3. R.K.Rajput 2001, *A text book of applied mechanics*,3rd Ed, Laxmi publications, New Delhi.
4. A.K. Sharma 2009,*Engineering Mechanics Practical*,Laxmi publications, New Delhi.

Reference Books:

1. R. C. Hibbler2017*., Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.*
2. Irving H. Shames 2017., *Engineering Mechanics,* 4th Edition, Prentice Hall.
3. Reddy Vijaykumar K. and K. Suresh Kumar,2016., *Singer's Engineering Mechanics.*
4. N.H. Dubey, 2013*., Engineering Mechanics-Statics and Dynamics*, Mc-Graw Hill-India.
5. Shanes and Rao, 2006., *Engineering Mechanics*, Pearson Education.
6. Tayal A.K. 2010., *Engineering Mechanics*, Umesh Publications.

E

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4010-ENGLISH LANGUAGE COMMUNICATION SKILLS LABORATORY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

The basic idea behind offering English as a practical subject at the undergraduate level is to acquaint the students with a language that enjoys currently as a lingua franca of the globe. In the ELCS lab the students are trained in Communicative English Skills: phonetics, word accent and intonation, making effective oral presentations – both extempore and prepared, role- play, telephonic skills, asking for and giving directions, etc. The lab encourages students to work in a group, engage in peer-reviews and inculcate team spirit through various exercises related to listening to native speakers' accent and participating in speaking activities.

Course Pre/co-requisites

"This course has no specific prerequisite and co requisite".

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4010.1: Improve his/her pronunciation
A4010.2: Take part in role-plays and perform effectively in real-life situations
A4010.3: Choose appropriate words and phrases to make effective telephonic conversations
A4010.4: Minimize stage fear and make effective presentations
A4010.5: Build sustained conversations

3. Course Syllabus

a. **Computer Assisted Language Learning (CALL) Lab**
b. **Interactive Communication Skills (ICS) Lab**

Module – 1:ALL: Introduction to Phonetics - Speech Sounds – Vowels and Consonants
ICS: Ice-Breaking activity and JAM session.

Module - 2: CALL: Past Tense Marker and Plural Marker – Syllable Structure – Consonant Clusters Minimal Pairs

Module-3:ICS: Situational Dialogues-Role-Play-Expressions in Various Situations: Greetings: Self-introduction and Introducing others – Apologies – Requests Complaints – Congratulating – Expressing sympathy/ condolences.

Module – 4: CALL: Basic Rules of Word Accent – Stress Shift – Weak Forms and Strong Forms

Module – 5:ICS: Asking for and Giving Directions – Giving Instructions – Seeking Clarifications Thanking and Responding – Agreeing and Disagreeing – Seeking and Giving Advice – Making Suggestions

Module-6:CALL: Neutralization of Mother Tongue Influence-Common Indian Variants in Pronunciation – Differences between British and American pronunciation

Module – 7:

CALL: Intonation Patterns-Types of Tones - Sentence Stress

Module – 8:ICS: Social and Professional Etiquette - Telephone Etiquette

Module – 9:IC Oral Presentation Skills (short presentations) - Making a Presentation-Prepared – Extempore

Module – 10: ICS: Listening-Types of Listening-Steps to effective Listening –Business Listening Comprehension exercises

4. Laboratory Equipment/Software/Tools Required

1. Computers with internet
2. K VAN Solutions Software
3. Headphones
4. Audio Visual Equipment

5. Books and Materials

Text Book: NIL

Reference Books:

1. Mohanraj, J., *Let Us Hear Them Speak,* Sage Texts. Print, New Delhi, 2015.
2. Hancock, M., *English Pronunciation in Use* Intermediate, Cambridge University Press. Print, Cambridge, 2009.
3. Sanjay Kumar and Pushp Lata, *Communication Skills,* Oxford University Press, 2011.
4. *Exercises in Spoken English,* Parts I-III CIEFL, Oxford University Press, Hyderabad.

COURSE STRUCTURE

A4022-ENGINEERING EXPLORATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

This course starts with differentiating science and engineering, scientist and engineer, followed by describing engineering graduate attributes and what engineers "do". This course offers the fundamental principles, concepts of engineering, as well as the influences of engineering on society and also hands-on and experiential learning opportunities in specific areas of engineering. This course focuses on data collection and analysis, engineering problem-solving, mathematical modeling, contemporary tools (software and hardware), professional practice and expectations (e.g. Communication, teamwork, ethics) and the diversity of fields and majors within engineering. Topics to be covered in this course include: engineering design process in multidisciplinary domain, and unique platform to showcase any idea into functional prototype, project management skills, exploring engineering skills with ethical and sustainability perspective.

Course Pre/co-requisites

To design and develop a sustainable model to existing social problems by using a development platform (ARDUINO or equivalent).

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4022.1: Compare and contrast the contributions of different types of engineers in the development of a product, process or system.

A4022.2: Apply the common engineering design process to solve complex problems and arrive at viable solution

A4022.3: Explore various contemporary software and hardware tools to provide solutions for the problems.

A4022.4: Applyskillsneededforsuccessfulteamworkincludingthebasicsof project management and written and oral communication.

A4022.5: Identifythekeyelementsofprofessionalcodesofethicsaswellasthe ethicalandsocietalissuesrelatedtothedisciplinesandtheirimpact onsocietyandtheworld.

3. Course Syllabus

Introduction to Engineering and Engineering Study: Difference between science and engineering, scientist and engineer needs and wants.

Various disciplines of engineering, some misconceptions of engineering, Expectation for the 21st century engineer and Graduate Attributes

Engineering Design Process, Multidisciplinary facetofdesign, Importance of analysis in engineering design, generalanalysis procedure. Introduction to mechatronics system, generation of multiple solution, decision matrix, Concepts of reverse engineering. Introduction to various plat form based development (Arduino) programming and its essentials. Introduction to sensors, transducers and

actuators and its interfacing with arduino Community study, develop questionnaire, identifying the causes of a particular problem. Engineering Ethics: Identifying Engineering as a Profession, Significance of Professional Ethics, Code of Conduct for Engineers.

Identifying EthicalDilemmas in different tasks of engineering, Applying Moral Theories and codes of conduct for resolution of Ethical Dilemmas. Sustainability: Introduction to sustainability, Sustainability leadership, Life cycle assessment.
Project Management: Introduction, Significance of team work, Importance of communication in engineering profession. Project management tools: Checklist, Timeline, Gantt Chart, Significance of documentation.

4. Books and Materials

1. Keat,GeorgeWise,ExploringEngineering:AnIntroducti ontoEngineeringandDesign,AcademicPress,3rdedition,2012.
2. ByronFrancis,Arduino:TheCompleteBeginner'sGuide,CreatespaceIndependentPublishers,2016.
3. M. Govindarajan, S. Natarajan & V.

Text Book:

1. PhilipKosky,RobertT.Balmer,WilliamD.S. Senthil Kumar, Engineering Ethics, 1st Edition, Phi Learning, 2009.

Reference Books:

1. Neerparaj Rai, Arduino Projects for Engineers, 1st edition, BPB Publications, 2016. 2.
2. Asimon Monk, Programming Arduino: GettingStarted withSketches,2nd Edition, McGraw-Hill Education, 2016.
3. W. Richard Bowen, Engineering Ethics – Outline of an aspirational approach, Springer London.

SYLLABI FOR II YEAR I SEMESTER

COURSE STRUCTURE

A4025– Managerial Economics and Financial Analysis

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course addresses the concepts, principles and techniques of Managerial Economics and Financial Analysis. It covers the fundamentals of Managerial Economics and its various aspects. Apart from Capital budgeting and its techniques, financial analysis gives clear idea about concepts and conventions of accounting, accounting procedures like journal, ledger, trial balance, final accounts and interpretation of financial statements through ratios.

Course Pre/co requisites: The Course has no specific Prerequisite and Co- Requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4025.1: Explain the concepts of Managerial Economics and Financial Accounting.
A4025.2: Analyze interrelationship among various economic variables and it's impact.
A4025.3: Classify the market structure to decide the fixation of suitable price.
A4025.4: Analyze financial statements to assess financial health of business.
A4025.5: Apply capital budgeting techniques to select best investment opportunity.

3. Course Syllabus

Contents

Introduction To Managerial Economics & Demand: Managerial Economics - Meaning, Definition, Nature and Scope of Managerial Economics. Demand Analysis: Demand - Meaning, Types, Demand Determinants, Law of Demand and its assumptions & exceptions.

Elasticity Of Demand & Demand Forecasting: Elasticity of Demand - Meaning, Types, Measurement and Significance. Demand Forecasting - Meaning, Need, Methods of demand forecasting. **Production Analysis:** Production – Meaning, Production function, Production function with one variable input, Iso-quants and Iso-costs, MRTS, Least Cost Combination of Inputs, Law of returns to scale.

Cost & Break Even Analysis: Cost- Meaning, Cost Concepts - Opportunity cost, Fixed vs. Variable costs, Explicit costs Vs. Implicit costs, Marginal cost, Sunk cost. Break-even Analysis (BEA)-Determination of Break-Even Point (simple problems) - Significance and limitations of BEA. **introduction to markets:** Market – Meaning, structure, Types of competition - Features of Perfect competition, Monopoly, Monopolistic Competition and Oligopoly - Price-Output Determination in case of Perfect Competition, Monopoly.

Pricing: Objectives and Pricing policies - Methods of Pricing -Cost plus Pricing, Marginal Cost Pricing, Sealed Bid Pricing, Going Rate Pricing, Limit Pricing, Market Skimming Pricing, Penetration Pricing, Two-Part Pricing, Block Pricing, Bundling Pricing, Peak Load Pricing, Cross Subsidization. **Introduction To**

Financial Accounting: Accounting Principles - Concepts, Conventions - Double-Entry Book Keeping - Journal, Ledger, Trial Balance.

Preparation Of Financial Statements: Final Account problems with simple adjustments. **Financial Analysis Through Ratios:** Ratio Analysis – Meaning, importance - Types: Liquidity Ratios, Solvency Ratios, Turnover Ratios and Profitability ratios. (Simple problems).

Capital Budgeting: Nature and scope of capital budgeting, features of capital budgeting proposals, Methods of Capital Budgeting - Payback Method, Accounting Rate of Return (ARR), Net Present Value Method, Profitability Index, Internal rate of return (simple problems).

4. Books and Materials

Text Books:

1. A.R. Aryasri (2011), *Managerial Economics and Financial Analysis*, TMH, India.

Reference Books:

1. *Varshney & Maheswari (2003*), *Managerial Economics*, Sultan Chand.
2. *Ambrish Gupta (2011), Financial Accounting for Management: An Analytical Perspective*, 4th Edition, Pearson Education, New Delhi.
3. *Richard Lipsey and Alec* Chrystal (2012), Economics, Oxford University Press.
4. *Domnick Salvatore:* Managerial Economics in a Global Economy, 4th Edition,Thomson.

COURSE STRUCTURE

A4206-BASIC ELECTRICAL AND ELECTRONICS ENGINEERING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course is intended to introduce the basic concepts of Electric Circuits, Machines, Diodes and Rectifiers to Mechanical Engineering students. This course makes the student to understand the basics of Network theorems and its applications. The operation and performance of D.C. Machines (Motors & Generators) will be exposed to the students theoretically and practically. Also, the students are made to have awareness about the AC fundamentals, Transformers and Diode rectifiers. Being an integrated course, the students will realize the theoretical concepts studied in the course by conducting experiments in the laboratory using hardware.

Course Pre/Co-Requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4206.1 Understand the basic laws of electrical circuits and Machines.
A4206.2 Analyze the electrical circuits using Nodal Analysis, Mesh analysis and Network theorems with DC Source.
A4206.3 Calculate power and Power factor in AC circuits.
A4206.4 Conduct suitable test to determine the performance of DC and AC Machines.
A4206.5 Analyze the characteristics of DC machines, Transformers, Diodes and rectifiers.

3. Course Syllabus

Dc Circuits: Electrical circuit elements (R, L and C), voltage and current sources, Ohms Law, KVL&KCL, Mesh and Nodal Analysis, Superposition, Thevenin, Norton and Maximum Power Transfer Theorems.

Ac circuits: Representation of sinusoidal waveforms, peak and RMS values, phasor representation,real power, reactive power, apparent power, power factor, Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel)

D.c. Generators: Principle of operation, constructional features,E.M.F. Equation, separately excited and self excited generators-Magnetization Characteristics.

D.c. Motors: Principle of operation –Types- Back E.M.F., Torque equation,Speed control of D.C. Motors(Armature and field control),Losses and Efficiency, Swinburne's Test.

Single phase transformers: Principle of operation**,** construction, minimization of hysteresis and eddy current losses. EMF equation, NO load and ON load Conditions, Phasor diagrams. Equivalent circuit ,losses and efficiency,OC and SC tests.

Diode and its characteristics: P-N junction diode, symbol, V-I characteristics, rectifiers - half wave, full wave and bridge rectifiers (simple Problems).

4. List of experiments

1. Verification of Ohms Law.
2. Verification of KVL and KCL
3. Determination of PN junction diode characteristics
4. Realization of full wave and half wave rectifier characteristics
5. Verification of Thevenins theorems.
6. Verification of Norton's theorems.
7. Verification of Maximum Power Transfer theorem.
8. Verification of Super Position theorems.
9. OC and SC Test on a Single Phase Transformer
10. Open circuit characteristics of DC Shunt Generator
11. Brake test on DC Shunt motor and draw the characteristics.
12. Predetermination of efficiency of given DC Shunt machine(Swinburnes Test).

5. Books and Materials

Text Books:

1. T. K. Nagasarkar, M. S. Suhkija (2007), BasicElectricalEngineering, 2nd Edition, Oxford University Press, New Delhi.
2. S. Salivahanan, N Suresh Kumar, A. Vallavaraj (2007), ElectronicDevicesandCircuits, Tata McGraw Hill, India. 3. J. Millman, C. C. Halkias, and SatyabrathaJit (2011), ElectronicDevicesandCircuits, 3rd Edition, Tata McGraw Hill, New Delhi**.**

Reference Books:

1. SudhakarShyam Mohan S P (2005), NetworkAnalysis, 2ndEdition, Tata McGraw-Hill, New Delhi.
2. L. Thereja and A. K. Thereja (2008), A Text Book of Electrical Technology, First Edition, S. Chand & Company limited, New Delhi.
3. S. Salivahanan, N. Suresh Kumar, A. Vallavaraj (2008), Electronic Devices and Circuits, 2nd edition, Tata McGraw Hill, New Delhi.

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COURSE STRUCTURE

A4305-MECHANICS OF SOLIDS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	2	42	14	28	5	30	70	100

1. Course Description

COURSE OVERVIEW

This course will provide the fundamental background needed to understand the material behavior under various types of loadings. This deals stress and strain concepts, axially loaded members, thermal, shear and bending stresses, deflections in beams, stresses in thin and thick cylinders under internal and external pressure.

This course forms the basis for the study of advanced courses like Design of Machine Members, Finite Element Methods and Advanced Mechanics of Solids. It is imperative that these concepts are well understood.

2. Course Outcomes (COs)

A4305.1: **Understand** the concepts of stress and strain instructural members
A4305.2: **Construct** SF & BM diagrams for beams
A4305.3: **Solve** numericalproblems onstructural members to find deformations and deflections.
A4305.4: **Analyze** stresses inbars, beams and cylindrical shells
A4305.5: **Test** formechanical properties of the material and its behavioral analysis

3. Course Syllabus

Simple Stresses And Strains: Elasticity and plasticity, Types of stresses and strains, Hooke's law, stress strain diagram for mild steel, Working stress, Factor of safety, Lateral strain, Poisson's ratio and volumetric strain, Elastic module and the relationship between them, Bars of varying section, composite bars, Temperature stresses. Strain energy, Resilience - Gradual, Sudden, Impact and Shock loadings.

Shear Force And Bending Moment: Definition of beam, Types of beams, Concept of shear force and bending moment, Relation between Shear Force and Bending Moment, and rate of loading at a section of a beam. Shear Force and Bending Moment diagrams for cantilever simply supported and overhanging beams subjected to point loads, U.D.L., uniformly varying loads and combination of these loads.**Flexural Stresses:** Theory of simple bending, Assumptions, Derivation of bending equation, 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, I, T, angle and channel sections.

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 various loads.

Thin and thick cylinders: Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses hoop, longitudinal and volumetric strains, changes in diameter, and volume of

thin cylinders, Thin spherical shells. A thick cylinder lame's equation, cylinders subjected to inside and outside pressures, compound cylinders.

4. List Of Experiments

1. To determine tensile strength of mild steel specimen using Universal Testing Machine.
2. To determine modulus of rigidity given specimen using Torsion Testing Machine.
3. To determine Young's modulus and stiffness of Simple supported beam.
4. To determine Young's modulus and stiffness of Cantilever beam.
5. To determine Hardness of given specimen using Brinell Hardness Testing Machine.
6. To determine Hardness of given specimen using Rockwell Hardness Testing Machine.
7. To determine impact strength of given specimen by Charpy Testing Machine.
8. To determine impact strength of given specimen by Izod Testing Machine.
9. To determine stiffness and modulus of rigidity of given spring using Spring Testing Machine.
10. To determine compressive strength of given specimen using Compression Testing Machine.
11. To determine Hardness of given specimen using Vicker's Hardness Testing Machine.

5. Books and Materials

Text Books:

1. Ramamrutham. S (2012), Strength *of materials*, 17th edition, Dhanpat Rai Publications, New Delhi, India.
2. Timoshenko. S (2004), *Strength of materials*, 3rd edition, CBS Publishers, New Delhi, India.

Reference books:

1. Ryder G. H (2007), *Strength of materials*, 3rd edition, Macmillan, New Delhi, India.
2. Bhavikathi S. S (2008), *Strength of materials*, 3rd edition, Vikas Publishing House, New Delhi, India.
3. Bansal R. K (2007), Strength of materials, 10th edition, Laxmi Publications, Hyderabad, India.

COURSE STRUCTURE

A4306– THERMODYNAMICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course Overview

Thermodynamics is the field of physics that deals with the relationship between heat and work in a substance undergoing thermodynamic process. Key topics include thermodynamic properties of fluids, first law of thermodynamics applied to common engineering situations, second law of thermodynamics applied to heat engines and refrigeration systems. The course is extended to the study of properties of pure substance and the analysis of power cycles.

Course Pre/Co-requisites

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4306.1: **Understand** the basic principles of classical thermodynamics.
A4306.2: **Apply** the laws of thermodynamics to solve engineering problems.
A4306.3: **Evaluate** change in entropy for ideal and real gases.
A4306.4: **Solve** numerical problems using relationships of thermodynamic fluids.
A4306.5: **Analyze** the performance of basic thermodynamic cycles.

3. Course Syllabus

Basic Concepts: Macroscopic and microscopic approaches, thermodynamic systems, boundary, surroundings,thermodynamic property, intensive and extensive properties, concept of continuum, thermodynamic equilibrium, state, path, process and cycle, quasi static, reversible and irreversible processes, Energy and its forms, concepts of heat and work, equality of temperature and Zeroth Law of thermodynamics, thermodynamic temperature scales.

First Law Of Thermodynamics: First law ofthermodynamics, internal energy, enthalpy, PMM -I, Steady flow energy equation, Application of First law to non-flow and steady flow processes, Throttling and free expansion processes, Limitations of first law of thermodynamics.

Second Law Of Thermodynamics: Kelvin-Planck and Clausiusstatements, heat engine, heat pump, refrigerator, PMM-II, Carnot cycle, Carnot heat engine, Carnot theorem and its corollaries, Entropy, Clausius inequality, principle of entropy increase, Availability, unavailable energy.

Pure Substance: Properties of pure substance, phase transformation, saturated and superheated steam, solid-liquid-vapour equilibrium, dryness fraction, properties of dry, wet and superheated steam, Mollier diagram and steam calorimetry.

Thermodynamic Relations: Maxwell's equations, Tds equations, Difference in heat capacities, ratio of heat capacities, energy equation, Joule-Thomson effect. Clausius- Clapeyron equation, Evaluation of thermodynamic properties from an equation of state (Vander Wall’s Equation).

Power Cycles: Air standard cycles - Otto, Diesel and Dual combustion cycles, description andrepresentation on PV and TS diagrams, Thermal efficiency, mean effective pressures on air standard basis, comparison of cycles, Braton cycle and Rankine Cycle

4. Books and Materials

Text Books:

1. *P. K. Nag (2008),* Engineering Thermodynamics, 3rd edition, Tata McGraw-Hill, New Delhi, India.
2. *R. K. Rajput (2010),* A text book of Engineering Thermodynamics, Fourth Edition, Laxmi Publications, New Delhi, India

Reference Books:

1. *J. B. Jones, R. E. Dugan (2009),* Engineering Thermodynamics, 1st edition, Prentice Hall of India Learning, New Delhi, India.
2. *YunusCengel, Boles (2011*), Thermodynamics - An Engineering Approach, 7th edition, Tata McGraw-Hill, New Delhi, India.
3. *V. C. Rao (2009),* An introduction to Thermodynamics, Revised Edition, Universities Press, Hyderabad, India.

COURSE STRUCTURE

A4307 – METALLURGY AND MATERIAL SCIENCE

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

The course provides an overview of material science in which different material properties and their interrelationship with various metallurgical parameters will be studied.
This is an integrated course having theory and practical components that integrates hands on experience with different experiments to study structure of materials using metallurgical microscopes. This course forms the basis for the study of advanced courses like Production Technology I and II, Composite materials, Nanotechnology and High Temperature Materials. It is imperative that these concepts are well understood.

Course Pre/co-requisites: The Course has no specific Prerequisite and Co- Requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4307.1: **Understand** the basic principles of materials through crystal structure.

A4307.2: **Identify** the phases and interrelationship between structure and properties.

A4307.3: **Construct** phase diagram of alloy systems at different temperatures and composition

A4307.4: **Apply** basic principles for selection of materials.

A4307.5: **Analyze** effect of heat treatment on material properties.

3. Course Syllabus

Introduction: Historical perspective, scope of materials science and engineering. Atomic structure and inter atomic bonding and metallurgical tools. Mechanical Property Measurement-Tensile, compression, hardness, creep, fatigue, Non-destructive Testing.

Structure Of Metals: Lattices, basic idea of symmetry. Bravais lattices, unit cells, crystal structures, crystal planes and directions, co-ordination number. Imperfections in solids: point defects, line defects, surface defects. Grain and grain boundaries, effect of grain boundaries on the properties of metal / alloys, determination of grain size.

Constitution Of Alloys: Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds; Working and annealing of metal and its alloys.

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 Fe-Fe3C, equilibrium phase diagram.

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 and stainless steel.

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.

Non-Ferrous Metals And Alloys: Structure and properties of copper and its alloys, Aluminium and its alloys.

Advanced And Special Purpose Alloys: High temperature alloys, Special steels and alloys for Aero-space, Missile and Strategic applications.- Maraging steel, Titanium and its alloys. Precipitation hardness steel**.**

Ceramic Materials: Crystalline ceramics, glasses, cermets, abrasive materials, nanomaterials - definition, properties and applications of the above.

Composite Materials: Classification of composites, particle - reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal matrix composites and C – C composites. Methods of manufacturing of composites.

4. List Of Experiments

1. Preparation and study of crystal models for simple cubic, body centered cubic, face centered cubic and hexagonal close packed structures.
2. Preparation and study of the Microstructure of pure metals like Fe, Cu and Al.
3. Grain size measurement by intercept method.
4. Preparation and study of the Microstructure of Mild steels, low carbon steels, high carbon steels.
5. Study of the Microstructures of Cast Irons.
6. Study of Microstructures of nickel base super alloy.
7. Study of the Microstructures of brass and bronze.
8. Study of the Microstructures of Titanium alloys.
9. Hardenability of steels by Jominy End Quench Test.
10. To find out hardness of various heat treated and untreated plain carbon steels.
11. Study of microstructure of precipitation hardened steel.
12. Study of change in microstructure of steel after normalizing, hardening and tempering.

5. Books and Materials

Text Books:

1. Sidney H. Avener , *Introduction to Physical Metallurgy*, 2nd edition, Tata McGraw hill education (P) Ltd, New Delhi, India.
2. V. Raghavan , *Material Science and Engineering: A first course*, 5th edition, Prentice Hall of India (P) Ltd, New Delhi, India.
3. R E Smallonan, K H G Ashbee- Moderns Metallography, Elsiver, January 1966.

Reference Books:

1. William F. Hosford (2007), Materials Science, an Intermediate Text, Cambridge university press.

2. Dieter, George Ellwood, Mechanical Metallurgy, Copyright © 1988 McGraw-Hill Book Company (UK) Limited.
3. Michael F. Ashby and David R. H. Jones, Engineering Materials 2, an Introduction to Microstructures, Processing and Design Second Edition, Butterworth-Heinemann.
4. W. D. Callister, Jr.,(2006) Materials science and engineering: An introduction, 6th Edition, John Wiley & Sons.
5. R. E. Smallman, R. J. Bishop, Modern Physical Metallurgy and Materials Engineering Science, process, applications, Butterworth-Heinemann
6. S.L. Kakani and Amit Kakani (2004), Materials Science, New Age International (P) Limited, Publishers.
7. Superalloys-A Technical Guide-M J Donachie & S J Donachie A S M International .Metal Park .Ohio
8. A S M Hand Book Vol-1
9. Mechanics of composite materials, ROBERT M. JONES, Taylor & Francis,U.S.A
10. Balram Gupta etal Aerospace Materials, S B Chand & Company Ltd, January 2009.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4019- VERBAL ABILITY AND LOGICAL REASONING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
1	0	0	14	0	0	1	30	70	100

1. Course Description

Course Overview

This course provides the basic skills of verbal and logical reasoning as required by companies for Campus Recruitment and also for other Competitive exams. The contents of this course includes different techniques of solving problems on Coding and Decoding, Seating Arrangements, Syllogisms, Blood Relations, Visual reasoning and brief account on basic grammar such as Error detection, Modifiers, Articles etc .

Course Pre/co-requisites

To equip learners with the knowledge and skills required to get placed in reputed companies and other competitive exams.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4019.1 Identify efficient and appropriate methods to solve logical reasoning problems.

A4019.2 Choose the techniques to solve puzzles on analytical reasoning.

A4019.3 Apply the grammar rules for effective sentence formation

3. Course Syllabus

Coding and Decoding: Coding and Decoding, Arrow Method, Chinese coding, Series, Analogy, Odd man out.

Articles and Tenses: Introduction, usage of articles, Omission of Articles, Types of tenses, Forms and Usage of tenses.

Direction Sense: Introduction, Distance method, Facing Method and Shadow Method.

Blood Relations: Introduction, Direct, Puzzle and Coded models.

Voices and Forms of Speech: Introduction, conversion of active and passive voice, conversions of direct and indirect speech.

Data Arrangements: Linear Arrangement, Circular Arrangement, Multiple Arrangements.

Syllogisms: Introduction, Tick-Cross method, Inferential Technique, Venn-Diagram method.

Visual Reasoning: Patterns, Folded Images, Cubes and Analytical Reasoning.

Sentence Correction: Subject-Verb Agreement, Pronoun Antecedent, Parallelism, Verb-Time Sequence Error, Determiners and Modifiers.

4. Books and Materials

Text Books:

1. R.S. Aggarwal, Vikas Aggarwal, *Quick Learning Objective General English,* S.Chand, 2003.
2. *R*.S. Aggarwal, *A Modern Approach to Logical Reasoning*, Revised Edition, S Chand & Co Ltd.

Reference Books

1. Edgar Thorpe, *Test of Reasoning for all competitive examinations*, 6th Edition, McGraw Hill Education, 2017.
2. Arun Sharma, *How to Prepare for Logical Reasoning for CAT and other Management Examination*s, 4th edition, McGraw Hill Education, 2017.
3. Simbo Nuga, *English Grammar and Verbal Reasoning – The Toolkit for Success*, Trafford Publishing, 2013.

COURSE STRUCTURE

A4013-GENDER SENSITIZATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	0	100	100

1. Course Description

Course Overview

Towards a World of Equals is a course that introduces students to different dimensions of gender issues. Gender Sensitization is one of the basic requirements for the normal development of an individual and primarily highlights the contribution of both the genders in creation and development of a well balanced society. A curriculum-based approach to bring a change is desired to inculcate sensitivity towards issues concerning the relationship between men and women, caste, declining sex ratio, struggles with discrimination, sexual harassment, new forums for justice, eve-teasing, etc., The need for this sensitivity has been felt and realized through times immemorial and in almost all kinds of human existence, across the globe.

Course Pre/Co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4013.1: Build the significance of the process of socialization and relationships between men and women on the basis of a just and equal world

A4013.2: Examine the decline of female sex ratio and discrimination faced by people with different gender identities

A4013.3: Take part in house work, in order to allow for equality and share equal family spaces Estimate women's contribution to the nation's economy

A4013.4: Analyze the consequences of sexual violence and importance of consent in friendship and other relationship

A4013.5: Perceive the invisibility of women in history and show how locating a women in history makes them visible

3. Course Syllabus

1. Gender Sensitization: Why should we study it?
2. Socialization: Making Women, Making Men
3. Introduction
4. Preparing for womanhood
5. Growing up male
6. First lessons in caste
7. Different masculinities
8. Just Relationships: Being Together as Equals
9. Mary Kom and Onler
10. Love and Acid just do not mix
11. Love letters
12. Mothers and fathers

13. Further Reading: Rosa Parks-The Brave heart
14. Missing Women: Sex Selection and Its Consequences
15. Declining Sex Ratio
16. Demographic Consequences
17. Gender Spectrum: Beyond the Binary
18. Two or Many?
19. Struggles with Discrimination
20. Additional Reading: Our Bodies, Our Health
21. Housework: The Invisible Labor
22. "My Mother doesn't work"
23. "Share the load"
24. Women's Work: Its Politics and Economics
25. Fact and fiction
26. Unrecognized and unaccounted work
27. Further Reading: wages and conditions of work.
28. Sexual Harassment: Say No!
29. Sexual harassment, not eve-teasing
30. Coping with everyday harassment
31. Further Reading: "Chupulu"
32. Domestic Violence: Speaking Out
33. Is home a safe place?
34. When women unite (Film)
35. Rebuilding lives
36. Further Reading: New Forums for justice.
37. Thinking about Sexual Violence
38. Blaming the Victim- " I Fought for my life…"
39. Further Reading: The caste face of violence.
40. Knowledge: Through the Lens of Gender
41. Point of view
42. Gender and the structure of knowledge
43. Further Reading: Unacknowledged women artists of Telangana
44. Whose History? Questions for Historians and Others
45. Reclaiming a Past
46. Writing other Histories
47. Further Reading: Missing pages from modern Telangana history

1. Books and Materials

Text Book:

1. "*Towards a World of Equals*: A Bilingual Textbook on Gender". *Telugu Akademi*, Hyderabad, 2015

Reference Book: NIL

SYLLABI FOR II YEAR II SEMESTER

COURSE STRUCTURE

A4012-PROBABILITY AND STATISTICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course provides a solid undergraduate foundation in both probability theory and mathematical statistics and at the same time provides an indication of the relevance and importance of the theory in solving practical problems in the field of multidisciplinary engineering applications. The mathematical skills sustained from this course form a suitable base to analytical and theoretical concepts encountered in engineering profession.

Course Pre/Co-Requisites

The course has no specific prerequisite and co-requisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4012.1: Solve real world problems using the theory of probability
A4012.2: Identify the types of random variables, distributions involved in a given problem
A4012.3: Determine probabilities using discrete and continuous distributions
A4012.4: Evaluate confidence interval for a population parameter for single and two sample cases
A4012.5: Estimate goodness of fir, hypothesis testing for small and large samples

3. Course Syllabus

Probability: Sample Space, Events, Counting Sample Points, Probability of an Event, Additive Rules, Conditional Probability, Independence, and the Product Rule, Bayes' Theorem.

Random Variables and Probability Distributions: Concept of a Random Variable, Discrete Probability Distributions, Continuous Probability Distributions, Statistical Independence, Joint Probability Distributions. Mean of a Random Variable, Variance and Covariance of Random Variables, Means and Variances of Linear Combinations of Random Variables.

Discrete and Continuous Distributions: Moment generating function, moments and properties. Discrete distributions: Binomial distribution, Poisson Distribution, Continuous Distribution: Uniform distribution, Normal distribution, Evaluation of all statistical constants of above mentioned distributions through moments, MGF.

Estimation and Testing of Hypothesis for Large samples: Point estimation, Maximum error estimate, Interval Estimation, Introduction to Hypothesis, Type I and Type II error, Level of significance, one tailed and two tailed test, Test concerning one mean and one proportion, Two means and two Proportions.

Testing of Hypothesis for Small samples: Test for single mean, difference of means and paired t-test, Test for ratio of variances (F-test), Chi-square test for goodness of fit and independence of attributes.

4. Books and Materials

Text Books:

1. Ronald E. Walpole,Raymond H. Myers,Sharon L. Myers,Keying Ye.,*Probability & Statistics for Engineers & Scientists,* 9th Edition,Pearson Publication, 2012.
2. S.C. Gupta and V. K. Kapoor**,** *Fundamentals of Mathematical statistics*, Tenth Revised Edition, S Chand & Sons, New Delhi, 2000.

Reference Books:

1. T.T. Soong,*Fundamentals of Probability and Statistics for Engineers**,John Wiley & Sons, Ltd, 2004*
2. Sheldon M Ross, *Probability and Statistics for Engineers and Scientists*, 4th Edition, Academic Press**,** 2009.
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, 9th Edition, John Wiley & Sons, 2006..

COURSE STRUCTURE

A4308 – IC ENGINES AND GAS TURBINES

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course is intended to introduce basic principles of **I**nternal **C**ombustion (**IC**) engines. It is further extended to cover the application of IC engines, air compressors and gas turbines by their inclusion in the content. In day to day life IC engines, air compressors and gas turbines are playing vital role and have wide applications in many situations directly or indirectly. Thus, there is a great relevance of this course for mechanical engineers.

Course Pre/Co-Requisites

A4306 –Thermodynamics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4308.1: Compare air standard cycles with actual and fuel air cycles.

A4308.2: Analyze combustion phenomenon in SI and CI engines.

A4308.3: Explain the performance parameters of internal combustion engines, compressors and gas turbines.

A4308.4: Solve the problems related to internal combustion engines, compressors and gas turbines.

A4308.5: Evaluate the performance of internal combustion engines and compressors.

4. Course Syllabus

Ic Engines:Classification, Working principles, Valve and Port Timing Diagrams. 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.

Combustion In Ic Engines:

Combustion in SI Engines Normal Combustion and abnormal combustion, Importance of flame speed and effect of engine variables, Type 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, open and divided combustion chambers and nozzles used – fuel requirements and fuel rating.

Testing And Performance Of Ic Engines: 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.**Reciprocating Compressors**: Classification of compressors, Principle of operation of reciprocating compressors, work required, Isothermal efficiency volumetric efficiency and effect of clearance, multi-stage compression, under cooling, saving of work, minimum work condition for multi-stage compression.

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

Gas Turbines: Simple gas turbine plant, Ideal cycle, essential components, parameters of performance, actual cycle , regeneration, inter cooling and reheating, optimum pressure ratio.

4. List of Experiments

1. To conduct the Performance Test on Single Cylinder 4 Stroke Diesel Engine.
2. To conduct the Motoring Test on Single Cylinder 4-Stroke Diesel Engine.
3. To conduct the Heat Balance test on 4 – Stroke Diesel Engine.
4. To conduct the Performance Test on Single Cylinder two stroke Petrol Engine.
5. To conduct the Performance Test on Single Cylinder four stroke Petrol Engine.
6. To conduct the Performance Test on Four Stroke Single Cylinder Variable Compressor Ratio (VCR) Petrol Engine.
7. To conduct the Morse Test on Multi Cylinder 4 Stroke Petrol Engine.
8. To conduct the Performance Test on 2 Stroke Twin Cylinder Reciprocating Air Compressor.
9. To draw Valve Timing Diagram for 4-stroke diesel engine.
10. To draw Port Timing diagram for 2-stroke petrol engine.
11. Disassembly/assembly of an engine (old engine).

5. Books and Materials

Text Books:

1. V. Ganesan (2011), I.C. Engines, 3rd edition, Tata McGraw-Hill, New Delhi, India.
2. B. John Heywood (2011), internal combustion engine fundamentals, 2nd edition, Tata McGraw-Hill,New Delhi.
3. M. Mahesh Rathore (2010), Thermal Engineering, 1st Edition, Tata McGraw-Hill, New Delhi, India.

Reference Books:

1. Mathur, Sharma (2008), IC Engines, 3rd edition, Dhanpat Rai & Sons, New Delhi, India.
2. R. K. Rajput (2011), Thermal Engineering, 18th edition, Lakshmi Publications, New Delhi, India.
3. Pulkrabek (2008), Engineering fundamentals of IC Engines, 2 nd edition, PearsonEducation, New Jersey.

COURSE STRUCTURE

A4309 – KINEMATICS OF MACHINERY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course deals with the fundamental concepts and principles applied by engineers in the design of structures and to provide in-depth knowledge in basic mechanisms. It builds upon the mathematics and physics courses, extending to learn the systematic way of solving problems and kinematics to understand what happens to a body when force(s) is/are applied to it. It aim also to engage students to understand the different methods of obtaining a mechanism and utilize analytical, mathematical and graphical aspects of kinematics for effective design.

Course Pre/co requisites

A5302-Engineering Mechanics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4309.1. **Explain** the principles of kinematic pairs, chains and their classification, degrees of freedom, inversions and planar mechanisms.

A4309.2. **Analyze** the planar mechanisms for position, velocity and acceleration.

A4309.3. **Select** planar four bar and slider crank mechanisms for specified kinematic conditions.

A4309.4. **Evaluate** gear tooth geometry and select appropriate gears for the required applications.

A4309.5.**Choose** the cams and followers for specified motion profiles.

Course Syllabu

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.

Machines: Mechanism and machine, kinematic chain, inversion of mechanism, inversions of four bar chain, Beam Engine, Coupling rod of a locomotive, Watt's indicator mechanism inversions of single slider crank chain - Pendulum pump, Oscillating cylinder engine, Rotary I.C. Engine, Crank and slotted lever quick return motion mechanism, Whit worth quick return motion mechanism and inversions of double slider crank chain- Elliptical trammel, Scotch yoke mechanism, Oldham's coupling.

Straight Line Motion Mechanisms: Straight line motion - Exact and approximate straight line mechanisms and its types, Peaucellier, Hart and Scott Russul, Grasshopper, Watts, Tchebicheff and Robert Mechanisms and Pantograph.
Kinematics: Velocity and acceleration, Motion of link in machine, Determination of Velocity and acceleration diagrams, Graphical method, Application of relative velocity method four bar chain.

Plane Motion Of Body: Instantaneous center of rotation, centroids and axodes, relative motion between two bodies, three centre's in line theorem, Graphical determination of instantaneous centre, diagrams for simple mechanisms and determination of angular velocity of points and links.

Analysis Of Mechanisms: Analysis of slider crank chain for displacement, velocity and acceleration of slider, Acceleration diagram for a given mechanism, Klein's construction, Coriolis acceleration.

Steering Mechanisms: Conditions for correct steering, Davis Steering gear, Ackerman's steering gear, velocity ratio.
Hooke's Joint: Single and double Hooke's joint, Universal coupling, application, problems.
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- Dispacement, Velocity and acceleration diagrams. Construction of Cam profiles- Cam with knife edge follower, roller follower and flat faced follower. Maximum velocity and maximum acceleration during outward and return strokes in the above 3 cases.
Belt Rope And Chain Drives: Introduction, Belt and rope drives, selection of belt drive- types of belt drives-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.

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. Introduction to Helical, Bevel and worm gearing.
Gear Trains: Introduction, Train value, Types, Simple and reverted wheel train, Epicyclic gear Train. Methods of finding train value or velocity ratio, Epicyclic gear trains.

4. Books and Materials

Text Books:

1. R. K. Bansal (2010), *Theory of machines*, 5th edition, Lakshmi Publications, Hyderabad,India.
2. S.S.Rattan(2009),*TheoryofMachinesandMechanisms*,3rdedition,TataMcGraw-Hilleducation
3. (P) Ltd, New Delhi, India.

4. Thomas Bevan (2012), *Theory of machines*, 3rd edition, CBS Publishers, New Delhi,India.

Reference Books:

1. R. L. Norton(2011), *Kinematics And Dynamics Of Machinery (Sie),* Tata Mcgraw-Hill Education (P) Ltd, New Delhi,India.
2. Uicker, J.J., Pennock G.R and Shigley, J.E., "Theory of Machines and Mechanisms", 3rd Edition, Oxford University Press,2009.
1. V.P.Singh (2012),Theory of machines,3rd edition, Dhanapat Rai & Co, NewDelhi, India.
2. Ghosh. A and Mallick, A.K., "Theory of Mechanisms and Machines", Affiliated East-West Pvt. Ltd., New Delhi,1988.
3. R. S. Khurmi, J. K. Gupta (2010), *Theory of machines*, S. Chand Publishers, New Delhi, India. Jagadish lal (2006), Theory of mechanisms and machines, 2nd edition, metropolitan book Co.Pvt.ltd.

COURSE STRUCTURE

A4310 – FLUID MECHANICS AND HYDRAULIC MACHINES

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course mainly deals with the behaviour of fluids and hydraulic machines. The concepts include fluid properties, fluid statics and dynamics. This course also covers working principles of Hydraulic Machines and its characteristics. This course is an integrated course having theory and practical components that integrates hands on experience on various fluid flow parameters including hydraulic machines such as turbines and pumps. This course is fundamental to study some of the advanced courses like Heat Transfer and Computational Fluid Dynamics.

Course Pre/Co-Requisites

A4303-Engineering Mechanics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4310.1: **Explain** the fundamental aspects of fluid properties, fluid statics, dynamics including the theory of boundary layer and hydraulic turbines &pumps.

A4310.2: **Establish** relationships among fluid flow parameters.

A4310.3: **Solve** fluid engineering problems using mass, momentum, and energy conservation principles.

A4310.4: **Analyze** fluid flow through pipes and its fittings; models and prototypes of fluid systems and performance of hydraulic turbines and pumps.

A4310.5: **Determine** the specifications of pressure and flow measuring devices, piping systems, turbines and pumps

3. Course Syllabus

Fluid Statics: Dimensions and units: physical properties of fluids- specific gravity, viscosity, and surface tension - Vapour pressure and their influence on fluid motion- atmospheric, gauge and vacuum pressures – measurement of pressure- Piezometer, U-tube and differential manometers.

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

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

Closed Conduit Flow: Reynold's experiment-Hagen-Poisuelle equation, Darcy-Weisbachequation, Minor losses in pipes, pipes in series and pipes in parallel, total energy line and hydraulic gradient line. Measurement of flow: Pitot tube, venturi meter and orifice meter.

Dimensional Analysis: Need for dimensional analysis, Dimensions and units, Dimensional Homogeneity, dimensionless numbers, methods of dimensional analysis: Buckinghum π theorem, Rayleigh's method, similitude and model studies.

Boundary Layer Concepts: Definition, thicknesses, characteristics along thin plate, laminar and turbulent boundary layers (No derivation), boundary layer in transition flow, separation of boundary layer, drag and lift on submerged bodies.

Impact Of Jets: 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.
Hydraulic Turbines: Classification of turbines, Heads and efficiencies, impulse and reaction turbines, Pelton wheel, Francis turbine and Kaplan turbine-working proportions, work done, efficiencies, Performance of turbines
Hydraulic Pumps: Classification, Centrifugal pumps: working, work done – manometric head- losses and efficiencies specific speed- performance characteristic curves. Reciprocating pumps: Working, Classification, Discharge, slip.

4. List Of Experiments:

1. To determine the co-efficient of discharge and calibrate the Venturimeter.
2. To determine the co-efficient of discharge and calibrate the Orifice meter.
3. To determine the co-efficient of friction factor in a given pipe line.
4. To determine the loss co-efficient due to sudden contraction.
5. To verify the Bernoulli's theorem
6. To identify types of flow through a pipe
7. To determine the efficiency of vane using Impact of jet on Vane Setup.
8. To determine the operating characteristics of Pelton Turbine.
9. To determine the operating characteristics of Francis Turbine.
10. To determine the operating characteristics of Kaplan Turbine.
11. To determine the efficiency of Single Stage Centrifugal Pump.
12. To determine the efficiency of Multi Stage Centrifugal Pump.
13. To determine the efficiency of Reciprocating Pump.

4. Books and Materials

Text Books:

1. P. N. Modi&S. M. Seth (2011), *Hydraulics and Fluid Mechanics including hydraulic machines,* 14th edition, AD. Computers, New Delhi, India.
2. S. K. Som& G. Biswas (2012), Introduction to Fluid Mechanics and Fluid Machines, Tata McGraw hill education (P) Ltd, New Delhi, India.
3. Dr. R. K. Bansal, (2011*), Fluid Mechanics and Hydraulic machines*, 11th edition, Laxmi publications Private limited, New Delhi, India.

Reference Books:

1. Dr. A. K .Jain (2009), *Fluid Mechanics*, 10th edition, Khanna Publishers, New Delhi, India.
2. M. Fank White, (2011*), Fluid Mechanics* (SIE), 7th edition, Tata McGraw hill education (P) Ltd, New Delhi, India.
3. S. P. Ojha, R. Berndtsson (2012), *Fluid Mechanics and Machinery*, Oxford Higher Education, USA.
4. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd.

COURSE STRUCTURE

A4311- MANUFACTURING PROCESSES

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Overview

Course Overview

Production technology deals with various manufacturing processes of materials like melting, casting joining, hot and cold working, forming and plastic components making. A combination of basic theory and industrial manufacturing processes will be discussed.

Course Pre–requisites

A4307-Metallurgy & Material Science

2. Course Outcomes (COs)

After the completion of the course, the student will be able to

A4311.1: Understand various manufacturing operations including their capabilities, limitations and applications.

A4311.2: Analyze products and be able to improve their manufacturability and to reduce the cost

A4311.3: Analyze the thermal and metallurgical aspects during solidification in casting and welding and their role on quality of cast and weld objects.

A4311.4: Design the gating and riser system.

A4311.5: Apply knowledge on selection of suitable manufacturing process for typical component.

2. Course Syllabus

Casting: Introduction, Steps involved in making a casting, Advantages of casting and its applications; Pattern and Pattern making - Types of patterns, Materials used for patterns, pattern allowances, Principles of Gating system, Gating ratio and design of Gating system; Solidification of casting - Solidification of pure metal and alloys, short and long freezing range alloys; Risers - Types, function and design; Special casting processes - Centrifugal, Die and Investment casting; Methods of melting - Crucible melting and cupola operation, steel making processes, Casting defects.

Welding: Classification of welding processes, types of welds and welded joints and their characteristics, design of welded joints, Gas welding, ARC welding, Forge welding, resistance welding, Thermit welding and Plasma (Air and water) welding, Current Voltage Characteristics of Arc Welding.
InertGas Welding: TIG and MIG welding, Friction welding, Induction welding, Explosive welding, Laser welding, Soldering and Brazing. Heat affected zones in welding, welding defects, causes and remedies, destructive and nondestructive testing of welds.

Cutting Of Metals: Oxy Acetylene Gas cutting, water plasma, cutting of ferrous and non-ferrous metals.
Hot Working And Cold Working: Strain hardening, recovery, recrystallisation and grain growth, Comparison of properties of cold and hot worked parts.
Rolling: Fundamentals, theory of rolling, types of Rolling mills, Forces in rolling and power requirements. Stamping, forming and other cold working processes: Blanking and piercing, Bending and forming,

Drawing and its types, wire drawing and Tube drawing, coining, spinning, Forces and power requirement in the above operations.

Forging: Principles of forging, Tools and dies, Types of Forging, Smith forging, Drop Forging, Roll forging, Rotary forging, forging defects.

Extrusion Of Metals: Basic extrusion process and its characterics, Hot and Cold extrusion, forward extrusion and backward extrusion, impact extrusion and hydrostatic extrusion.

Processing Of Plastics: Types of plastics, properties and applications, processing methods and equipments of plastics - blow moulding and injection moulding.

4. List Of Experiments

1. To prepare a wooden pattern of given model.
2. To determine the Compressive Strength of the Moulding Sand.
3. To test the permeability of given Moulding sand.
4. To Prepare a Casting for the given Solid Patten using Sand Moulding Process.
5. To join the given two work pieces as a Lap Joint and Butt Joint using Arc welding process.
6. To join GI (Galvanized iron) sheets using Resistance spot welding.
7. To join a given work pieces by using Gas welding Process.
8. To prepare Butt Joint Using Tungsten Inert Gas Welding process.
9. To conduct punching and blanking operations on sheet metal by using hydraulic press.
10. To prepare a V-shape bend on G.I sheet metal by using fly press.
11. To produce a component by using Injection Moulding machine.
12. To produce a Hollow component using Blow Moulding machine.

5. Books and Materials

Text Books:

1. P. N. Rao (2011), Manufacturing Technology, Vol -1, 3rd edition, Tata McGraw- Hill education (P) Ltd, New Delhi.
2. S. Kalpakjain and Steven Schemid, Manufacturing Processes for engineering materials (5th Edition)- Pearson India, 2014.
3. Ghosh and Mallik(2014), Manufacturing Science, 2nd edition, Tata McGraw- Hill education (P) Ltd, New Delhi.

Reference Books:

1. R. K. Jain (2010), Production Technology, 16th edition, Khanna publishers, New Delhi, India.
2. S. Raghuwanshi (2011), A course in workshop Technology, Vol - II, 3rd Edition, Dhanpat Rai & Co, New Delhi, India.
3. Richard W. Heine, Carl R. Loper, Philip C. Rosenthal, Principles of Metal Casting, Tata McGraw-Hill Education.

COURSE STRUCTURE

A4312 – MACHINE DRAWING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	4	0	0	56	2	30	70	100

1. Course Description

Course Overview

Machine drawing is used to communicate the necessary technical information required for manufacture and assembly of machine components. These drawings follow rules laid down in national and International Organizations for Standards (ISO). Hence the knowledge of the different standards is very essential. Students have to be familiar with industrial drafting practices and thorough understanding of production drawings to make them fit in industries. The following topics have been covered to fulfil the above objectives. Classification of Machine Drawings, Principles of Drawings, Sectioning, Dimensioning, Limits, Fits and Tolerance, Symbols and Conventional Representation, Screw Fasteners, Key Joints, Coupling and its Types, Riveted Joints, Structural Applications, Assembly Drawings, Introduction of Computer Aided Drafting, Introduction of Solid 3D Modeling.

Course Pre/Co-requisites

A4301- Engineering Graphics and Computer Aided Drafting

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4312.1. **Identify** the national and international standards pertaining to machine drawing.

A4312.2. **Illustrate** various machine components through drawings as per ISO standards.

A4312.3. **Draw** machine components by applying the principles of engineering drawing using CAD software.

A4312.4 **Compare** part drawings and assembly drawings.

A4312.5 **Prepare** assembly drawings by applying drawing conventions using CAD Software.

3. Course Syllabus

Contents

I. Machine Drawing Conventions:

1. Need for drawing conventions – introduction to ISconventions
2. Conventional representation of materials, common machine elements and parts such as screws, nuts, bolts, keys,gears.
3. Methods of dimensioning, general rules for sizes and placement of dimensions for holes, centers, curved and taperedfeatures.
4. Title boxes, their size, location and details - common abbreviations & their liberalusage

Types of Drawings – working drawings for machineparts

II. Drawing Of Machine Components:

Selection of Views, additional views for the following machine elements and parts with every drawing proportion.

1. Popular forms of Screw threads, bolts, nuts, stud bolts, tap bolts, setscrews.
2. Keys, Cotter and knuckle joints.

3. Riveted joints for plates
4. Shaft coupling, spigot and socket pipejoint.
   Journal, pivot and collar and foot stepbearings.

III. Assembly drawing:

Drawings of assembled views for the part drawings of the following using conventions and easy drawing proportions.

1. Engine parts – stuffing box, cross head, eccentric, connecting rod, piston assembly.
2. Other machine parts - Screws jack, Machine Vice, Plummer block, Lathe-Tailstock, Tool post and revolvingcentre.
3. Valves: Steam stop valve, spring loaded safety valve, Feed check valve and Aircock.

NOTE: First angle projection to be adopted. The student should be able to provide working drawings of actual parts.

Software Used:Autodesk FUSION 360.

4. Laboratory Equipment/Software/Tools Required

5. Books and Materials

Text Books:

1. N. Sidheshwar, P.Kannaiah, (2009), *Machine Drawing*, Vol-1, 3rd edition, Tata McGraw hill education (P) Ltd, New Delhi,India
2. K.L. Narayana, P. Kannaiah, K. Venkata Reddy, (2006), *Machine Drawing,* 3rd edition, New Age Publishers, New Delhi,India.

Reference Books:

1. Dhawan, (2008), *Machine Drawing*, *a Text book of Machine Drawing*, 4th edition, S. Chand Publications, New Delhi, India.
2. N. Siddeshwar, P.Kannaiah, V.V.S. Sastry (1999), *Machine Drawing,* 21st edition, Tata McGraw hill education (P) Ltd, New Delhi,India.

COURSE STRUCTURE

A4017-QUANTITATIVE APTITUDE

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
1	0	0	28	0	0	1	30	70	100

1. Course Description

Course Overview

This course provides the basic skills required in solving the problems of Aptitude required by various companies for Campus Recruitment and competitive tests. The contents of course include solving problems on different concepts such as – Permutations and Combinations, Averages, Percentages and Logarithms etc.

Course Pre/Co-Requisites

To equip learners with the knowledge and skills required to get placed in reputed companies and appear for competitive exams.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4017.1 Interpret data using graphs and charts.

A4017.2 Apply the concepts of ratios, proportions and percentages to solve problems.

A4017.3 Solve problems on Logarithms, permutations, combinations, clocks, and calendars.

3. Course Syllabus

Ratio and Proportion: Ratio, Proportion, Variations, Problems on Ages

Average, Mixtures and Alligation : Averages, Weighted average, Difference between mixture and alligation, Problems on Mixtures and allegation

Percentages, Simple Interest (SI) and Compound Interest(CI): Fundamentals of Percentage, Percentage change, SI and CI, Relation between SI and CI.

Data Interpretation: Introduction, Tabulation, Bar Graph, Pie Charts, Line Graphs, Combined Graphs.

Profit and Loss, Partnerships: Basic terminology in profit and loss, Types of partnership, Problems related to partnership

Logarithms: Fundamental formulae of logarithms and problems, finding number of terms on expanding a given number.

Permutations and Combinations: Fundamentals counting principle, Definition of Permutation, Seating arrangement, Problems related to alphabets, Rank of the word, Problems related to numbers, Circular permutation, Combination.

Clocks: Introduction, Finding angle between hands of clock, Gain or loss of time

Calendar: Calendars method- 1, Calendars method -2

4. Books and Materials

Text Books:

1. R.S Aggarwal , *Quantitative Aptitude for competitive examinations*, 2017 edition, S.Chand**.**

Reference Books:

1. Abhijit Guha, *Quantitative Aptitude for competitive examinations*, 6th Edition, McGraw Hill Education.
2. Dinesh Khattar, *The Pearson guide to Quantitative Aptitude****for Competitive Examinations*****, 3rd Edition, Pearson Education.**

COURSE STRUCTURE

A4014-ENVIRONMENTAL SCIENCES

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	0	100	100

1. Course Description

Course Overview

Through this course students engage with the scientific principles, concepts, and methodologies required to understand the interrelationships of the natural world. The course requires that students identify and analyze natural and human-made environmental problems, evaluate the relative risks associated with these problems, and examine alternative solutions for resolving or preventing them. It is essentially a multidisciplinary approach that brings about an appreciation of our natural world and human impact on its integrity. Its components include biology, geology, chemistry, physics, engineering, sociology, health, anthropology, economics, statistics, computers and philosophy.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4014.1. **Identify** the important components of environment
A4014.2. **Identify** global environmental problems and come out with best possible solutions.
A4014.3. **Apply** environmental laws for the protection of forest and wildlife
A4014.4. **Apply** theknowledge ofEnvironmental ethicsto maintain harmonious relation between nature and human being.
A4014.5. **Illustrate** the major environmental effects of exploiting natural resources.

3. Course Syllabus

Introduction: Definition, The Multidisciplinary nature of environmental studies, importance of environmental education, need for public awareness.
Ecosystems: Ecosystem Definition. Classification of ecosystems. Structure of an ecosystem: Producers, Consumers and Decomposers. Function of ecosystems: Food chains, food webs and Energy flow in an ecosystem. Ecological pyramids: Pyramid of number, Pyramid of biomass and Pyramid of energy. Ecological succession.
Biogeochemical Cycles: Definition, Carbon cycle, Hydrologic cycle and Nitrogen cycle.

Natural Resources
Classification Of 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, floods, drought, conflicts over water, dams – benefits and problems.
Mineral Resources: Use and exploitation, environmental effects of extracting and using mineral resources.

Food Resources: World food problems, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Energy Resources: Growing energy needs, renewable energy resources-solar energy, wind energy, geothermal energy. Bio fuels- definition, Gobar gas production and biodiesel production by trans esterification.

Land Resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification.

Biodiversity and its conservation :

Introduction and definition. Genetic diversity, species diversity and ecosystem diversity. Values of biodiversity: Consumptive use, Productive use, Social, Ethical, Aesthetic and Option values. Threats to biodiversity: Habitat loss, Poaching of wildlife, Man-wildlife conflicts. In-situ conservation of biodiversity. Ex-situ conservation of biodiversity. Endangered and endemic species of India. Hot-spots of biodiversity. India as a mega diversity nation.

Environmental Pollution:

Definition, causes, effects and control measures of : Air Pollution, Water pollution, Marine pollution, Soil pollution, Noise pollution, Thermal pollution, Nuclear pollution. Eutrophication, bio-magnification. Solid waste management: Causes, effects and methods of solid waste disposal. E-waste. Role of an individual in prevention of pollution. Disaster management: Floods, Earthquakes and Cyclones. Pollution case studies.

Global Environmental Problems And Global Efforts: Global warming, Acid rain, Ozone layer depletion. Kyoto protocol1997, Carbon credits, clean development mechanism.

Social Issues And The Environment: Concept of sustainable development. Threats to sustainability: Population explosion, Crazy consumerism, Over exploitation of resources. Environmental economics: Strategies of environmental economics. Green Building definition, green building materials, energy considerations in green buildings, water requirement in green buildings, health considerations in green buildings. Role of information Technology in Environment and human health. Water conservation, Rainwater harvesting, watershed management, A brief study about Environmental performance Index(EPI), mission Kakatiya, water man of India Dr. Rajendra singh and Anna hazare watershed management development programme. Environmental ethics. A brief study about Bishnoi tribe environmental conservation, Khejarli massacre.

Environmental Policies And Legislations: Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act. Wildlife Protection Act. Forest Conservation Act.

4. Books and Materials

Text Books:

1. Textbook of Environmental Studies for Undergraduate Courses by ErachBharucha for
2. University Grants Commission.
3. Environmental Studies by R.J. Ranjit Daniels, Jagdish Krishnaswamy,first edition,
4. Wiley India (P)Ltd., New Delhi. ISBN 9788126519439.
5. Environmental Studies by Anubha Kaushik, C.P. Kaushik, 4th edition, New age international
6. publishers, New Delhi.

7. **Environmental studies by Benny joseph, Third edition, McGraw Hill Education (India) Private Limited, Chennai.**

Reference Books:

1. **Environmental science by Daniel B.Botkin&Edwards A.Keller, 8th edition, International student version, Wiley India (P) Ltd., New Delhi.** ISBN 9788126534142.
2. Environmental Science: towards a sustainable future by Richard T. Wright. 2008 PHL Learning Private Ltd. New Delhi.
3. Ecology And Environment by P.D.Sharma, 2005 reprint edition, Rastogi Publications, Meerut, Uttar Pradesh. ISBN 8191339050.

SYLLABI FOR III YEAR I SEMESTER

COURSE STRUCTURE

A4313 – DYNAMICS OF MACHINERY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Dynamics of machinery is an applied field of mechanical engineering that is concerned with understanding the relationship between the geometry and the motions of the parts of a machine and the forces that produce this motion. This course helps to learn how to analyze the motions of mechanisms, design mechanisms to have given motions, and analyze forces in machines.

Course Pre/co requisites

A4303-Engineering Mechanics

A4309-Kinematics Of Machinery

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4313.1: Find a solution to minimize vibrations in engines.
A4313.2: Apply laws of Mechanics to evaluate forces causing motion.
A4313.3: Build turning moment diagrams for two stroke and four stoke engines.
A4313.4: Analyze the effect of gyroscopic couple on all rotating bodies.
A4313.5: Evaluate the power lost due to friction at different machine elements.

3. Course Syllabus

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

Friction: Introduction, types of friction, Inclined planes, screw friction, friction circle, uniform pressure and wear theory, pivot and collar bearings.
Clutches: Friction clutches: Single Disc clutch, Multiple Disc Clutch, Cone Clutch and Centrifugal Clutch.

Brakes: Simple block brakes, internal expanding brakes. Band brakes of Vehicle.
Turning Moment Diagram And Fly Wheels: Turning Moment-Inertia Torque - crank effort and torque diagrams, Fluctuation of energy, Fly wheels and its applications.

Governors: Watt, Porter and Proell Governors. Spring loaded governors – Hartnell and Hartung Governors. Sensitiveness, isochronism and hunting.
Balancing Of Rotating Masses: Single and multiple masses in single and different planes, Analytical and graphical methods.
Balancing Of Reciprocating Masses: Primary and Secondary balancing of reciprocating masses. Locomotive balancing - Hammer blow, Swaying couple, variation of tractive efforts.

Vibration: Types of vibration, free and forced vibrations, undamped and damped vibrations, longitudinal, transverse and torsional vibrations. Single degree of freedom systems, Dunkerly's methods, Raleigh's method, whirling and critical speed of shafts.

5. List Of Experiments

1. To determine the active and reactive gyroscopic couples and compare them.
2. To determine stiffness of the given helical spring, period and frequency of undamped free vibration of spring mass system.
3. To balance the given reciprocating mass system.
4. To balance the given rotating mass system with the aid of the force polygon and the couple polygon.
5. To determine the whirling speed of shaft.
6. To determine the characteristic curves of the spring loaded governor.
7. To determine the jump speed of a Cam for different weights
8. To determine the period and frequency of torsional vibration of the single rotor system.
9. To study the transverse vibrations of a simply supported beam.
10. To determine angular velocity, angular acceleration, mass moment of inertia and centrifugal force of reciprocating masses.
11. To determine the natural frequency, radius of gyration and mass moment of inertia of the given rectangular bar experimentally.
12. To determine the radius of gyration and the moment of Inertia of a given circular plate.

5. Books and Materials

Text Books:

1. S. S. Rattan (2012), Theory of Machines, 3rd edition, Tata McGraw- Hill education (P) Ltd, New Delhi, India.
2. J. S. Rao, R. V. Dukkipati (2010), Mechanism and Machine Theory, New Age Publishers, New Delhi, India.

Reference Books:

1. Shiegly (2011), Theory of Machines, Tata McGraw hill education (P) Ltd, New Delhi, India.
2. Khurmi, R.S. (2011), Theory of machines, S.Chand publishers, New Delhi, India.
3. Thomas Bevan (2012), Theory of machines, 3rd edition, CBS Publishers, New Delhi, India.
4. Jagadish Lal, J. M. Shah (2009), Theory of Machines, Metropolitan, New Delhi, India.

COURSE STRUCTURE

A4314 – METROLOGY AND MACHINE TOOLS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course overview

The purpose of this course is to learn about the machines like lathe, shaper, slotter, planer, milling machine, drilling machine, grinding machine etc. This course helps the students to operate the machines and to do machining for different applications. Students will come to know about metal cutting theory, different cutting tools and tool angles also. In metrology student will learn basics of linear and angular measurement instruments, Surface roughness, limits and tolerances etc.

Course Pre/co requisites

A4311 - Manufacturing processes

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4314.1: **Understand** the basic principles of Metal cutting process on different machines.

A4314.2: **Apply** the proper measuring instrument to determine the various elements that are present on the work piece.

A4314.3: **Evaluate** the machining time on machine tools.

A4314.4: **Solve** problems related to machining operations.

A4314.5: **Analyze** the performance of machine tools.

3. Course Syllabus

Theory Of Metal Cutting: Basic definitions: cutting speed, feed and depth of cut, orthogonal and oblique cutting, classification of cutting tools.

Mechanics Of Metal Cutting: Merchant's circle diagram, forces on a single point cutting tool in turning, stress, strain and work done in cutting process.

Lathe Machines: Different operations on lathe machine, Turret and capstan lathes, Single spindle and multi-spindle automatic lathes, Problems related to cutting speed, feed and depth of cut.

Shaping, Slotting And Planing Machines: Different operations on Shaping, Slotting and Planing machines.

Milling Machines: Types of milling machines, different operations on milling machine.

Drilling And Boring Machines: Types of Drilling and Boring machines, Different Operations on Drilling and Boring machines. Problems related to cutting speed, feed.

Grinding Machines: Types of Grinding machines, Operations on Grinding machines, Tool and Cutter Grinding machine and selection of a grinding wheel.

Systems Of Limits And Fits: Normal size, tolerance limits, deviations, allowance, fits and their types, unilateral and bilateral tolerance system, hole and shaft basis systems, Design of go and No go gauges.

Screw Thread Measurement: Errors in Screw threads, measurement of effective diameter, angle of thread and thread pitch.

UNIT – V

Surface Roughness Measurement: Methods of measurement of Surface finish using Talysurf instrument.

Machine Tool Alignment Tests: Alignment tests on Lathe, Milling, and Drilling Machines.

Coordinate Measuring Machines: Types of CMM and Applications of CMM.

4. List Of Experiments

Part - A: Metrology

1. Applications of vernier calipers, micrometer, Bore gauge and height gauge etc.
2. Machine tool alignment test on the lathe and milling machine.
3. Tool maker's microscope and its application
4. Thread measurement by two wire/ three wire method.
5. Surface roughness measurement by Tally Surf.

Part - B: Machine Tools

6. To perform step turning, taper turning, Thread cutting and knurling operations on lathe machine.
7. To performing drilling and tapping operation on drilling machine.
8. To perform different types of milling operations on a milling machine
9. To perform grinding operations on cylindrical and surface grinding machines
10. To perform planing on a planning machine
11. To perform shaping on a shaping machine
12. To perform slotting operation on a slotting machine

5. Books and Materials

Text Books:

1. R. K. Jain (2010), Production Technology, 16th edition, Khanna publishers, New Delhi, India.
2. R. K. Jain (2012), Engineering Metrology, 20th edition, Khanna Publishers, New Delhi, India.

Reference Books:

1. Anand K Bewoor, Vinay A Kulkarni (2009), Metrology and Measurement, 1st Edition, Tata Mc Graw Hill, Education, New Delhi, India.
2. P N Rao (2009), Manufacturing Technology (Volume-2), 2nd Edition, Tata McGraw Hill, New Delhi, India.

COURSE STRUCTURE

A4315-DESIGN OF MACHINE ELEMENTS

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course overview

This course covers the systematic approach for the design of machine element in engineering design eras such as: Selection of materials for design consideration, discussion of theories of failure, analysis of different types of joints (rivet, welded, screw fasteners, cotter and knuckle), analysis of power transmission and coupling mechanism in shafts.

Course Pre/co requisites

A4303-Engineering Mechanics
A4305-Mechanics of Solids

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4315.1.Understand the basic concepts about different types of elements used for mechanical design.

A4315.2.Demonstrate strong understanding on the theories of failure of materials due to static and dynamic loads.

A4315.3.Design different types of mechanical joints such as riveted, welded, and bolted under various loading conditions.

A431.4.Analyze the design of solid and hollow shafts based on strength and rigidity criterions.

A4315.5.Explain the shaft couplings at various operating conditions with design procedures.

3. Course Syllabus.

Introduction To Mechanical Engineering Design: Engineering Materials and Processes and their Selection, Principle of machine design, preferred number, Tolerances, Mechanical Properties.

Design Against Static Load: Theories of failure, Stresses due to bending and torsional moment, Eccentric axial loading, Design of simple machine parts.

Design Against Fluctuating Load: Stress Concentration, Reduction of Stress Concentration, Types of Cyclic Stresses, Endurance Limit, S-N Diagram, Gerber, Soderberg, Goodman and modified Goodman criterion, Design against combined loads.

Welded Joints: Types of Welded Joints, Stress Relieving of Welded Joints, Strength of Butt Weld and Fillet Weld (Parallel and Transverse), axially loaded unsymmetrical welded joints.
Riveted Joints: Types of Riveted Joints, Strength Equations, Joint Efficiency, Boiler Shell, Caulking and Fullering, Longitudinal and lap joint for boiler shell, Eccentrically Loaded Riveted Joint.

Threaded Fasteners: Threaded Joints, Basic Types of Screw Fastening, Bolt of Uniform Strength, Locking

devices, Stresses in Threaded Fasteners, Design of Threaded Fasteners in shear.

Design Of Cotter And Knuckle Joints:

Cotter Joint: Types of Cotter Joint, Design Procedure for Cotter Joint (Socket and Spigot)

Knuckle Joint: Failure of knuckle joint, Design Procedure for Knuckle Joint.

Design Of Shafts: Transmission Shafts, Design of Solid and Hollow Shafts Based on Strength and Rigidity, ASME Codes for Shaft Design.

Design Of Couplings: Types of Couplings, Design of Rigid Flange Coupling and Bushed-pin Flexible Coupling.

Keys: Types of Keys, Saddle Keys, Sunk Keys, Feather Keys, Woodruff Key, Square and Flat Keys (ONLY ANALYSIS).

4. Books and Materials

Text books:

1. *Design of Machine elements*: V.B.Bhandari, McGraw Hill Education (India) Private Limited, New Delhi, 4th Edition 2017.
2. Mechanical Engineering Design: Shigley, McGraw Hill Education (India) Private Limited, New Delhi, 10thEdition 2017.
3. **References:**Machine Design: An Integrated Approach: Robert L.Norton, Pearson India Education Services Pvt. Ltd., 5thEdition 2018.
1. Machine Design: N C Pandya and C S Shah, 20th Edition, Charotar Publishing House Pvt. Ltd., New Delhi, India.
2. A text book of Machine Design: R S Khurmi and J K Gupta, Eurisia Publishing House, New Delhi.

Data Books Permitted:

1. Machine Design Data Book by V B Bhandari, McGraw Hill Edition(India).
2. *S. M. D. Jalaludin (2014)* Design Data Hand Book-2ndEdition- Anuradha Publishers-Kumbakonam-Chennai-India.

COURSE STRUCTURE

A4316- APPLIED THERMODYNAMICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course overview

This course is based on the fundamental concepts and analysis techniques of thermodynamics course learnt in third semester. This course presents the thermodynamic analysis of the Rankine cycle and the methods to improve its performance. It develops theoretical knowledge related to steam nozzles and steam turbines. It also gives an understanding of vapour compression refrigeration system and thus a very important course for mechanical engineers.

Course Pre/Co Requisites

A4306-Thermodynamics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4316.1.	**Understand** the components and processes of Rankine cycle and Vapour compression refrigeration cycle.
A4316.2.	**Solve** numerical problems on Rankine cycle, Refrigeration cycle, Steam nozzles, and Turbines.
A4316.3.	**Analyze** Steam and Refrigeration cycles and components by applying thermodynamic concepts.
A4316.4.	**Compare** and suggest modification in the Rankine cycle and its components to improve performance.
A4316.5.	**Evaluate** the specifications of the Rankine cycle, steam nozzles and turbines.

3. Course Syllabus

Steam Power Cycle: Rankine cycle - Schematic layout, Comparison between Rankine Cycle and Carnot cycle. Thermodynamic Analysis, Concept of Mean Temperature of Heat addition, Methods to improve cycle performance, Regeneration and reheating.

Steam Nozzles: Function of nozzle, applications, types, Flow through nozzles, velocity of nozzle at Exit-Ideal and actual expansion in nozzle, velocity coefficient, and condition for maximum discharge, criteria to decide nozzle shape.

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 - its features. Methods to reduce rotor Speed-Velocity compounding and pressure compounding, Velocity and Pressure variation along the flow, combined velocity diagram for a velocity compounded impulse turbine.

Reaction Turbine: Mechanical details, principle of operation, thermodynamic analysis of a stage, degree of reaction, velocity diagram, Parson's reaction turbine, condition for maximum efficiency.

Refrigeration Cycle: Refrigeration Cycles: Vapour compression refrigeration system; description, analysis, refrigerating effect. Capacity, power required, units of refrigeration, COP, Refrigerants and their desirable properties, alternate Refrigerants. Vapour absorption refrigeration system

4. Books and Materials

Text Books:

1. *Mahesh M Rathore (2010),* Thermal Engineering, Tata McGraw hill education (P) Ltd, New Delhi, India.
2. *M. J. Shapiro (2018),* Introduction to Thermal Systems Engineering, Whiley.

Reference Books:

1. P.L. Ballaney (2015) Thermal Engineering, 25th Edition Khanna Publishers, Delhi.
2. R. Yadav, (2012) Thermodynamics and Heat Engines, 6th Edition, Central Publishing House, Allahabad.
3. R. K. Rajput (2015), Thermal Engineering, 10^{th} edition, Lakshmi Publications, New Delhi, India.

COURSE STRUCTURE

A4351- ADDITIVE MANUFACTURING

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Advanced/Additive manufacturing processes - extrusion, jetting, photo polymerization, powder bed fusion, direct-write, sheet lamination, directed-energy deposition and the latest state of the art. Design and fabrication processes - data sources, software tools, file formats, model repair and validation, post-processing. Designing for additive manufacturing (DFAM)

Bio-printing, biomaterials, scaffolds and tissue and organ engineering. Materials: Metals, polymers, ceramics, composites and material selection. Applications of additive manufacturing, such as in biomedical, aerospace, surgical simulation, architecture, art, and health care. The new age of distributed manufacturing, direct part production and mass customization.Processes related to AM, such as 3D scanning, mold-making, casting and sintering.

Course Pre/co-requisites:

This course has no specific pre/co requisites

2. Course outcomes (Cos)

After the completion of the course, the student will be able to:

A4351.1: Define the various process used in Additive Manufacturing

A4351.2: Analyse and select suitable process and materials used in Additive Manufacturing.

4351.3: Identify, analyse and solve problems related to Additive Manufacturing.

A4351.4: Apply knowledge of additive manufacturing for various real-life applications

A4351.5: Apply technique of cad and reverse engineering for geometry transformation in additive manufacturing.

3. Course syllabus

Introduction to additive manufacturing (am): Need for Additive Manufacturing, Generic AM process, Distinction between AM and CNC, Classification of AM Processes, Steps in AM process, Advantages of AM, Major Applications.

Vat Photo polymerization AM Processes: Stereo lithography (SL), Materials, SL resin curing process, Micro-stereo lithography, Process Benefits and Drawbacks, Applications of Photo polymerization Processes.

Material Jetting AM Processes: Evolution of Printing as an Additive Manufacturing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting AM Processes: Materials, Process Benefits and Drawbacks, Research achievements in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes.

Extrusion-Based AM Processes: Fused Deposition Modelling (FDM), Principles, Materials, Plotting and path control, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes
Sheet Lamination AM Processes: Materials, Laminated Object Manufacturing (LOM), Ultrasonic Consolidation (UC), Gluing, Thermal bonding, LOM and UC applications.

Powder Bed Fusion AM Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.
Directed Energy Deposition AM Processes: Process Description, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Benefits and drawbacks, Applications of Directed Energy Deposition Processes.

Post Processing of AM Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques.
AM Applications: Functionalmodels, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries.

4. Books and Materials

Text Books:

1. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, Springer, 2015.
2. Chua Chee Kai, Leong Kah Fai, “3D Printing and Additive Manufacturing: Principles& Applications”, 4th Edition, World Scientific, 2015.

Reference Books:

1. Ali K. Kamrani, EmandAbouel Nasr, “Rapid Prototyping: Theory & Practice”, Springer, 2006.
2. D.T. Pham, S.S. Dimov, “Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling”, Springer 2001.
3. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons, 2006

COURSE STRUCTURE

A4352 – AUTOMOBILE ENGINEERING

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Automobile engineering is a course that intends to provide knowledge and information about an automobile and its parts functioning in an engineering approach. It also provides the technical details of all the components of an automobile in detail. By selecting a type of an automobile component, it also helps to understand its working principle and how they are interconnected. It also facilitates, analyzing the system's connectivity to enable the vehicle into motion. It also enhances the insight of the e-vehicles, which demands the future generation transport system.

Course Pre/co requisites

This course has no specific pre/co requisites

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4352.1: Identify the components of an automobile namely IC engines

A4352.2: Classify various sub systems in an automobile.

A4352.3: Illustrate the working mechanisms of the different components in an automobile.

A4352.4: Analyze various sub systems and their components in an automobile.

A4352.5: Assess the performance of an automobile and its sub systems.

3. Course Syllabus

Introduction: Components of four wheeler automobile, chassis and body, 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, decarburization, Nitriding of crank shaft.

Fuel System:

s.i. Engine:fuel supply systems, mechanical and electrical fuel pump, Electronic Fuel Injection pump filters, carburetor, types, air filters, petrol injection, Multipoint fuel injection for SI Engines.

C.I. ENGINES: Requirements of diesel injection systems, types of injection systems, fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Multipoint fuel injection for CI Engines.

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System, Radiators,Types, Cooling Fan - water pump, thermostat, evaporating cooling, pressure sealed cooling, antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug, Magneto coil

ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers, spark advance and retard mechanism.

Transmission System: Power Unit & Transmission, Mechanical Clucthes, 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.

Braking System: Mechanical brake system, Hydraulic brake system, Master cylinder, wheel cylinder tandem master cylinder Requirement of brake fluid, Pneumatic and vacuum brakes

Steering System: Steering geometry, camber, castor, king pin rake, combined angle toein, center point steering. Types of steering mechanism, Ackerman steering mechanism, Davis steering mechanism, power steering system.

Suspension System: Objects of suspension systems, rigid axle suspension system, torsion bar, shock absorber, Independent suspension system.

4. Books and Materials

Text Books:

1. Kirpal Singh (2012), *Automobile Engineering - Vol. 1 &2*, 12th edition, standard publishers, New Delhi, India.
2. William Crouse (2012), *Automobile Engineering (SIE)*, 10th edition, Tata McGraw hill education (P) Ltd, New Delhi, India.

Reference Books:

1. B. S. Narang (2011), *Automobile Engineering*, 5th edition, Karman publishers, New Delhi, India.
2. J. B. Gupta (2012), *Automobile Engineering*, satyaprakhashan, New Delhi, India.
3. Internal Combusion engine fundamental by JOHN B. Heywood, McGraw Hill Publications, 1998
4. I C Engines by M Mathur & R P Sharma, Dhanapath Rai, Publications, 2010.

COURSE STRUCTURE
A4353-SOLID MECHANICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course will provide the behavior of structural elements like Truss elements, shafts, columns, struts and curved beams under various types of loadings. This course forms the basis for the study of advanced courses like Design of Machine Members, Finite Element Methods and Advanced Mechanics of Solids. It is imperative that these concepts are well understood.

2. Course Outcomes (COs)

A4353.1. **Understand** the concepts of stress instructural members

A4353.2. **Apply** various failure criteria for general stress states at points

A4353.3. **Solve** numericalproblems onstructural members

A4353.4. **Analyze** stresses inbars, beams ,columns, truss element, struts and shafts

A4353.5. **Compute** the forces acting on structural members.

3. Course Syllabus

principal stresses and strains: Introduction- stresses on an inclined section of a bar under axial loading-compound Stresses-Normal and tangential stresses on an inclined plane for biaxial stresses-two perpendicular normal stresses accompanied by a state of simple Shear-Mohr's circle of stresses.

Trusses: Perfect, Deficient and Redundant Trusses, Assumptions, Nature of Forces in Members, Methods of Analysis, Method of Joints, Method of Section.
Torsion In Circular Shafts: Introduction, pure torsion, Assumptions, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.

Columns And Struts: Buckling and stability, slenderness ratio, combined bending and direct stress, middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin ended columns, effect of end conditions on column buckling, Ranking Gordon formulae, examples of columns in mechanical equipment's and machines.

Curved Beams: Bending of beams with large initial curvature, position of neutral axis for rectangular, trapezoidal and circular cross sections, stress in crane hooks, stress in circular rings subjected to tension or compression.

4. Books and Materials

Text Books:

1. *Srinath L.S "Advanced mechanics* of solids", Tata McGraw Hill Education Pvt. Ltd., Delhi, 2012

2. *Rajput R.K. "Strength of Materials"*, S.Chand and Co, New Delhi, 2013

Reference Books:

1. *B.S. Basavarajaiah, P.Mahadevappa* "Strength of Materials" in SI Units, University Press (India) Pvt. Ltd., 3rd Edition, 2010
2. *Rattan S.S., "Strength of Materials",* Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2011.
3. *Punmia B.C., "Strength of materials"* (SMTS- Vol 1), Laxmi Publishing Pvt Ltd, New Delhi 2013

COURSE STRUCTURE

A4018-ENGINEERING DESIGN THINKING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

Engineering design is the extension of engineering exploration course; it links the primary fields of engineering and explores the engineering design process from conceptual design and optimal choice evaluation to prototyping and project construction. This course provides insights into particular design challenges within their specific fields of engineering. Everything learned in this course will be applied to the "Design Challenge" which enables you to apply learning's in real time - designing, constructing and testing a prototype (actual physical build) to solve a real world engineering problem. In extent this course is an excellent roadmap for design engineers seeking to broaden their engineering knowledge to design concepts to their current work.

Course Pre/Co-Requisites

To focus on building basic necessary skills, problem solving, design processes and enhancing the engineering design robustness

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4018.1: Interpret the problem-solving skills and product design skills

A4018.2: Apply foundational knowledge of the primary fields of engineering and scientific concepts to find the solution

A4018.3: Identify various techniques and applications of the engineering design process

A4018.4: Inspect the design and assess a prototype that solves an engineering problem

A4018.5: Interpret the solutions and document the findings/reflections

3. Course Syllabus

Introduction: Definition of design, design process, different problem types, characteristics of novice and informed designers, enhance negotiation and iteration in design

Case Studies: Recognized organizations for design and innovation, shopping cart case study, benefits of failure in design

Human Centered Design: Introduction to HCD (Human Centered Design), HCD as a Mindset, personas and scenarios, best practice working with communities

Specification Development: Definition of specification, three examples of ways to generate specifications, how to manage specifications, functional decomposition

Prototyping: Three kinds of prototypes, how prototypes can be used in the design process, how to use prototypes can be used to elicit input from users

Ideation, Innovation & Creativity: Concept Selection , Interpretation of Creativity and Innovation, Brain storming Expanding the Design Space, case study using decision matrix .

Teamwork and Leadership in Design: Professional Preparation, Recognizing differences in teammates, VRE Model, Best Model for Leadership, Conflict Vs. Effectiveness, Code of Cooperation, Project (Team) and individual Artifacts, Evaluating Teams.

Design for Robustness: Review the design, Brainstorm potential failure models, List potential effects of failure & potential causes for each failure, Rank failures, Develop action plan, Implement fixes, Revisit potential failure risks.

4. Laboratory Equipment/Software/Tools Required

5. Books and Materials

Text Books:

1. Oakes, Leone, and Gunn (2004). Engineering Your Future. Okemos, MI: Great Lakes Press.
2. Crismond, D. (2007). Contrasting strategies of beginning and informed designers: One representation of learning progressions in engineering design.
3. Ryan Jacoby and Diego Rodriguez, Innovation, Growth, and Getting to Where You Want to Go, Design Management Review Vol. 18 No. 1
4. G.Pahl and W.Beitz," Engineering design: A systematic approach", Springer 2nd Editon.
5. Dean Nieusma (2012), "Seeing Social Power: Technology Design for User Empowerment," Great Lakes Press.
6. Avery, C. M. (2001). Teamwork is an Individual Skill: Getting Your Work Done When Sharing Responsibility. San Francisco, CA: Berrett-Koehler Publishers, Inc.
7. Astin, A. W., & Astin, H. S. (2000). Leadership reconsidered: Engaging higher education in social change. Battle Creek, MI: W. K. Kellogg Foundation.

Reference Book:

1. Ali k.Kamrani, EmadAbouel Nasr, "Engineering design and Rapid Prototyping", Springer.Ken Hurst," Engineering design principles", Elesiever,2nd edition.

COURSE STRUCTURE

A4015- ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	0	100	100

1. Course Description

Course Overview

The course focuses on introducing Indian Knowledge Systems, Indian perspective of modern scientific world-view, and basic principles of Yoga and holistic health care system to the students. The course is intended to develop the understanding of Traditional Knowledge in terms of various government acts and modern society and science among students.

Course Pre/co-requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

A4015.1. Interpret the basic structure of traditional knowledge

A4015.2. Organize the need to preserve traditional knowledge through various acts

A4015.3. Identify the role of Indian contribution to modern science

A4015.4. Understanding the importance of traditional knowledge for holistic health

A4015.5. Compare Indian artistic tradition with the present art

3. Course Syllabus

Module1:Introduction to traditional knowledge and basic structure of Indian Knowledge System: Features of Indian Traditions: Nature and Characteristics of traditional knowledge-scope and importance-kinds of traditional knowledge-traditional knowledge Vs western knowledge.

Module 2:
Philosophical Tradition and Protection of traditional knowledge: Significance of traditional knowledge protection-value of traditional knowledge in global economy-role of government to harness traditional knowledge –Various Acts regarding protection of Traditional Knowledge

Module3:
Modern Science and Indian Knowledge System:Historical Background- the global problem today-Indian contributions to global science.

Module 4:
Yoga and Holistic Health care**:** Science and Spirituality in India- the need for both outer and inner sciences-yogic science.

Module 5:
Indian Artistic Tradition: Visual arts ad culture- the journey of Indian art from traditional to modern era

4. Books and Materials

Text Book: NIL

Reference Book:

1. Sengupta, Nirmal. Traditional Knowledge in Modern India: Preservation, Promotion, Ethical Access and Benefit Sharing Mechanisms, Springer, London. 2018. Print.
2. V. Sivaramakrishnan (Ed.), Cultural Heritage of India-course material, Bharatiya Vidya Bhavan, Mumbai. 5th Edition, 2014
3. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan
4. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta, International Chinmay Foundation, Velliarnad, Ernakulam
5. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata
6. GN Jha (Eng. Trans.), Ed. RN Jha, Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan, Delhi 2016

SYLLABI FOR III YEAR II SEMESTER

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4318- MACHINE DESIGN

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	1	0	42	14	0	4	30	70	100

1. Course Description

Course Overview

This course covers the systematic approach for the design of mechanical components in engineering design eras such as different types of bearing, application of various types of gears, power transmission through friction drives.

Course Pre/Co-requisites

A4305: Mechanics of Solids

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:
A4318.1: Select the form of bearings for different operating conditions
A4318.2: Analyze the design of different types gears used in mechanical components
A4318.3: Estimate the effective strength of gears based on dynamic and wear criterions.
A4318.4: Apply the mechanism of brakes and clutches in locomotives
A4318.5: Determine the stresses and deflections produced in various mechanical components

3. Course Syllabus

Sliding contact bearing: types of journal bearings, basic modes of lubrication, bearing construction, bearing design
Rolling contact bearings: types of rolling contact bearings, selection of bearing types, design for cyclic loads.
Design of ic engine parts: design of cylinder and cylinder liner, design of piston, design of connecting rod
Spur gear drives: classification of gears, beam strength of gear tooth, estimation of module
Helical gears: terminology, virtual number of teeth, beam strength of helical gears.

Bevel gears: types, terminology, beam strength of bevel gears.
Worm gears: terminology, strength rating, thermal consideration of worm gear.

Power screws: mechanics of power screw, stresses in power screws, efficiency and self-locking, design of power screw.
Mechanical springs: terminology, stress and deflection Equations, Design of Helical Spring

4. Books and Materials

Text Books:

1. Design of Machine elements: *V B Bhandari, McGraw* Hill Education (India) Private Limited, New Delhi, 4th Edition 2017.

2. Mechanical Engineering Design: Shigley, McGraw Hill Education (India) Private Limited, New Delhi, 10th Edition 2017.

Reference books:

1. Machine Design: An Integrated Approach: Robert L. Norton, Pearson India Education Services Pvt. Ltd., 5th Edition 2018.
2. Machine Design: N C Pandya and C S Shah, 20th Edition, Charotar Publishing House Pvt. Ltd., New Delhi, India.
3. A text book of Machine Design: R S Khurmi and J K Gupta, Eurisia Publishing House, New Delhi.

Data books permitted:

1. Machine Design Data Book by *V B Bhandari,* McGraw Hill Edition(India).
2. *S. M. D. Jalaludin (2014*) Design Data Hand Book-2nd Edition- Anuradha Publishers-Kumbakonam-Chennai-India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4319 – HEAT TRANSFER

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

This course is an introduction to the principal concepts and methods of heat transfer. The objectives of this integrated course are to develop the fundamental principles and laws of heat transfer and to explore the implications of these principles for system behaviour, to formulate the models necessary to study, analyze and design heat transfer systems through the application of these principles, to develop the problem solving skills essential to good engineering practice of heat transfer in real world applications.

Course Pre/Co-Requisites:

A4001- Linear Algebra and Ordinary Differential Equations
A4310- Fluid Mechanics and Hydraulic Machines

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4319.1: Apply the principles of conduction, convection and radiation heat transfer to analyze natural phenomena.

A4319.2: Determine thermal resistance for conduction, convection and radiation heat transfer, using fundamental relationships and correlations.

A4319.3: Analyze and apply empirical correlations in connection with the heat transfer at convection, boiling and condensation.

A4319.4: Design and analyze the performance of heat exchangers and evaporators.

A4319.5: Examine blackbody and gray surface radiation, and evaluate radiation exchange between surfaces.

3. Course Syllabus

Introduction: Modes and mechanisms of heat transfer, Basic laws of heat transfer –Applications of heat transfer.

Conduction Heat Transfer: General heat conduction equation in Cartesian coordinates. One dimensional steady state heat conduction through Homogeneous slabs, hollow cylinders. Overall heat transfer coefficient, Electrical analogy, Critical radius of insulation.

One Dimensional, Steady State Heat Conduction: Heat Transfer from Extended surfaces- Types of fins, Heat flow through rectangular and circular fins, Long, Short and insulated tips, fins losing heat at the tip, efficiency and effectiveness of fins.

One Dimensional, Transient Heat Conduction: Systems with negligible internal resistance, Significance of Biot and Fourier Numbers.

Convective Heat Transfer: Dimensional Analysis-Buckingham's Pi Theorem - Application for developing non-dimensional correlation for convective heat transfer.

Forced Convection: External Flows **–** Concepts of hydrodynamic and thermal boundary layer and use of empirical correlations for Flat plates and Cylinders. Internal Flows **–** Concepts about Hydrodynamic and Thermal Entry Lengths, use of empirical correlations 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.

Boiling And Condensation: Basic introduction, Different Regimes.

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.

Radiation Heat Transfer: Emission characteristics – 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.

Practice

1. To determine the thermal resistance and thermal conductivity of composite slab.
2. To determine the thermal conductivity of lagged pipe.
3. To determine the thermal conductivity of insulating powder using concentric sphere.
4. To determine the thermal conductivity of a metal rod along its length.
5. To determine the efficiency of a pin-fin.
6. To determine the heat transfer coefficient in Transient Heat Conduction.
7. To determine the heat transfer coefficient for forced convection through pipe.
8. To determine the heat transfer coefficient for natural convection through pipe.
9. To determine the effectiveness and overall heat transfer coefficient of double pipe heat exchanger with Parallel and counter flow arrangement.
10. To determine the emissivity of a metal plate.
11. To determine the critical Heat flux at different temperatures of water.
12. To compare the heat transfer through heat pipe with copper and stainless steel pipes.

4. Laboratory Equipment/Software/Tools Required

1. Composite slab Apparatus.
2. Lagged pipe Apparatus.
3. Concentric sphere Apparatus.
4. Metal rod Apparatus.
5. Pin fin Apparatus.
6. Transient Heat Conduction Apparatus.
7. Forced convection Apparatus.
8. Natural convection Apparatus.
9. Double pipe heat exchanger with Parallel and counter flow arrangement.
10. Emissivity Apparatus.
11. Critical Heat flux Apparatus.

12.Heat pipe Apparatus.

5. Books and Materials

Text Book:

1. *D.S. Kumar, (2013),* Heat and Mass Transfer, Eight Edition, S.K. Kataria, New Delhi.

Reference Books:

1. *M. Thirumaleshwar, (2009*), Fundamentals of Heat & Mass Transfer, Second Edition, Pearson, India
2. *Yunus A Cengel, (2014),* Heat Transfer a Practical Approach, TMH, New York
3. *R.C. Sachdeva, (2016),* Fundamentals of Engineering, Heat & Mass Transfer, Third Edition, New Age, New Delhi
4. *Holman, (2008),* Heat Transfer, Ninth Edition, TMH, New York
5. *Incropera & Dewitt, (2009),* Fundamentals of Heat Transfer, Sixth Edition, John Wiley, U.K.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4320 – CAD/CAM

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	1	2	42	14	28	5	30	70	100

1. Course Description

Course Overview

Computer Aided Design (CAD) and Computer Aided Manufacturing (CAM) are two classes of application programs that help the user to design and build simple or complex products, assemblies, and plants. Now a day, with the advent of fast personal computers, user friendly GUI interfaces, and much more efficient calculation algorithms, CAD/CAM has become a household name in the engineering and manufacturing field. In fact, because of these tools, an engineer has become a designer, eliminating the need for a full time drafter.

Course Pre/co requisites

This course has no specific pre/co requisites

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4320.1: **Explain** various elements of computers, computer graphics, and product cycle in manufacturing industry, drafting and modelling systems.

A4320.2: **Model** machine components using Computer-Aided Design software.

A4320.3: **Develop** NC part programming, group technology and computer aided Process planning.

A4320.4: **Perceive** quality using computer aided quality control techniques.

A4320.5: **Make use** of computer integrated manufacturing systems in industries.

3. Course Syllabus

Computers in Industrial Manufacturing, Product cycle, CAD / CAM Hardware, Basic structure, CPU, Memory types, input devices, display devices, hard copy devices, and 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.

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, and solid modeling.

Numerical Control:NC, NC modes, NC elements, NC machine tools, structure of CNC machine tools, features of Machining centre, turning centre, CNC Part Programming: fundamentals, manual part programming methods, Computer Aided Part Programming.

Group Tech: Part family, coding and classification, production flow analysis, advantages and limitations, Computer Aided Processes Planning, Retrieval type and Generative type.

Computer Aided Quality Control: Terminology in quality control, the computer in QC, contact inspection methods, noncontact inspection methods-optical, noncontact inspection methods-non optical, 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, computer control systems, human labor in the manufacturing systems, CIMS benefits.

4. List Of Experiments

1. Development of part drawings for various components in orthographic to isometric forms
2. Generation of various 3D models using sketch based features and dress-up features
3. Model the components of Stuffing Box using part design workbench
4. Perform Assembly of Stuffing Box using Assembly design workbench
5. Model the components of Drill Jig using part design workbench
6. Perform the Drafting of Drill Jig using drafting workbench
7. Develop a part program to perform facing and simple turning operation on CNC Turning Machine
8. Develop a part program to perform facing and taper turning operation on CNC Turning Machine
9. Develop a part program to perform Multiple turning (G71) operation on CNC Turning Machine
10. Develop a part program to perform Linear and circular interpolation operation on CNC Milling Machine
11. Develop a part program to perform Mirroring using sub program on CNC Milling Machine
12. Develop a part program to perform Drilling operation on CNC Milling Machine.

5. Books and Materials

Text Books:

1. *Zimmers, P. Groover (2010*), *CAD / CAM*, 3 rd edition, Prentice Hall of India, New Delhi.
2. *Ibrahim Zeid(2011), CAD / CAM Theory and Practice*, 4th edition, Tata McGraw Hill education (P) Ltd, New Delhi, India.

Reference Books:

1. *P. Groover(2011), Automation, Production systems and Computer integrated Manufacturing*, 3rd edition, Pearson Publications, India.
2. *Radhakrishnan, Subramanian (2009), CAD / CAM / CIM*, New Age International Pvt. Ltd, New Delhi, India
3. *Alavala, C. R (2012), CAD/CAM: Concepts and Applications*, 1st edition, Prentice Hall of India, New Delhi, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4331 – BASIC MECHANICAL ENGINEERING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview:

This course is designed to lay emphasis on the fundamental principles of Thermodynamics, Fluid Mechanics, Hydraulic Machines and heat transfer and to equip the students with the knowledge and skills to solve mechanical engineering problems efficiently.

Course Pre/Co Requisites

A4001- Linear Algebra and Ordinary Differential Equations

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4331.1:Develop the general energy equations for thermal systems by laws of thermodynamics.

A4331.2:Compare types of fluids, fluid flows, pressure and flow measuring devices, losses in pipes, laminar and turbulent boundary layer concepts.

A4331.3:Evaluate design parameters of hydraulic turbines at given efficiency and discharge

A4331.4.Analyze an expression for force, workdone and efficiency of vane, turbines and pumps.

A4331.5:Apply the principles of conduction, convection and radiation heat transfer to analyze natural phenomena.

3. Course Syllabus

Basic Concepts Of Thermodynamics And Heat Transfer

Definitions – continuum concept – properties – point and path functions – systems – processes – thermodynamic equilibrium - laws of thermodynamic- First law applied to open and closed systems – steady and unsteady flow systems - Second law – heat engines and heat pumps – efficiency and Coefficient of Performance (COP).

Heat transfer – conduction – general conduction equation in Cartesian coordinates – conduction in composite walls. Convection – free and forced convection – simple empirical correlations. Radiation – laws – black body and grey body radiation.

Ic Engines And Air Conditioning:I C engines – classification - construction and working - two and four stroke engines – S I and C.I. engines – powdered coal as an alternative to diesel fuel.

Air conditioning – air cycles, vapour compression cycle – vapour absorption cycle – psychrometric processes. Air cooling – methods and simple cooling load calculations. Systems applicable to mining environment.

4. Power Transmission

Gears – nomenclature, laws of gearing, types of gears including rack and pinion, interference, gear trains, calculation of gear ratios, couplings - types, features and applications.
Basic concepts in hydraulic & pneumatic power and devices and their utilisation – simple calculations.

Kinematics Of Machines: Mechanisms – basics – kinematic concepts and definitions – degree of freedom, mechanical advantage – transmission angle – description of common mechanisms – quick return mechanisms, straight line generators, dwell mechanisms, ratchets and escapements – universal joints.Cams and followers – terminology and definitions, displacement diagrams – uniform velocity, parabolic and simple harmonic motions.

Rotodynamic And Vibratory Machines: Fans and compressors – types, construction, working principle, characteristics and applications. Single stage and multistage air compressors – intercooling. Simple calculations for output and efficiency.
Vibration – Importance of free and forced vibration. Vibrators and shakers – construction, working principle, applications and limitations. HMT Data book to be permitted

5. Books and Materials

Text Books:

1. Rajput, R.K. Thermal Engineering, 6th Edition, Laxmi Publications, 2007
2. Ballaney, P.L. Thermal Engineering, Khanna Publishers, 24th Edition, 2003
3. Shigley J.E., Pennock G.R. and Uicker J.J. Theory of Machines and Mechanisms, Oxford University Press, 2003.

Reference Books:

1. Domkundwar, Kothandaraman, and Domkundwar. A Course in Thermal Engineering, Dhanpat Raj & Sons, Fifth edition, 2002.
2. Yunus A. Cengel. Heat Transfer - A Practical Approach – Tata Mc Graw Hill 2004.
3. Nag, P.K. Engineering Thermodynamics, 3rd Edition, Tata Mc Graw Hill, 2005
4. Thomas Bevan. Theory of Mechanics, CBS Publishers and Publishers and Distributers, 1984.
5. Ghosh, A. and Mallick A.K.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4531 – FUNDAMENTALS OF JAVA

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course provides OOP concepts using Java. The course focuses on different aspect of core Java Environment suitable to write efficient, maintainable, and portable code. It also ignites Object Oriented thinking and explores with the evolution of Java and its basics. It provides strong foundation on Inheritance, Packages, and Interfaces and also illustrates Exception Handling and Multithreaded mechanisms. In depth knowledge to implement Collection frameworks. Emphasis on AWT concepts used for GUI applications is given with event handling. The course plays a vital role in developing front-end interface for Mini and Major Projects.

Course Pre/co requisites

- A5501– Python Programming
- A5502– Data Structures

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4531.1: Understand the principles of Object Oriented Programming to model real world problem.

A4531.2: Use various constructs / concepts to write programs in OOP paradigm.

A4531.3: Analyze the applications for Handling Exceptions and Multithreading in Java runtime environment.

A4531.4: Implement Collection Frameworks to retrieve and process data efficiently.

A4531.5: Build GUI applications using AWT for Interactive applications.

3. Course Syllabus

introduction to oop: Evolution of Java, OOP principles, Java Buzzwords, Implementing Java program, JVM, Data Types, Variables, Type conversions and Casting, Operators, Control statements, Arrays**.**CLASS, METHODS, OBJECTS AND CONSTRUCTORS- Classes, Objects, Methods, Constructors, this keyword, Overloading Methods and Constructors, Argument passing, Exploring String class.

Inheritance, Interfaces and Packages:INHERITANCE: Inheritance Basics, Using super, Multilevel Hierarchy, Method Overriding, Dynamic Method Dispatch, Abstract classes, final keyword. PACKAGES AND INTERFACES: Defining a Package, Finding Packages and CLASSPATH, Access Protection, Importing Packages, Defining and Implementing interfaces, Extending interfaces.

Exception Handling and Multithreading:EXCEPTION HANDLING-Exception Handling Fundamentals, Exception Types, Using try catch, throw throws and finally keywords, Built-in Exceptions, Creating own

exception subclasses. MULTITHREADING- Life cycle of a thread, creating threads, thread priorities, Synchronizing threads, Interthread Communication.

Collections and Event Handling:COLLECTIONS FRAMEWORK-Collection classes- ArrayList, LinkedList, HashSet, and TreeSet. EVENT HANDLING-Delegation Event Model, Event Sources, Event Classes, Event Listener Interfaces, Handling Mouse and Keyboard Events, Adapter classes.

AWT: AWT Hierarchy, AWT controls – Label, Button, TextField, TextArea , Checkbox , CheckboxGroup List and Choice. Layout Managers: FlowLayout, BorderLayout, GridLayout, and CardLayout. Limitations of AWT.

4. Books and Materials

Text Books:

1. *Herbert Schildt (2011),* Java: The Complete Reference, 8th Edition, Tata McGraw-Hill Education, New Delhi.

Reference Books:

1. *Michael Ernest (2013),* Java SE 7 Programming Essentials, John Wiley & Sons Inc.
2. *Y. Daniel Liang (2014),* Introduction to Java Programming, Comprehensive Version, 10thEdition,
3. Pearson Education, India.
4. *Kathy Sierra, Bert Bates (2014),* OCA/OCP Java SE 7 Programmer I & II Study Guide (Exams 1Z0-803 & 1Z0-804), 1st Edition, McGraw-Hill Education Publisher, USA.
5. *T. Budd (2010),* An Introduction to Object Oriented Programming, 3rd Edition, Pearson Education, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4231 – TRANSDUCERS AND MEASUREMENTS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course provides an overall understanding of the elements and processes, including sources of errors, and digitally acquiring these measurements. Along with an overview of instrumentation principles, the physical principles and electrical characteristics for several common instrument transducers are studied. The electronic signal conditioning circuits required converting the electrical changes in the transducers to signal which can be interpreted accurately by a microprocessor or an embedded controller are analyzed and designed effectively. This course also gives an integration of hardware and software in designing computer controlled processes and/or systems with the aid of sensors, transducers data acquisition board, and instrument control.

Course Pre/co requisites

"The course has no specific prerequisite and co requisite"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4231.1 . Aware the basic concepts of measurement parameters as well as instrument standards, characteristics and errors.

A4231.2 Construct and design various measuring devices like voltmeters, Ammeters, Ohmmeters, analog, digital multi-meters and analyze different types of cathode ray oscilloscopes.

A4231.3 Design different bridge networks and analyze balanced condition for finding out values of resistance, capacitance and inductance.

A4231.4 Analyze different physical parameters like pressure, force, velocity, acceleration, sound, torque, strain and stress etc. using non-electrical transducers.

A4231.5 Apply the principles and practice for instrument design and develop for real world problems.

3. Course Syllabus

Characterstics Of Instruments: Block schematic of measuring system, Performance characteristics of instruments-static and dynamic characteristics, Errors in measurement.

Measuring Instruments: DC voltmeters- multi-range, range extension, DC Ammeter- multi range, range extension, ohm-meters-series type and shunt type, AC Voltmeter.

Digital Voltmeters: Dual slope and Successive Approximation type DVM.

Transducers-I: Introduction, classification, strain gauges, LVDT, Piezo electric transducers, OP-AMP applications in measurement and transducer circuits, instrumentation amplifier, thermometers, thermocouples, thermistors, sensistors.

Transducers-II: Measurement of non electrical quantities- displacement, pressure, torque, vibration, pH, sound, velocity, humidity, speed, analog and digital data acquisition systems, programmable logic controllers and their industrial applications.

DC and AC BRIDGES: Measurement of resistance Wheat's stone bridge, Kelvin's double bridge, measurement of Inductance using Maxwell's inductance bridge, Anderson's bridge, Hay's bridge, measurement of capacitance using Schering bridge.

Cathode Ray Oscilloscope (Cro): Introduction to CRT, vertical amplifiers, horizontal deflection system, simple CRO, measurement of phase and frequency (lissajous patterns).

4. Books and Materials

Text Books:

1. A. K. Sawhney (2007), Electrical and Electronic Measurements and Instrumentation, 18th Edition, Dhanpat Rai & Co, New Delhi.
2. H.S.Kalsi, Electronic Instrumentation, 3rd edition, Tata McGraw-Hill Education.

Reference Books:

1. D.Helfrick, W.D. Cooper (2002), Modern Electronic Instrumentation and Measurement Techniques, 5th edition, Prentice Hall of India, New Delhi.
2. David A. Bell (2003), Electronic Instrumentation & Measurements, 2nd edition, Prentice Hall of India, New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4631-PRINCIPLES OF SOFTWARE ENGINEERING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course acts as a foundation in the field of software engineering and is aimed at helping students develop an understanding of how software systems are developed from scratch, by guiding them through the development process, adopting the fundamental principles of system development. The course will orient the students to the different software process models, software requirements engineering process, systems analysis and design as a problem-solving activity, with focus on quality.

Course Pre/co requisites: Nil

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

- **A4631.1** : Understand metrics in the process and project domains.
- **A4631.2** : Identify the right process model to develop the right software system.
- **A4631.3** : Gather requirements and analyze them scientifically in order to develop the right product, besides authoring software requirements documents.
- **A4631.4** : Apply testing strategies for application being developed.
- **A4631.5** : Propose design as per functional and non-functional requirements using design principles.

3. Course Syllabus

Introduction To Software Engineering: The Evolving nature of software engineering, Changing nature of software engineering, Software engineering Layers, The Software Processes, Software Myths.

Process Models: A Generic Process Model, Waterfall Model, Incremental Process Models, Evolutionary Process Models, Spiral Model, the Unified Process, Personal and Team Process Models, the Capability Maturity Model Integration (CMMI).

Requirements engineering: Functional and Non-Functional Requirements, The Software requirements Document, Requirements Specification, requirements Engineering, Requirements Elicitation and Analysis, Requirement Validation, Requirement Management.

System Modeling: Context Models, Interaction Models, Structural Models, Behavioural Model, Model-Driven Engineering.

Design Concepts: The Design Process, Design Concepts, The Design Models, Architectural Design: Software Architecture, Architectural Genres, Architectural Styles.

Design And Implementation: The Object Oriented Design with UML, Design Patterns, Implementation Issues, Op en Source Development.

User Interfacedesign: The Golden Rules, User Interface Analysis and Design, Interface Analysis, Interface Design Steps, Design Evaluation.

Software Testing Strategies: A Strategic approach to Software Testing, Strategic Issues, Test Strategies for Conventional Software, Validation Testing, System Testing, The Art of Debugging, White-Box Testing, Black Box Testing.

Product Metrics: A Framework for Product Metrics, Metrics for the Requirements Model, Metrics for Design Model, Metrics for Source Code, Metrics for Testing.

Process And Project Metrics: Metrics in the Process and Project Domains, Software Measurements, Metrics for Software Quality.

Risk Management: Risk versus Proactive Risk Strategies, Software Risks, Risk Identification, Risk Projection, Risk Refinements, Risk Mitigation Monitoring and Management (RMMM), The RMMM Plan.

Quality Management: Quality Concepts, Software Quality, Software Quality Dilemma, Achieving Software Quality. Review Techniques, Reviews: A Formal spectrum, Informal Reviews, Formal Technical Reviews.

Software Quality Assurance: Background Issues, Elements of Software Quality Assurance, Tasks, Goals and Metrics, Software Reliability, the ISO 9000 Quality Standards.

4. Books and Materials

Text Books:

1. Roger S.Pressman (2011), Software Engineering, A Practitioner's approach, 7th edition, McGraw Hill International Edition, New Delhi.
2. Sommerville (2001), Software Engineering, 9th edition, Pearson education, India.

Reference Books:

1. K. K. Agarval, Yogesh Singh (2007), Software Engineering, 3rd edition, New Age International Publishers, India.
2. Lames F. Peters, WitoldPedrycz(2000), Software Engineering an Engineering approach, John Wiely& Sons, New Delhi, India.
3. Shely Cashman Rosenblatt (2006), Systems Analysis and Design, 6th edition, Thomson Publications, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4131-PROJECT PLANNING AND MANAGEMENT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course will provide a general introduction to project management. This course covers key components of project management including project integration, project scope management, project time and cost management, quality management, human resource considerations, communications, and procurement management. Understand network techniques for Project planning, scheduling and Execution Control with limited resources.

Course Pre/co requisites

This course has no specific prerequisite and co requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4131.1 Identify project characteristics and various phases of a project.

A4131.2 Explain project organization, staffing and feasibility of projects.

A4131.3 Apply the techniques of Project planning, scheduling and Execution Control.

A4131.4 Analyse the role of stakeholders.

A4131.5 Evaluate Resources, Budget, Claims and Disputes.

3. Course Syllabus

Project Management: Overview of Project Management, Concepts and Definitions. Project manager and his responsibilities. Types of projects, Various stages of projects, Organizational structures used in project management. Management Functions and staffing.**Project Planning:** Time planning, Contents of Project plan, planning process, Work breakdown structure, process mapping. Project Budgeting: Financial Projections, time value of money, cost of capital, capital investment decisions.

Scheduling Techniques: Bar Charts, CPM & PERT: Time estimate- Optimistic time estimate, Most likely time estimate, Pessimistic time estimate & Expected time. Project Scheduling, Network Analysis, Cost-Time Analysis in Network Planning, Float - Total float, free float.

Monitoring and Controlling: Plan monitor control cycle, data collection and reporting, Project control. Working with stakeholders.

Conflict Management: claims and Disputes- Source of claim, Claim Management, Dispute resolution, Arbitration and its advantages, Project closure.

4. Books and Materials

Text Book:

1. *Punmia B.C., Khandelwal* K.K., Project *planning and control with PERT and CPM*, Fourth Edition, Laxmi Publications, New Delhi, 2016.

Reference Books:

1. *Stephen A. Robbins, David* A. Decenzo & Mary Coulter, *Fundamentals of Management* 7th Edition, Pearson Education, 2011.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4431 - FUNDAMENTALS OF IOT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

The course introduces you to advance concepts and design methodologies to design IoT systems and developing IoT applications programming languages and tools optimized for IoT domain. It also exposes participants to communication technologies and legacy protocols as well as newly developed IoT specific application and physical layer protocols. The course covers python languages in great detail with set of packages which makes it obvious choice as a leading IoT language.

Course Pre/Co-Requisites:

The course has no specific prerequisite and co-requisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4431.1: Identify the basic building blocks of IoT and its characteristics

A4431.2:Choose the application-layer protocols and web services architectures for a seamless integration of various components within an IoT ecosystem

A4431.3: Utilize Python standard libraries for implementing various IoT Applications

A4431.4: Examine the communication between a machine or a device with a remote system

A4431.5: Analyze cloud infrastructure, services, APIs and architectures of commercial and industrial cloud platforms

3. Course Syllabus

Introduction To Internet Of Things: Introduction, Physical Design of IoT, Logical Design of IoT, IoT enabled Technologies, IoT Levels and Templates, IoT Platforms Design Methodology.

Introduction To Python: Language features of Python, Data types& data structures, Control of flow, Functions, Modules, Packages, File Handling, Data/Time operations, Classes, Python packages of interest for IoT(JSON,XML)

IoT AND M2M: Introduction, M2M, Difference between IoT and M2M, SDN and NFV for IoT, **IoT System Management With Netconf- Yang**-Need for IoT Systems Management, SNMP, Network Operator Requirements, NETCONF, YANG, IoT Systems Management with NETCONF-YANG

Iot Physical Devices And Endpoints: Introduction to IoT Device, Exemplary Device: Raspberry Pi, Components of Raspberry Pi Board, Linux on Raspberry Pi, Raspberry Pi Interfaces, Programming – Raspberry Pi with Python

Iot Physical Servers And Cloud Offerings: Introduction to Cloud Storage models and communication APIs,WAMP – AutoBahn for IoT, Xively Cloud for IoT, Python web application framework-Django, Designing a RESTful web API

4. Books And Materials

Text Book:

1. ArshdeepBahga and Vijay Madisetti: *Internet of Things,A Hands-on Approach*; University Press, 2016.

Reference book:

1. Getting Started with Raspberry Pi:Matt Richardson & Shawn Wallace,O'Reilly (SPD),2014.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4354- COMPOSITE MATERIALS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Composite materials are materials comprising two or more material phases with different physical properties. Because they usually exhibit remarkable physical properties, in general superior to the properties of their individual components, they appear pervasively in engineering applications (e.g., reinforced concrete in construction, fiber-reinforced materials for aircraft structures, reinforced rubber in car tires). Despite being comprised multiple material phases with different physical properties, these materials may be considered for practical purposes as homogeneous materials with physical material-like effective properties.The course will focus primarily on the elastic properties of a wide range of composites (laminated materials, particulate/fiber-reinforced composites, multidirectional laminates) and will cover a number of engineering methods for the computation of the effective properties of these materials based on the properties and spatial arrangement (volume fraction, shape, orientation, …) of their underlying constituents.

Course Pre/Co-Requisites:

A4307- Metallurgy and Materials Science

1. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4354.1: Understand the Knowledge of composite materials for component design.

A4354.2: Evaluate the properties of fibre reinforcements, polymer matrix materials and commercial composites.

A4354.3: Apply knowledge of composite mechanical performance and manufacturing methods to a composites design project

A4354.4: Identify the most appropriate manufacturing process for fabrication

A4354.5:Analyze the elastic properties and simulate the mechanical performance of composite materials and predict the failure behaviour of composites.

2. Course Syllabus

Introduction: Definition, Classification of Composite materials based on structure, based on matrix. Advantages of composites, application of composites, functional requirements of reinforcement and matrix. Properties of composite materials – strength, Fracture and toughness, Fatigue behavior.

Fibers: Preparation, properties and applications of glass fibers, carbon fibers, Kevlar fibers and metal fibers, properties and applications of whiskers, particle reinforcements.

Manufacturing Of Advanced Composites:*Polymer matrix composites*: Preparation of Molding compounds and prepregs, hand layup method, Autoclave method. Filament winding method, Compression molding, Reaction injection molding.

Manufacturing Of Metal Matrix Composites: Casting, Solid State diffusion technique, Cladding - Hot isostatic pressing.
Manufacturing Of Ceramic Matrix Composites: Liquid Metal Infiltration, Liquid phase sintering.
Manufacturing Of Carbon – Carbon Composites: Knitting, Braiding, Weaving.

Response Of Composites To Stress: (a) Isostrain condition (b) Isostress condition (c) Load friction shared by the fibers. Environmental effects of composites, Testing and inspection of composites.

4. Books And Materials

Text Books:

1. *K. K. Chawla (2012),* Composite Materials-Science & Engineering, 3rd Edition, Springer, USA.
2. Bryan Harris (1999), Engineering composite materials, 1st Edition, The Indian Institute of materials, London, U K.

Reference Books:

1. *R W Cahn (2003),* Material Science and Technology, Vol. 13, 3rd edition, VCH Wein Hein, West Germany.
2. E. *D. Lubin (2007),* Hand Book of Composite Materials, 1st edition, Wan Nostrand Hein Held, USA
3. *P. K. Sinha (2006),* Composite Materials and structure, 1st edition, IIT Kharagpur, India.
4. *Mel M. Schwartz (1996),* Composite materials: Properties, Nondestructive testing and repair, Prentice Hall publishers, New Jersey, USA.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4355 – ENERGY CONSERVATION AND MANAGEMENT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Energy Resources & Conservation deals with the various available sources of energy and different conversion methods to convert energy into useful energy for society needs and demands. It also gives the information regarding energy conservation and its importance for future needs.

Course Pre/co-requisites

A4306 -Thermodynamics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4355.1: Explain the various sources of energy available in nature to make society needs.
A4355.2: Classify the sources of energy.
A4355.3: Illustrate the various methods to convert available sources of energy into useful power.
A4355.4: List merit and demerits of various sources of energy.
A4355.5: Identify the importance of energy conservation and conservation policies for future needs and demands.

3. Course Syllabus

Introduction: Overview of the course; Examination and Evaluation patterns; Basic concepts of energy; Introduction to Renewable Energy Technologies; Energy and Environment: Global warming, acid rains, Depletion of ozone layer; Global and Indian Scenario of renewable energy sources

Energy Storage: Introduction; Necessity of Energy Storage; Energy Storage Methods
Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data
Solar Thermal Systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems

Solar Photovoltaic Systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

Wind Energy: Introduction: Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems
Fuel Cells: Overview; Classification of fuel cells; operating principles; Fuel cell thermodynamics

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Other Forms Of Energy: Introduction: Nuclear, ocean and geothermal energy applications; Origin and their types; Working principles.

4. Books And Materials

Text Books:

1. *Sukhatme S.P. and J.K. Nayak*, Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008.
2. *Khan B.H.,* Non-Conventional Energy Resources, Tata McGraw Hill, New Delhi, 2006.

Reference book:

1. *J.A. Duffie and W. A.* Beckman, Solar Energy - Thermal Processes, John Wiley, 2001.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4356 – TRIBOLOGY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Tribology is the science and technology of interacting surfaces in relative motion. This includes study of friction, lubrication, contact mechanics, surface damage processes and surface optimization. It is highly multidisciplinary and spans many applications including physics, chemistry, materials science, biology and engineering.

Course Pre/co-requisites: A4014-Environmental Science

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4356.1.Understand the nature of engineering surfaces, concepts of friction, wear and lubrication

A4356.2.Explain the different bearing Materials with their properties

A4356.3.Apply the basic theories of friction, wear and lubrication to predictions about the frictional behavior of commonly encountered sliding interfaces.

A4356.4.Identify, Analyze and solve the Tribo-logical problems by using laws of friction, wear and lubrication

A4356.5.Analyze the behavior of bearing in different lubrication regimes and able to develop mathematical model

3. Course Syllabus

Introduction: History and basic concept of friction wear and lubrication, Types of lubricants, Objectives and selection of lubricant, Physical properties of lubricants.

Lubrication: Regimes of lubrication - hydrodynamic, Elasto-hydrodynamic, mixed and boundary lubrication, Reynolds' equation, Hydrodynamic lubrication of roughened surfaces.

Theories Of Other Lubrication: Externally pressurized lubrication, Squeeze-film lubrication, Elasto-hydrodynamic lubrication, Rheological lubrication regime, Functional lubrication regime.

Applications Of Hydrodynamic Lubrication Theory: Journal bearing, inclined thrust pad bearing, Rayleigh step bearing.

Friction And Wear: Origin of sliding friction Causes of Friction, Laws of Rolling Friction. Friction Instability, Contact between two bodies in relative motion, Wear classification - Wear between solids - Wear between solid and liquid - Factors affecting wear - Measurement of wear, Types of

wear and their mechanisms - Adhesive wear-adhesion junction growth, Abrasive wear, Wear due to surface fatigue and wear due to chemical reactions, wear of metallic materials.

Text Books:

1. Stachowaik, G.W., Batchelor, A.W., Engineering Tribology, 3rd Ed., Elsevier, 2010.
2. Majumdar B.C, Introduction to bearings, S. Chand & Co., Wheeler publishing, 1999.

Reference Books:

1. Andras Z. Szeri, Fluid film lubrication theory and design, Cambridge University press, 1998.
2. Stolarski TA, Tribology in Machine Design, Butterworth Heinemann, 2000.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4024-PRODUCT REALIZATION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
0	0	2	0	0	28	1	30	70	100

1. Course Description

Course Overview

The accelerating demand for rapid product design and manufacturing, calls for constant technological innovation. The art of launching latest technological concepts and creating better products for future is achieved by strong Engineering judgment. Current research in this area includes lean product development, integration of knowledge and learning into design through product realization and rapid prototyping. In a similar note an initiative is taken to further explore and implement concepts like product realization and concurrent engineering1 Design and manufacturing tasks are central to mechanical engineering as these experiences begin in the freshman year and last until a real world component is designed and manufactured at a senior level. This process introduces the students to the concept of problems having more than one valid solution and to methods for generating parametric solutions to problems 2. Thus, a curriculum that provides a base for future professional growth is highlighted and enhanced by launching a ”learning laboratory”, or “research laboratory”, with state- of- the- art rapid prototyping and experimental stress analysis devices 4.

Course Pre/Co-Requisites:

This course provides the alternative avenues to develop engineers who are both technically competent and who have significant experience in the design and development of products.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4024.1 Interpret the specifications of product and solve it for Practical realization
A4024.2 Analyze the Costumers mindset and accordingly designing of the product.
A4024.3 Applying Gantt Charts to define timeline for Product Realization.
A4024.4 Conceptualize the terms called Product, Purchase, Production and Monitoring of products.
A4024.5 Communicate the process of converting an idea to physical Product

3. Course Syllabus

Introduction to Product Realization: Introduction to Product Realization, Need for Product Realization, Product realization process, Case Study of Product Realization for Global Opportunities.

Planning of Product Realization: Plan and develop the processes needed for product realization, Defining Quality objectives and requirements, establish processes documents. Needs - verification, validation,

monitoring inspection and test activities (inspection nodes) and criteria for product acceptance and record needed. Case study on timeline of Product realization planning (Gnatt Chart).

Customer-Related Processes: Product information Enquiries, contracts or order handling Customer feedback including customer complaints, A field survey.

Design and Development: Review verification and validation of each design and development stages, Functional and performance requirements, Information for purchasing, production and service provisions, review and validation, Develop a Design model of the product.

Purchasing, Production and Service Provision : Purchasing information, Vendors evaluation and approval process, Verification of purchased product. Control of production, service provision, validation of processes for production and service provision, Identification and tractability, Customer property and Preservation of product.

Control of Monitoring and Measuring Equipment: Monitoring and measurements - Calibrated or verified, Adjusted or re-adjusted, Identified to determined the calibration status, Safeguarded from adjustment and Protection from change and deterioration.

Regulatory Investigation & Identification: Various regulatory bodies, roles and responsibilities, model of comprehensive document for the body of information about an investigational product.

4. Laboratory Equipment/Software/Tools Required

[List of Equipment/Software/Tools required for conducting the laboratory need to be included here]

5. Books and Materials

Text Books:

1. Mileta M Tomovic, Sowping Wang, Product Realization – A Comprehensive Approach, Spinger.
2. Stark, John, Product Life Cycle Management, 21st centaury Paradigm for Product Realisation 2011, Springer.

Reference Books:

1. Verna J. Bowen , Lucy V. Fusco, The Competitive Edge Research Priorities for U.S. Manufacturing, National Academy of Sciences.
2. Renuka Thota, Suren Dwivedi, Implementation of product realization concepts in design and manufacturing courses, University of Louisiana-Lafayette.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4016-INDIAN CONSTITUTION

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
2	0	0	28	0	0	0	0	100	100

1. Course Description

Course Overview

This course enables the students to understand the constitution of India as the Supreme law of India. The student will also gain knowledge about the parliament of India and how it functions. This course will survey the basic structure and operative dimensions of the Indian constitution. It will explore various aspects of the Indian political and legal system from a historical perspective highlighting the various events that led to the making of the Indian constitution.

Course Pre/Co-Requisites

This course facilitates graduate students to know about importance of the Indian constitution and facilitates students to know about the fundamental rights of the citizens.

4. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4016.1 Identify the important components of Indian Constitution.
A4016.2 Apply the fundamental rights in right way and become a more responsible citizen.
A4016.3 Illustrate the evolution of Indian Constitution.
A4016.4 Explain the basic structure of Indian Constitution.
A4016.5 Define the basic concepts democracy, liberty, equality, secular and justice.

5. Course Syllabus

Evolution of Indian constitution: Indian independence act 1947, formation of constituent assembly of India, committees of the constituent assembly, constitution of India drafting committee, brief study about Dr. *B. R. Ambedkar, time line of formation of the constitution of India.*

Structure of the constitution of India: Parts, schedules, appendices, constitution and government, constitution and judiciary.
Preamble to the constitution of India: Brief study about sovereignty, socialist, secularism, democracy, republic, justice (political justice, social justice, economic justice), liberty, equality, fraternity, unity & integrity.

Acts: Right to education act, right to information act, anti-defection law, Jan Lokpal bill.
Fundamental rights: Right to equality, right to freedom (freedom of speech and expression, right to practice any profession etc.), right against exploitation, right to freedom of religion, cultural & education rights, right to property, right to constitutional remedies.

6. Books and Materials

Text Book:

1. *Dr. Durga das basu*. Introduction to the constitution of India. 21st edition, Lexis Nexis books publication Ltd, 2013.

Reference Books:

1.*Subhash C. Kashyap*, Our Constitution, National Book Trust, New Delhi, 2011.
2.*Arun K Thiruvengadam.* The constitution of India. 1st edition, Hart publishing India, 2017.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

SYLLABI FOR IV YEAR I SEMESTER

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4322 – FINITE ELEMENT METHODS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	2	42	0	28	4	30	70	100

1. Course Description

Course Overview

Finite element methods course is one of the important courses in mechanical engineering. This course introduces student's finite element methods for analysis of solid, structural, fluid and heat transfer problems. It deals analysis of one dimensional, two dimensional problems like truss, beams and plane stress and plane strain problems, steady state Heat Transfer and dynamic analysis problems. This course is an integrated course having theory and practical components that integrates hands on experience to observe the stress analysis of solid and structural members due external loads. This course forms how to model the given problem for analyses of one dimensional, two dimensional, steady state heat transfer and dynamic problems.

Course Pre/Co-Requisites

A4305 - Mechanics of Solids

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4322.1. **Understand** the general procedure of finite element method, one dimensional problems and shape functions.

A4322.2. **Solve** structural elements including trusses and beams.

A4322.3. **Apply** finite element method to solve two dimensional and axi-symmetric problems.

A4322.4. **Analyze** heat transfer problems, dynamic analysis on bar and beam elements.

A4322.5. **Simulate** the static, dynamic and thermal analysis of the components as per the boundary conditions.

3. Course Syllabus

Theory

Introduction To Fem: Stress and Equilibrium, boundary conditions, Strain-Displacement relations. Stress - strain relations. Finite element modeling coordinates and shape functions. Potential Energy approach: Finite Elements: 1- Dimensional, 2 – Dimensional, 3-Dimensional & Interpolation Elements; One Dimensional Problem, Assembly of Global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

Analysis Of Trusses: Stiffness Matrix for plane truss and space truss elements, stress calculations.
Analysis Of Beams: Shape functions-Element stiffness matrix for two nodes, two degrees of freedom per node beam element, load vector, deflection, stresses.

2-D Problems:CST-Stiffness matrix and load vector, Isoperimetric element representation, convergence requirements, Problems. Finite Element Modelling: Axisymmetric solids subjected to Axisymmetric

loading with triangular elements. Two dimensional four noded ISO-parametric elements and numerical integration

Steady State Heat Transfer Analysis: 1-D analysis of a slab, fin and 2-D analysis of thin plate. Analysis of a uniform shaft subjected to torsion.

Dynamic Analysis: Formulation of finite element model, element matrices, Lumped and consistent mass matrices, evaluation of Eigen values and Eigen vectors for a stepped bar and a beam.

Practice:

List Of Experiments

1. Statically Indeterminate Reaction Force Analysis
2. Stress Tool for Long Bar with Compressive Load
3. Rectangular Plate with Circular Hole Subjected to Tensile Loading
4. Thermal Stress in a Bar with Temperature Dependent Conductivity
5. Modal Analysis of a Rectangular Plate
6. Buckling of a Stepped Rod
7. Harmonic Response of a Single Degree of Freedom System
8. Thermal Stress Analysis with Remote Force and Thermal Loading
9. Modal Analysis for Beams
10. Bending of Long Plate Subjected to Moment - Plane Strain Model
11. Deflection of Beam using Symmetry and Anti-Symmetry
12. Fundamental Frequency of a Simply-Supported Beam

Note: Minimum ten experiments needs to be conducted.

Software Package: ANSYS

4. Books and Materials

Text Books:

1. Tirupathi R. Chandrapatla and Ashok Belegundu (2012), Introduction to Finite Elements in Engineering, 4rd edition, Pearson Education, India.
2. S. S. Rao (2012), The Finite Element Methods in Engineering, 5th edition, Elsevier, USA.

Reference Books:

1. V. David. Hutton (2010), Fundamentals of finite elements analysis, 1st edition, Tata McGraw-Hill education (P) Ltd, New Delhi, India.
2. J. N. Reddy (2010), An introduction to Finite Element Method, 3rd edition, Tata McGraw hill education (P) Ltd, New Delhi, India
3. Chennakesava R. Alavala (2009), Finite elements methods, 1st edition, second reprint, Prentice Hall of publishers, New Delhi, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4323- ROBOTICS

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course overview

This course introduces students to the basics, types and elements of robots. The course exposes students to the theoretical concepts of robot kinematics and dynamics as well as the merger of this for implementation. Programming and path planning concepts gives the perception on control of robotics. The concepts on actuators and sensor gives clear understanding and design ability for mobility systems. It gives an overview on robot work cell design and control.

Course Pre/Co-Requisites:

This course has no specific pre/co requisites:

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4323.1 **Understand** the basic concepts and components of a robotic system.

A4323.2 **Identify** the use of actuators and sensors for designing robot mobility system.

A4323.3 **Solve** numerical problems on forward and inverse kinematics of robots for motion analysis.

A4323.4 **Apply** the key concepts of robot dynamics and programming for obstacle avoidance.

A4323.5 **Apply** the concepts of work cell design and control.

3. Course Syllabus

Theory

Introduction to Robotics, Classification of Robots, Advantages and Disadvantages of Robots, Application of Robots, Degree of freedom, joints, Robot coordinates, Robot workspace, Robot characteristics, Robot Components, types of robot arms, end effectors, grippers.

Actuators: Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic and Pneumatic Devices, Electric Motors in Robotics.

Sensors: Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finder.

Motion Analysis: Homogeneous Transformation 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.

Manipulator Dynamics - I: Differential transformation of serial manipulators, Jacobians, Problems. Dynamics: Lagrange formulation method, Lagrange -Euler formulation, Problems.

Manipulator Dynamics - II: Trajectory planning and avoidance of obstacles, Path planning, Skew motion, joint integrated motion, straight line motion, Robot programming, languages and software.
Robot Work Cell Design and Control: Robot Cell Layouts, Multiple Robots and Machine Interface, Some Consideration in Work Cell Design, Interlocks, Error Detection and Recovery, Robot Cycle Time Analysis.

Text Books:

1. Richard D. Klafter (2010), Robotic Engineering, 2nd edition, Prentice Hall of India, New Delhi.
2. M.P. Groover (2010), Industrial Robotics, 3rd edition, Pearson Education, New Delhi.

Reference books:

1. R.K. Mittal, I.J. Nagrath (2012), Robotics and Control, 1st edition, Tata Mc Graw Hill, New Delhi.
2. P. Coiffet, M. Chaironze (2010), An Introduction to Robot Technology, 3rd edition, Kogam Page Ltd., London.
3. Ganesh S. Hegde (2015), A Textbook of Industrial Robotics, 2nd edition, University Science Press.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4332 – INTRODUCTION TO 3D PRINTING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

3D printing is an additive manufacturing process whereby objects are built up from plastic filament, liquid resin, layers of powder, or even bio-compatible and edible materials. Desktop 3D printing is today's printing press, putting rapid prototyping, customizable products, and individualized medical appliances in reach of the general public. Literacy in basic 3D modeling and manufacturing is an essential skill for future STEM success in this country. In this course students will learn how to be "makers" by using various types of 3D modeling software and imaging equipment, printing actual physical objects that they have designed and modeled themselves, and participating in educational outreach in the institute and the community.

Course Pre/co requisites:

"AutoCAD and Manufacturing Process"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4332.1. **Understand** the fundamental concepts of Additive Manufacturing (i.e. Rapid Prototyping) and 3-D printing, its advantages and limitations.

A4332.2. **Apply** engineering knowledge, techniques, skills and modern tools to analyze problems in 3D PRINTING .

A4332.3. **Appraise** additive manufacturing through 3d printing**.**

A4332.4. **Solve** Complex manufacturing problems for significant technological and societal development

A4332.5. **Analyze,** design and evaluate engineering products using the knowledge of mathematics, science, engineering and IT tools.

3. Course Syllabus

Introduction To 3d Printing: Fundamental of 3D printing, Need for 3D printing Generic 3d printing process, Distinction between 3D printing and CNC, Classification of 3D printing Processes, Steps in 3D printing process, Advantages of 3D printing, standards for 3D printing, Major Applications.

Vat Photo Polymerization 3d Printing Processes: Stereo lithography (SL), Materials, SL resin curing process, Process Benefits and Drawbacks, Applications of Photo polymerization Processes

Material Jetting 3d Printing Processes:- Binder Jetting 3D PRINTING Processes: Evolution of Printing as a 3D printing Process, Materials, Process Benefits and Drawbacks, Applications of Material Jetting Processes.

Binder Jetting 3d Printing Processes: Materials, Process Benefits and Drawbacks, Research achievements

in printing deposition, Technical challenges in printing, Applications of Binder Jetting Processes

Extrusion-Based 3d Printing Processes: Fused Deposition Modeling (FDM), Principles, Materials, Plotting and path control, Bio-Extrusion, Process Benefits and Drawbacks, Applications of Extrusion-Based Processes.

Powder Bed Fusion 3d Printing Processes: Selective laser Sintering (SLS), Materials, Powder fusion mechanism, SLS Metal and ceramic part creation, Electron Beam melting (EBM), Process Benefits and Drawbacks, Applications of Powder Bed Fusion Processes.

Directed Energy Deposition 3d Printing Processes: Process Description, Laser Engineered Net Shaping (LENS), Direct Metal Deposition (DMD), Electron Beam Based Metal Deposition, Benefits and drawbacks, Applications of Directed Energy Deposition Processes.

Wire arc based additive manufacturing methods, Advantages and disadvantages, comparison with conventional 3D printing and WAAM.

Post Processing Of 3d Printing Parts: Support Material Removal, Surface Texture Improvement, Accuracy Improvement, Aesthetic Improvement, Preparation for use as a Pattern, Property Enhancements using Non-thermal and Thermal Techniques.

Inspection of 3D printing parts: Different destructive and non-Destructive testing of 3D printing parts, acceptance standards for 3D printing parts

3d Printing Applications: Functional models, Pattern for investment and vacuum casting, Medical models, art models, Engineering analysis models, Rapid tooling, new materials development, Bi-metallic parts, Re-manufacturing. Application examples for Aerospace, defense, automobile, Bio-medical and general engineering industries

Software Package: FUSION 360 and CATIA

4. Books and Materials

Text Books:

1. Ian Gibson, David W Rosen, Brent Stucker (2015) “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, 2nd Edition, Springer.
2. Ali K. Kamrani, EmandAbouel Nasr (2006) “Rapid Prototyping: Theory & Practice”, Springer

Reference Books:

1. D.T. Pham, S.S. Dimov (2001) “Rapid Manufacturing: The Technologies and Applications of Rapid Prototyping and Rapid Tooling”, Springer.
2. Rafiq Noorani (2006) “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley & Sons.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4532– OPERATIONS RESEARCH

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Operation Research facilitates the comparison of every possible alternative (courses of action or acts) to Know the potential outcomes, permits examination of the sensitivity of the solution to changes or errors in numerical values, and encourage rational decision-making based on the best available approaches or Techniques.

Course Pre/co-requisites

A4001- Linear Algebra and Ordinary Differential Equations
A4012- Probability and Statistics.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4532.1: **Explain** the Operations Research features, models, applications and methods such as linear programming, transportation, sequencing, assignment, replacement, games theory.

A4532.2: **Build** mathematical models for finding optimum solutions for various real world problems and case studies.

A4532.3: **Evaluate** various alternatives available to aid in decision making situations.

A4532.4: **Choose** the best strategies to maximize the profit in the presence of a competitor

A4532.5: **Devise** operating policies for the efficient and effective management of men, materials and machines, production, distribution and service systems.

3. Course Syllabus

Introduction To Operations Research: Basics definition, scope, objectives, phases, models and limitations of Operations Research. Linear Programming Problem, Formulation and Graphical solution of Linear Programming Problem. Simple Method, Artificial variables Techniques, big -M method.

Transportation Problem: Formulation, solution, unbalanced Transportation problem. Finding basic feasible solutions, North-West corner rule, least cost method and Vogel's approximation method. Optimality test – MODI method. Assignment Problem-formulation, types, application to maximization cases and travelling salesman problem.

Sequencing Models: Solution of Sequencing Problem, Processing n Jobs through two machines, Processing n Jobs through three machines, Processing two Jobs through m machines, Processing n Jobs through m Machines.

Queuing Theory: Introduction, Single Channel, Poisson arrivals, exponential service times with infinite population and finite population models.

Replacement Models And Game Theory: Replacement of Items that Deteriorate whose maintenance costs increase with time without change in the money value, Replacement of items that fail suddenly, individual replacement policy, group replacement policy. GAME THEORY: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

4. Books and Materials

Text Books:

1. S.D. Sharma (2010), Operations Research – Theory and Applications, 15th edition, Kedar Nath Ram Nath, , India.
2. Frederick S Hillier; Gerald J Lieberman (2015), Introduction to Operations Research,10th Edition, McGraw- Hill , New York

Reference Books:

1. Hamdy Abdelaziz Taha (2015), Operations Research: an Introduction, 9 th edition, Pearson, Boston
2. Prem Kumar Gupta & D S Hira (2015), Operations Research, Revised edition, S. Chand Publishing, New Delhi, India.
3. P Shankara Iyer (2008), Operations Research 1st Edition, Tata McGraw Hill, Publishing Company, New Delhi, India.
4. S Kalavathi (2012), Operations Research, 4th Edition, Vikas Publication.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4232 – SOLAR ENERGY AND APPLICATIONS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This is an engineering introduction to Solar energy technologies and potentials. The course aims to introduce a general engineering/science audience to the basic concepts of solar energy. The concepts of Photo Voltaic cells and their properties will be explained. Applications of solar cells will be explained in detail also the environmental issues of solar systems will be explained.

Course Pre/co-requisites:

"The course has no specific prerequisite and co requisite"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4232.1: Compare the present and future available electrical power from solar energy in the world based on the knowledge of global solar horizontal irradiation.

A4232.2: Assimilate and acquire the skills for design and engineering of solar thermal and solar photovoltaic technology and systems.

A4232.3: Identify simple to complex problems involved in solar thermal energy conversion technique used in the liquid based solar heating and cooling systems for buildings/societal needs.

A4232.4: Examine a solar PV(Photo Voltaic) system components and their function by utilizing the previous literature knowledge on different Photovoltaic solar cells like crystalline, Multi-Crystalline, Amorphous and thin film.

A4232.5: Analyze the techno economics interaction of developments in the solar energy systems

3. Course Syllabus

Principles Of Solar Radiation: Role and potential of solar energy, Environmental impact of solar power, physics of the sun, the solar constant, extraterrestrial and terrestrial solar radiation, solar radiation on tilted surface, instruments for measuring solar radiation and Sun shine, solar radiation data.

Solar Energy Collectors: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Storage And Applications: Different methods of solar energy storage, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating /cooling technique, solar distillation and drying.

Photo Voltaics (Pv): Fundamentals of solar cells, types of solar cells, absorption of photons, excitations and photo emission of electrons.

Pv Cell Properties: Solar cell properties and design, p-n junction photodiodes, depletion region, electrostatic field across the depletion layer, electron and holes transports, device physics, charge carrier generation, recombination and other losses, I-V characteristics, output power.

Solar Cell Applications: PV cell interconnection, module structure and module fabrication, Equivalent circuits, load matching, efficiency, fill factor and optimization for maximum power, Design of stand-alone PV systems, system sizing, device structures, device construction, DC to AC conversion, inverters.

Cost Analysis And Environmental Issues: Cost analysis and pay back calculations for different types of solar panels and collectors, installation and operating costs, Environmental and safety issues, protection systems, performance monitoring.

4. Books and Materials

Text Books:

1. G. D. Rai (2009), Non-Conventional Energy Sources, 4th Edition, Khanna Publishers, New Delhi.
2. Martin A. Green (2008), Solar Cells: Operating Principles, Technology and system Applications, 1st Edition, Prentice Hall, New Delhi.

Reference Books:

1. B. H. Khan (2016)- Non Conventional Energy Resources-3rd Edition, McGraw Hill Education (India) Private Limited.
2. Sukatme (2008), Solar Energy, 3rd Edition, McGraw Hill Companies, New Delhi.
3. D. Yogi gosuami, Frank Kreith, Jan F. Kreider (2000), Principles of Solar Engineering, 3rd Edition, Taylor & Francis, USA.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4132-ENVIRONMENTAL POLLUTION AND MANAGEMENT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

The course has been designed to improve the understanding of the students about different pollution control strategies and the skills of application of remediation techniques to combat pollution in three environmental compartments i.e. air, water and soil. The course will also be dealing about the sources of pollution in air, soil, water, and noise and the impacts these sources on the environment and health. In addition, the students will be given the knowledge to develop the particular skills required in pollution related structured research and environmental management.

Course Pre/co-requisites

Environmental sciences.

2. Course Outcomes (COs)

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

A4132.1. Identify water pollution sources, types and treatment methods.
A4132.2. Apply knowledge on Prevention and control of air pollution.
A4132.3. Inspect sources, effects and mitigation methods of noise pollution.
A4132.4. Examine soil pollution sources, effects and control measures.
A4132.5. Formulate Environmental management plan to minimize environmental pollution.

3. Course Syllabus

Water pollution: Water Pollution - Introduction - Sources and types of water pollutants Physical, Chemical and Biological. Ground water - Surface water - lake water - seawater. Effects of water pollution. Water Quality standards (drinking and industrial) - water treatment - physical, chemical and biological. Water Pollution Prevention and Control Act, 1974.

Air pollution: Structure and composition of atmosphere – classification, sources and effects of air pollution – Acid rain –green house effect – global warming – Ozone depletion, Prevention and control of air pollution particulate control – settling chamber, scrubber, bag filter, cyclones electrostatic precipitators. Gaseous emission control methods. Air pollution prevention and control Act 1981.

Noise Pollution: Noise Pollution Basics of acoustics- propagation of indoor and outdoor sound- noise profiling effects of noise – measurement, index and mitigation methods- health effects of noise- Vibration and its Effects, Whole body vibration problems in opencast mines-ground vibration and Air blast. Green Belt Development--Principles and design considerations, Industrial Noise Pollution Control methods.

Soil Pollution: Sources - solid waste disposal and their effects - pesticides - types and effect of pollutants on Plants - animals and human beings - biomagnifications - fertilizers and its Effect of pollutants on plants - animals and human beings - soil pollution Control measures - soil microbes and function - biofertilizer.

Environmental management: Environmental impact assessment and statement; Government strategies in pollution control: subsides, polluter pays principle and regulations; Government Agencies and Programs – The Tiwari committee – creation of NCEPC, Department of Environment & Forest – Function of State Pollution Control Board. Sources of environmental information and regulations; Sustainable development and environmental protection.

4. Books and Materials

Text Books:

1. Environmental Pollution Control Engineering: C. S. Rao, 2018.
2. Rao, M. N and H.V.N. Rao (2005) Air Pollution, Tata McGraw – Hill Publishing Company Limited. New Delhi,2017.
3. Kudesia, V.P and RituKudesia,Water Pollution, PragatiPrakashan Publication, Meerut, 2017.
4. Murphy, E., King,E., Environmental Noise Pollution, Elsevier, 2014

Reference Books:

1. Environmental Engineering, Peavy and Rowe, McGraw Hill Publication, 2016
2. De Nevers, N., Air Pollution Control Engineering, 3rd edition Waveland Press Inc 2017.
3. Noise Pollution and Control Strategy- by Sagar Pal Singal , Alpha Science International Ltd; 2005 2nd Edition.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4632- E-COMMERCE TRENDS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

The tremendous growth of the Internet and World Wide Web is having great impact on businesses, governments and individuals throughout the world. In this course, we will attempt to understand the phenomena, technological, economic and social, behind these rapid changes, and how organizations successfully conduct Internet-based activities. We will also study some of the technology of the Internet. This course provides an overview of e-commerce from both technological and managerial perspectives. It introduces e-commerce frameworks, and technological foundations; and examines basic concepts such as strategic formulation for e-commerce enterprises, management of their capital structures and public policy. It is particularly important that the student place a great deal of emphasis in understanding the different E-Commerce system design principles.

Course Pre/co-requisites

“The curse has no specific pre requisite and co- requisite”.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4632.1 : Illustrate the components and roles of the E-Commerce environment.

A4632.2 : Understand legal and ethical issues related to E-Commerce and web marketing approaches.

A4632.3 : Identify how to sell products and services on the web as well as to meet the needs of web site Visitors.

A4632.4 : Analyze e-commerce payment systems.

3. Course Syllabus

Theory

Introduction To E-Business And E-Commerce: What is the difference between e-commerce and e-business, Anatomy of E-Commerce applications, E-Business risks and barriers to business adoption, Management responses to E-Commerce and E-Business, Electronic Commerce-Frame work.

E-Commerce Fundamentals- Location of trading in the marketplace, Business models for ecommerce, Focus on auction business models, Focus on Internet start-up companies.

E-Business Infrastructure- Introduction, Internet technology, Web technology, Internet-access software applications, Managing e-business infrastructure, Focus on web services, SaaS and service oriented Architecture (SOA), Focus on mobile commerce.

E-ENVIRONMENT- Social and legal factors, Environmental and green issues related to Internet Usage, Focus on e-commerce and globalization, Political factors.

E-Business Strategy- What is e-business strategy, Strategic analysis, Strategic objectives, Strategy definition, Strategy implementation, Focus on information systems strategy and e-business strategy.

E-Security - Securing the Business on Internet- Security Policy, Procedures and Practices, Transaction Security, Cryptology, Digital Signatures, Security Protocols for Web Commerce.

Supply Chain Management- What is supply chain management? Focus on the value chain, Using e-business to restructure the supply chain, Supply chain management implementation
E-Procurement- What is e-procurement, Drivers of e-procurement, Focus on estimating eprocurement cost, implementing e-procurement.
E-Marketing- What is e-marketing? E-marketing planning, Situation analysis, Objective setting, Strategy, Tactics, Focus on online branding.
Customer Relationship Management- What is e-CRM and its applications, online buying process, focus on marketing communications for customer Acquisition, Customer retention management and Technology solutions for CRM.

4. Books and Materials

Text Book:

1. E-Business and E-Commerce Management , strategy, Implementation and practice, Dave Chaffey, Fourth Edition, Prentice Hall

Reference Books:

1. Frontiers of electronic commerce – Kalakata, Whinston,Pearson.
2. Bharat Bhaskar: Electronic Commerce,Tata Mc-Graw-Hill, New Delhi, 2003
3. E-Commerce — Business, Technology, Society, Kenneth C.Taudon, Carol Guyerico Traver.
4. Electronic Commerce Gary P.Schneider — Thomson
5. E-Commerce fundamentals and applications Hendry Chan, Raymond Lee, Tharam Dillon, Ellizabeth - 215 - Chang, JohnWiley.
6. E-Commerce, S.Jaiswal –Galgotia.

E-Commerce, Efrain Turbon, Jae Lee, David King, H.MichaelChang.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4432 - PRINCIPLES OF ANALOG AND DIGITAL COMMUNICATIONS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course is useful to understand the basics of Signals, Systems, Random Variables and Communication. The course presents and integrates the basic concepts for both continuous-time and discrete signals and systems. This course provides a foundation in the theory and applications of random variables stochastic processes and an understanding of the mathematical techniques elating to random processes in the areas of signal processing, detection & estimation theory and communications. it gives the basics of Analog and Digital Communication and also gives the background required for advanced study on the course. This is accomplished by providing overviews of the necessary background in signal, system, probability, and random process theory required for the analog and digital communications. It gives more emphasis on stressing fundamental concepts. The topics in the course, more than enough to students needs.

Course Pre/co-requisites

The course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4432.1.Analyze linear and non - linear modulators and demodulators in time as well as frequency domain.

A4432.2.Design a linear and non linear modulators and demodulators for the analog signals

A4432.3.Outline the basic concepts of digital communications with an insight into practical applications and Differentiate between PCM and DM and identify the applications of these modulation schemes in base band transmission

A4432.4.Estimate a overall digital communication system for the improvement of the system performance.

A4432.5.Analyze the performance of a digital communication system by introducing various spread spectrum modulation techniques.

3. Course Syllabus

Introduction to communication system, need for modulation, Types of modulation techniques: AM, FM, PM, Generation and detection. Radio Transmitters,Radio Receivers AM,FM Comparison of Radio transmitters and receivers.

Sources of Noise, Resistor Noise, Shot Noise, Calculation of Noise in a Linear System, Noise in AM Systems, Noise in Angle Modulation Systems, Comparison between AM and FM with respect to Noise, Figure of Merit, Threshold Improvement in Discriminators.

Analog-to-Digital Conversion: Pulse modulation Techniques, Sampling Process, PAM,PWM and PPM. Time Division Multiplexing, Digital Modulation Techniques: Pulse Code Modulation, Companding, Differential Pulse Code Modulation, Delta Modulation, Noise in Pulse-Code Modulation Systems.

Binary Amplitude Shift-Keying, Frequency Shift-Keying, Phase-Shift Keying, Differential Phase-Shift Keying, Quadrature Phase-Shift Keying (QPSK), Comparison of BASK, BFSK and BPSK, Minimum Shift Keying (MSK), Duo binary Encoding.

Spread Spectrum Modulation: Direct Sequence (DS) Spread Spectrum, Use of Spread Spectrum with Code Division Multiple Access (CDMA), Ranging using DS Spread Spectrum, Frequency Hopping (FH) Spread Spectrum, Generation and Characteristics of PN Sequences, Acquisition (Coarse Synchronization) of a FH Signal, Tracking (Fine Synchronization) of a FH Signal, Acquisition (Coarse Synchronization) of a DS Signal, Tracking of a DS Signal.

4. Books And Materials

Text Book:

1. Principles of Communications By Taub and Schilling

Reference Books:

1. Communication Systems, *Simon Haykins* (2nd Edition).
2. Analog and Digital Communication Systems by Martin *S. Roden, 3rd edition, Prentice Hall*, 1994.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4357- AUTOMATION IN MANUFACTURING

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course overview

This course introduces students to the basic concept of Automation, types and it is capable of greatly improving the efficiency of manufacturing operations at the same time it reduced costs. It also allows one single facility to produce a variety of products and boost output (a machine capable of packing a large number of units per minute or hour can improve a company's bottom line. It also refers to putting new products into high volume production while ensuring that the parts are designed for the available manufacturing process.

Course Pre/Co Requisites

A4314-Machine Tools
A4320-CAD/ CAM

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4357.1: **Illustrate** the basic concepts of automation in machine tools.

A4357.2: **Analyze** various automated flow lines, Explain assembly systems and line balancing methods.

A4357.3: **Describe** the importance of automated material handling and storage systems.

A4357.4: **Interpret** the importance of adaptive control systems, automated inspection systems.

A4357.5: **Apply** the concepts of image processing applications of machine vision.

3. Course Syllabus

Introduction to Automation, Single-Station Manufacturing Cells, types and strategies of automation, Automation in machine tools, automation principles, Mechanical feeding and tool changing, machine tool control, elements in product realization.

Automated Flow Lines: Methods of work part transfer, transfer mechanisms, buffer storage, control function, Design and fabrication consideration.
Analysis of automated Flow Lines, General terminology, analysis of transfer lines with and without buffer storage, partial automation, implementation of automated flow lines
Assembly Systems And Line Balancing: Assembly process, Manual Assembly Lines, Line balancing methods, ways for improving line balance, flexible assembly lines.

Automated Material Handling: Types of equipment, functions, analysis and design of material handling systems, conveyor systems, automated guided vehicle systems

Automated Storage Systems: Automated storage and retrieval systems, work in process storage, interfacing handling and storage with manufacturing

Adaptive Control Systems: Introduction – Adaptive control with optimization, Adaptive control with constraints, Application of Adaptive control in machining operations. Uses of various parameters such as cutting force, Temperature, vibration and acoustic emission, Adaptive control.

Automated Inspection: Fundamentals, types of inspection methods and equipment, CMM, Types, methods of CMM control, Machine vision- Introduction, image acquisition and image processing, applications of machine vision

Text Books:

1. M. P. Groover (2011), Automation, Production Systems and Computer Integrated Manufacturing, 3rd edition, Prentice Hall of India, New Delhi, India.
2. P. N. Rao (2011), CAD/CAM Principles and applications, 3rd edition, Tata McGraw- Hill Publishing Company Ltd., New Delhi, India.

Reference Books:

1. *Yoram Coreom* (2011), Computer control of Manufacturing Systems, 2nd edition, Prentice Hall of India, New Delhi, India.
2. *Buekinsham (2010), Automation*, 3rd edition, Prentice Hall of India, New Delhi, India.
3. *Radhakrishnan and Subramanian*,(2012) CAD/CAM/CIM, 2nd Edition, NewAge Publications,India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4358 – POWER PLANT ENGINEERING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Power Plant Engineering mainly focuses on available sources for producing power like conventional sources –fuel as solid, liquid and gaseous, nuclear activity materials and non-conventional sources like solar energy, wind energy, tidal energy. It also describes the working principle of different power plants like Steam power plant, Diesel power plant, Gas turbine power plant, Hydro-electric power plant, Nuclear power plant, wind power plant, solar power plant and importance of their basic components. It gives the information regarding power plant economics and environmental considerations.

Course Pre/co-requisites

A4306 -Thermodynamics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4358.1: Explain the working principle of various power plants.
A4358.2: Identify the different components and their importance in the various power plants.
A4358.3: Compare merits and demerits of different power plants.
A4358.4: Illustrate the pollution from power plant and pollution control methods.
A4358.5: Solve problems related to various power plants and plant economics.

3. Course Syllabus

Steam Power Plant: Introduction to Sources of Energy, Working, Plant Layout, and types of coal, Properties of coal, Fuel handling equipment, and Ash handling systems.
Combustion Process: Overfeed and under feed fuel beds, traveling grate stokers, spreader stokers, retort stokers, pulverized fuel burning system, draught system, cyclone furnace, dust collectors, cooling towers, feed water treatment.

Internal Combustion Engine Plant: Diesel Power Plant and types, plant layout with auxiliaries, fuel supply system, lubrication system, cooling system, super charging.
Gas Turbine Plant: Introduction, classification, layout with auxiliaries, Principles of working of closed and open cycle gas turbines. Combined cycle power plants and comparison
Hydro Electric Power Plant: Hydrological cycle, flow measurement, drainage area characteristics, hydrographs, classification of dams and spill ways, classification of hydro plants, plant auxiliaries, plant operation, pumped storage plants.

Nuclear Power Station: Nuclear fuel, breeding and fertile material, working, types of reactors-Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards - radioactive waste disposal.

Power From Non-Conventional Sources: Collectors, types, Principle of Working, Wind Energy- types, HAWT, VAWT, Tidal Energy- types, working.
Direct Energy Conversion: Introduction, Solar cells, Thermo electric and Thermo ionic, fuel cells, MHD generation.

Power Plant Economics And Environmental Considerations: Capital cost, fixed charges, operating costs, general arrangement of power distribution, Load curves and load duration curve. Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor. Effluents from power plants and Impact on environment, pollutants and pollution standards, Methods of Pollution control.

4. Books and Materials

Text Books:

1. Arora and S. Domkundwar (2008), *A Course in Power Plant Engineering*, 5th edition, Dhanpat Rai & Co.Delhi.
2. P. K. Nag (2014), *Power Plant Engineering,* 4rd edition, Tata McGraw- Hill Publishing Company Ltd., NewDelhi

Reference Books:

1. G.D. Rai (2009), An Introduction to Power Plant Technology, 3rd edition, Khanna Publications, New Delhi.
2. C. Elanchezhian, L. Saravana Kumar, B. Vijaya Ramkanth (2007), Power plant Engineering, 1 st edition, I.K International Publishing House, New Delhi, India.
3. M M El-Walkil (2002), Power Plant Technology, 2nd Edition, Tata McGraw Hill, New Delhi, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4359- PROCESS PLANNING AND ESTIMATION

OURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

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

Course Pre/Co Requisites:

This Course Has No Specific Pre/Co Requisites

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4359.1: Select the process, equipment and tools for various industrial products.
A4359.2: Prepare process planning activity chart.
A4359.3: Explain the concept of cost estimation.
A4359.4: Compute the job order cost for different type of shop floor.
A4359.5: Calculate the machining time for various machining operations

3. Course Syllabus

Introduction To process planning: Introduction- methods of process planning, Drawing interpretation, Material evaluation, steps in process selection, Production equipment and tooling selection.
Process Planning Activities: Process parameters calculation for various production processes-selections of jigs and fixtures, selection of quality assurance methods, Set of documents for process planning, Economics of process planning, case studies.
Introduction To Estimation: Importance of costing and estimation, methods of costing, elements of cost estimation, Types of estimates, Estimating procedure, Estimation labor cost, material cost, allocation of overhead charges, Calculation of depreciation cost.
Production Estimation: Estimation of Different Types of Jobs, Estimation of Forging Shop, Estimation of Welding Shop, Estimation of Foundry Shop.
Machining Time Calculation: Estimation of Machining Time, Importance of Machine Time Calculation, Calculation of Machining Time for Different Lathe Operations, Drilling and Boring, Machining Time Calculation for Milling, Shaping, Planning and Grinding.

Text Books:

1. Peter Scallan (2002) “Process planning: Design/Manufacture Interface”, ElsevierScience Technology Books.
2. Sinha B.P (1995) “Mechanical Estimating and Costing”, Tata-McGraw Hill Publishing Co.

Reference Books:

1. Chitale A.V. and Gupta R.C.(2002) “Product Design and Manufacturing”, 2nd Edition, PHI,2002.
2. OstwalalP.F.andMunezJ. (1988)“ManufacturingProcessesandsystems”,9th Edition,JohnWiley.
3. Russell R.S and Tailor B.W (2003) “Operations Management”, 4th Edition, PHI.

SYLLABI FOR IV YEAR II SEMESTER

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4026 – MANAGEMENT SCIENCE

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

In this course, students will learn the fundamental concepts and contributions of Management. It also explains Inventory control techniques, Human Resource Practices, Quality control techniques and Project Management which plays a vital role in the organization.

Course Pre/Co Requisites: The course has no specific and Pre/Requisite

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4026.1 : Explain and infer the concepts and aspects of management

A4026.2 : Analyze the different organizational structures, plant layouts, work study tools for enhancement of productivity in an organization

A4026.3 : Apply statistical quality control techniques to know quality of product with in control limits.

A4026.4 : Use Human resource management techniques for better people management.

A4026.5 : Apply the project management techniques to decide the optimum time and cost for completion of a project.

3. Course Syllabus

Introduction: Management - Definition, Nature, Importance of management, Functions of Management - Taylor's scientific management theory, Fayol's principles of management, Contribution of Elton mayo, Maslow, Herzberg, Douglas MC Gregor. Basic concepts of Organisation Authority, Responsibility, Delegation of Authority, Span of control, Departmentation and Decentralization - Organisation structures (Line organization, Line and staff organization, Functional organization, Committee organization, Matrix organization)

Operations Management: Plant location, Factors influencing location, Principles and types of plant layouts - Methods of production (job, batch and mass production), Work study - Basic procedure involved in method study and Work measurement.

Quality Control And Materials Management: Statistical quality control – Meaning- Variables and attributes - X chart, R Chart, C Chart, P Chart, (simple Problems) Acceptance sampling, Sampling plans, Deming's contribution to quality. Materials management – objectives, Need for inventory control, Purchase procedure, Store records, EOQ, ABC analysis, Stock levels.

Human Resource Management (Hrm): Concepts of HRM, Basic functions of HR manager: Man power planning, Recruitment, Selection, Training and development, Placement, Wage and salary

administration, Promotion, Transfers, Separation, performance appraisal, Job evaluation and Merit rating.

Project Management: Early techniques in project management - Network analysis: Programme evaluation and review technique (PERT), Critical path method (CPM), Identifying critical path, Probability of completing project within given time, Project cost analysis, project crashing (simple problems).

4. Books and Materials

Text Books:

1. Koontz & weihrich – Essentials of management, TMH, 8th edition, 2010 .
2. O.P. Khana, Industrial engineering and Management, Dhanpat rai publication.

Reference Books:

1. Dr.A.R.Aryasri, Management Science, TMH, 4th edition, 2009.
2. Stoner,Freeman, Gilbert, Management, 6th edition Pearson education, New Delhi, 2004.
3. L.S.Srinath, PERT & CPM , 3rd edition East-West press pvt. ltd.-New Delhi.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4333 –FUNDAMENTALS OF ROBOTICS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course introduces students to the basics, types and elements of robots. The course exposes students to the theoretical concepts of robot kinematics. Path planning and trajectory planning concepts gives the perception on control of robotics. The concepts on actuators and sensors gives clear understanding and design ability for mobility systems. It gives an overview on application of robotics in manufacturing industry.

Course Pre/Co Requisites

“The course has no specific prerequisite and co requisite”

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4333.1: **Understand** the basic concepts and components of a robotic system.

A4333.2: **Identify** theuse of actuators and sensors for designing robot mobility system.

A4333.3: **Solve** transformation problems to describe the robot position and orientation of robot.

A4333.4: **Apply** the concepts of robot work cell design and control.

A4333.5: **Select** appropriate robots for various applications suitable to modern manufacturing systems.

3. Course Syllabus

Introduction To Robotics: Classification of Robots, Advantages and Disadvantages of Robots, Degrees of freedom, Joints, Robot coordinates, Robot workspace, Robot characteristics, Robot Components, types of robot arms, end effectors, grippers.

Actuators:Characteristics of Actuating Systems, Comparison of Actuating Systems, Hydraulic and Pneumatic Devices, Electric Motors in Robotics.

Sensors: Sensor Characteristics, Position Sensors, Velocity Sensors, Acceleration Sensors, Touch and Tactile Sensors, Proximity Sensors, Range Finder.

Manipulator Kinematics:Specifications of matrices, Homogeneous Transformation, D-H notation, joint coordinates and world coordinates, Forward and inverse kinematics, Simple problems.

Path Planning:Trajectory planning and avoidance of obstacles, Path planning, introduction to robot programming.

Robot Work Cell Design And Control:Robot Cell Layouts, Multiple Robots and Machine Interface, Some Consideration in Work Cell Design, Interlocks, Error Detection and Recovery, Robot Cycle Time Analysis.

Robotic Applications:Robots in manufacturing and non- manufacturing applications, Health applications, Intelligent Home Applications, Military Applications, Space Application, Entertainment robots, Service robots, Domestic or household robots.

4. Books and Materials

Text Books:

1. *Richard D. Klafter (2010),* Robotic Engineering, 2nd edition, Prentice Hall of India, New Delhi.
2. *M.P. Groover (2010*), Industrial Robotics, 3rd edition, Pearson Education, New Delhi.

Reference Books:

1. *R.K. Mittal, I.J. Nagrath (2012),* Robotics and Control, 1st edition, Tata Mc Graw Hill, New Delhi.
2. *P. Coiffet, M. Chaironze (2010),* An Introduction to Robot Technology, 3rd edition, Kogam Page Ltd., London.
3. *Ganesh S. Hegde (2015),* A Textbook of Industrial Robotics, 2nd edition, University Science Press.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4233 – ENERGY MANAGEMENT AND AUDIT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Energy management can help industry control its operating costs. Energy management is also important for reducing local, regional and global emissions and can help mitigate the problem of global warming. This course will help industry professionals acquire the skills and techniques required to implement energy management. This course will also benefit researchers and students who are interested in working on energy management. In the context of the Energy Conservation Act 2001, the Bureau of Energy Efficiency has emphasised the importance of Energy Managers and Certified Energy Auditors. This course is designed to provide the background required for engineers to meet this role.

Course Pre/Co-Requisites:

"The course has no specific prerequisite and co requisite"

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4233.1 Analyze the influence of energy availability on the development of Industries and various other organizations.

A4233.2 Discuss the concepts and technologies used for energy conservation.

A4233.3 Develop methods for evaluating worth of project.

A4233.4 Investigate the schemes for demand side management.

A4233.5 Evaluate the VAR requirements for effective voltage control.

3. Course Syllabus

Electrical Energy And Safety Audit: Overview of Electricity Act – Energy conservation act – Electrical energy audit – Types – Tools – Tariff – Load factor improvement – Power factor correction – Power demand control and shifting – Electrical safety Auditing.

Energy Conservation In Electric Motors: Motors efficiency – Motor selection – Factors affecting motor performance – Efficiency at low load – Rewound motors – Variable speed drives – Load reduction – High efficiency motors – Energy savings in transformers – Case studies.

Electrical Energy Conservation In Driven Equipments: Input electrical energy requirements in pumps, fans and compressors – Load factor estimation in the equipment – Energy conservation potential.

Energy Conservation In Industrial Lighting: Concept of lighting systems – Choice of lighting – Different lighting technologies – Energy saving – Control of lighting – Lighting standards and requirements – Light meter audit – Methods to reduce costs.

Energy Management: Principles of energy management, organizing energy management program, initiating, planning, controlling, promoting, monitoring, reporting – Energy manager, Qualities and functions

4. Books and Materials

Text Books:

1. W. R. Murphy, G. McKay (2008), *Energy Management,* 1st edition*,* B.S. Publications, New Delhi.
2. Tripathy S. C., "Electric Energy Utilization and conservation", Tata McGraw Hill.
3. Industrial Energy Conservation Manuals, MIT Press, Mass, 1982.

Reference Books:

1. B. Smith (2007), *Energy Management Principles*, 1st edition, Pergamon Press, Inc., England.
2. Energy Management Handbook, Edited by W.C.Turner, Wiley, New York, 1982.
   IEEE Bronze Book, 'Recommended Practice for Energy Conservation and cost effective planning in Industrial facilities, IEEE Press.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4533 – FUNDAMENTALS OF DBMS

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course introduces the core principles and techniques required in the design and implementation of database systems. This course focus on relational database management systems, including database design theory: E-R modeling, data definition and manipulation languages, database security and administration. It also covers essential DBMS concepts such as: Transaction Processing, Concurrency Control, Recovery and various types of databases like distributed database, and intelligent database, Client/Server.

Course Pre/Co Requisites

A4531- Object oriented Programming

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4533.1: Understand design and implementation of a database for a given problem domain.

A4533.2: Construct Queries in Relational algebra, relational calculus and SQL.

A4533.3: Apply Normalization techniques to reduce data redundancy in data base.

A4533.4: Analyze various transaction control and recovery methods to keep data base consistent

3. Course Syllabus

Introduction: History of database systems, introduction to database management systems, database system applications, database systems versus file systems, view of data, data models, database languages- DDL & DML commands and examples of basic SQL queries, database users and administrators, transaction management.

Sql: Overview, the form of a basic SQL query, union, intersect and except operators, nested queries, aggregate operators, null values, complex integrity constraints in SQL, cursors, triggers

Schema Refinement And Normal Forms: Functional dependencies, reasoning about FDs. Normal forms: 1NF, 2NF, 3NF, BCNF, properties of decompositions, normalization, schema refinement in database design, other kinds of dependencies: 4NF, 5NF.

Transactions Management: Transaction concept, transaction state, implementation of atomicity and durability, concurrent executions, Anomalies due to interleaved execution of transactions, serializability, recoverability.

Concurrency Control And Recovery System: Concurrency control - lock based protocols, timestamp based protocols, validation based protocols, deadlock handling.

4. Books and Materials

Text Books:

1. Raghurama Krishnan, Johannes Gehrke (2007), Database Management Systems, 3rd Edition, Tata McGraw-Hill, New Delhi, India.
2. Abraham Silberschatz, Henry F. Korth, S. Sudarshan (2010), Database System Concepts, 6th Edition, McGraw- Hill, New Delhi, India.

Reference Books:

1. Elmasri Navate (2014), Fundamentals of Database Systems, Pearson Education, India
2. C. J. Date, A. Kannan and S. Swamynathan(2009),An Introduction to Database Systems,3rd Edition,Pearson Education, India.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4133 – DISASTER MANAGMENT

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	28	0	28	3	30	70	100

1. Course Description

Course Overview

The course has been framed with an intention to provide a general concepts in the dimensions of disasters caused by nature beyond human control as well as the disasters and environmental hazards induced by human activities with emphasis on Natural disaster, Man-made disaster, vulnerability and risks of disasters, Disaster Management Mechanism, Capacity Building and disaster coping Strategies and Disaster management planning.

Course Pre/Co Requisites

A4014- Environmental science

2. Course Outcomes (COs)

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

A4133.1. Identify concepts, hazards and vulnerabilities of different types of disasters.

A4133.2. Examine the components of disaster management mechanism.

A4133.3. Select suitable capacity building frame work for disaster management

A4133.4 Interpret various disaster coping strategies

A4133.5. Develop Strategies for disaster management planning

3. Course Syllabus

Concept- Hazards - Vulnerabilities Of Disasters: Concept of Disaster - Different approaches- Concept of Risk - Levels of Disasters - Disaster Phenomena and Events (Global, national and regional) Hazards and Vulnerabilities: Natural and man-made hazards; response time, frequency and forewarning levels of different hazards - Characteristics and damage potential or natural hazards; hazard assessment - Dimensions of vulnerability factors; vulnerability assessment - Vulnerability and disaster risk - Vulnerabilities to flood and earthquake hazards.

Disaster Management Mechanism: Concepts of risk management and crisis managements - Disaster Management Cycle - Response and Recovery - Development, Prevention, Mitigation and Preparedness - Planning for Relief.

Capacity Building: Capacity Building: Concept - Structural and Nonstructural Measures Capacity Assessment; Strengthening Capacity for Reducing Risk - Counter-Disaster Resources and their utility in Disaster Management - Legislative Support at the state and national levels.

Coping With Disaster: Coping Strategies; alternative adjustment processes - Changing Concepts of disaster management - Industrial Safety Plan; Safety norms and survival kits - Mass media and disaster management.

Disaster Management Planning: Strategies for disaster management planning - Steps for formulating a disaster risk reduction plan - Disaster management Act and Policy in India -Organizational structure for disaster management in India - Preparation of state and district disaster management plans.

4. Books and Materials:

1. Manual on Disaster Management, National Disaster Management, Agency Govt of India.
2. Disaster Management by Mrinalini Pandey Wiley 2014.
3. 3. Disaster Science and Management by T. Bhattacharya, McGraw Hill Education (India) Pvt Ltd Wiley 2017

Reference Books:

1. Earth and Atmospheric Disasters Management, N. Pandharinath, CK Rajan, BS Publications 2009.
2. National Disaster Management Plan, Ministry of Home affairs, Government of India (http://www.ndma.gov.in/images/policyplan/dmplan/draftndmp.pdf)

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4633- FUNDAMENTAL OF CYBER SECURITY

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course drawing upon a wealth of experience from academia, industry, and government service, Cyber Security details and dissects, in current organizational cyber security policy issues on a global scale—taking great care to educate students on the history and current approaches to the security of cyberspace. It includes thorough descriptions—as well as the pros and cons—of an excess of issues, and document policy alternatives for the sake of clarity with respect to policy alone. It also delves into organizational implementation issues, and equips students with descriptions of the positive and negative impact of specific policy choices.

Course Pre/Co Requisites:

"The course has no specific pre Requisite and Pre/ Requisite".

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

- **A4633.1.** : Understand how to protect them self and ultimately society from cyber-attacks by studying various case studies.
- **A4633.2.** : Summarize different government cyber laws and cyber-forensics techniques.
- **A4633.3.** : Apply different techniques to classify different types of cybercrimes
- **A4633.4.** : Analyze cyber-attacks on different online web applications
- **A4633.5** : Apply various investigating methods on the new cases using previous case studies

3. Course Syllabus

Introduction: Cyber Security, Cyber Security policy, Domain of Cyber Security Policy, Laws and Regulations, Enterprise Policy, Technology Operations, Technology Configuration, Strategy Versus Policy,

Cyber Security Evolution: Productivity, Internet, E-commerce, Counter Measures and Challenges.

Cyber Security Objectives And Guidance: Cyber Security Metrics, Security Management Goals, Counting Vulnerabilities, Security Frameworks, E-Commerce Systems, Industrial Control Systems, Personal Mobile Devices, Security Policy Objectives.

Guidance For Decision Makers: Tone at the Top, Policy as a Project, Cyber Security Management, Arriving at Goals, Cyber Security Documentation.
The Catalog Approach: Catalog Format, Cyber Security Policy Taxonomy.

Cyber Security Policy Catalog: Cyber Governance Issues, Net Neutrality, Internet Names and Numbers, Copyright and Trademarks, Email and Messaging, Cyber User Issues, Malvertising, Impersonation, Appropriate Use, Cyber Crime, Geolocation, Privacy, Cyber Conflict Issues, Intellectual property Theft, Cyber Espionage, Cyber Sabotage, Cyber Welfare.

Cyber Mangement Issues: Fiduciary Responsibility, Risk Management, Professional Certification, Supply Chain, Security Principles, Research and Development, Cyber Infrastructure Issue, Banking and finance, Health care, Industrial Control systems.

Case Study: A Government's Approach to Cyber Security Policy

4. Books and Materials

Text Book:

1. *Jennifer L. Bayuk* , J. Healey , P. Rohmeyer , Marcus Sachs , Jeffrey Schmidt , Joseph Weiss " Cyber Security Policy Guidebook" John Wiley & Sons 2012.

Reference Books:

2. *Richard A. Clarke, Robert Knake* " Cyberwar: The Next Threat to National Security & What to Do About It" Ecco 2010.
3. *Dan Shoemaker Cyber* security The Essential Body Of Knowledge, 1st ed. Cengage Learning 2011
4. *Anti-Hacker Tool Kit* (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
5. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives by Nina Godbole and Sunit Belpure, Publication Wiley.
6. *Rick Howard* "Cyber Security Essentials" *Auerbach Publications 2011*

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4433 - INTRODUCTION TO SIGNAL PROCESSING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

Signal Processing is an introductory course essentially attempts to cover classification, representation of signals and analysis in time domain and frequency domain of systems. It is a foundation course to advanced courses like Communication Systems, Image and Speech Processing in their undergraduate program. This course provides coherent and comprehensive coverage of signal processing.

Course Pre/Co Requisites

The course has no specific prerequisite and co-requisite.

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4433.1. Understand mathematical description of signals and representation of systems
A4433.2. Identify the spectrum of continuous-time periodic and non-periodic signals
A4433.3. Apply various transforms to analyze continuous and discrete-time systems
A4433.4. Analyze digital systems using various transform techniques
A4433.5. Design and implement FIR and IIR filters for given specifications

3. Course Syllabus

Classification Of Signals: Continuous time (CT) and Discrete time (DT) signals, elementary signals-Unit, Step, Impulse, ramp signals, singularity functions and operations on signals.
Signal Transmission Through Lti Systems: Classification of systems, discrete time LTI systems and continuous time LTI systems, properties of LTI system, Convolution

Fourier Transform (Ft): Fourier series, convergence of Fourier series, Fourier transform (FT), Fourier transform of standard signals, Hilbert transform and its properties
Laplace Transform (Lt): The Laplace transform (LT), The Region of convergence (ROC) for Laplace transforms, Properties of Laplace transforms, some Laplace transform pairs, Inverse Laplace transforms

Sampling: Sampling of continuous time signals, sampling theorem, reconstruction of signal from its samples, the effect of under sampling- aliasing, practical aspects of sampling.
Z - Transforms: The Z - Transform, The Region of Convergence (ROC) for Z - transform and its properties, properties of Z –transform.

Discrete Fourier Transform: Frequency domain representation of discrete time signals & Systems, Discrete Fourier transforms: Frequency domain sampling, Relationship of DFT to other transforms, Properties of DFT

Fir & Iir Filters: Design of linear phase FIR Digital Filters using Windows, IIR filter design (Butter worth) by suitable mapping technique, , comparison of IIR & FIR filters

4. Books And Materials

Text Books:

1. Oppenheim A. V, Willisky (2009), Signals and Systems, 2nd edition, Prentice Hall of India, India.
2. John G. Proakis, Dimitris G. Manolakis (2007), Digital Signal Processing, Principles, Algorithms, and Applications, Pearson Education / PHI, India.

Reference Books:

1. Anand Kumar, Signals and Systems, PHI Learning Pvt. Ltd.
2. B. P. Lathi (2001), Signals, Systems & Communications, BS Publications, New Delhi**.**
3. M. H. Hayes (2007), Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.
4. Dimitris G. Manolakis, Vinay Ingle (2011), Applied Digital Signal Processing, Cambridge University Press, Newyork

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4360- TOTAL QUALITY MANAGEMENT

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course introduces students to Quality management system that serves to control Quality the critical activities of an organization by bringing together resources, equipment, people and procedures. This course also introduces techniques and principles such as quality function deployment, Taguchi method, service quality management, bench marking and Six Sigma to control quality in every sphere of activity in an organization.

Course Pre/Co-Requisites

This course has no specific perquisite and pre/co requisites

2. Course Outcomes (Cos)

After the completion of the course, the student will be able to:

A4360.1	**Understand** the overview of Total Quality Management System.
A4360.2	**Understand** the concepts of customer satisfaction and employee involvement.
A4360.3	**Apply** the appropriate tools and techniques of continuous process improvement for controlling and improving quality.
A4360.4	**Apply** Quality Function Deployment, Six Sigma and Bench Marking tools for improving product or process quality.
A4360.5	**Implement** the concepts of ISO 9000 in quality management.

3. Course Syllabus

Introduction To T.Q.M: Introduction to Quality; Evolution of and basic approach to Total Quality Management, Leadership concepts, The Seven habits of highly effective people, Role of TQM Leaders, Implementation of TQM, Quality council, Quality statements.

Customer Satisfaction: Types of Customers-Internal and External, Customer perception of quality, Feedback & brief discussion on Information Collecting Tools.

Employee Involvement: Maslow's hierarchy of needs, Types of Teams, Stages of team development, Common barriers to team progress, Training; Benefits of Employee Involvement.

Continuous Process Improvement: Introduction, Juron trilogy, Improvement strategies, P-D-S-A cycle & Problem solving method, Basic concepts of Kaizen, Taguchi method, Quality circles. Supplier Partnership: Introduction, Partnering, Sourcing, Supplier Selection, Supplier Rating, Relationship Development.

Tools & Techniques Of Tqm: Pareto diagram, Cause & Effect diagram.

Principles Of Six Sigma: Evolution of Six Sigma, The statistical basis of Six Sigma, Six Sigma Problem Solving, The DMAIC Methodology, Tools and Techniques, Design for Six Sigma.

Benchmarking: Define benchmarking, Reasons to benchmark Process, Deciding what to Benchmark, Pitfalls and criticism of Benchmarking.

Quality Function Deployment: Benefits of QFD, House of Quality.

Iso And Its Concept Of Quality Management: Quality systems, need for ISO 9000, ISO 9001-9008; Quality system- elements, documentation, Quality auditing, ISO 14000- concepts, requirements and benefits; TQM implementation in manufacturing and service sectors.

4. Books and Materials

Text Books:

1. *Dale H. Besterfield, Carol Besterfield (2010),* Total Quality Management, 5th edition, Pearson Education India.
2. Joel E Ross (2015), Total Quality Management, 3rd edition, CRC Press.

Reference Books:

1. *Poornima M. Charanthimath (2017),* Total Quality Management, 3rd edition, Pearson Education.
2. *V.S. Bagad (2019),* Total Quality Management, 2nd edition, Technical Publications.
3. *Dr. S. Kumar (2015),* Total Quality Management, University Science Press.

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE
A4361- REFRIGERATION AND AIR-CONDITIONING

Hours Per Week			Hours Per Semester			Credits	Assessment Marks		
L	T	P	L	T	P	C	CIE	SEE	Total
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course consists of basic concepts and applications of refrigeration and air-conditioning. It includes air refrigeration systems, vapour compression refrigeration system, vapour absorption system, steam jet refrigeration system, thermoelectric refrigeration, vortex tube refrigeration, components of various refrigeration systems, comparison among various refrigeration systems, types of refrigerants. Air-Conditioning focuses on its basic concepts and types of air conditioning systems, and various components.

Course Pre/Co-Requisites

A4306-Thermodynamics
A4310-Fluid Mechanics and Hydraulic Machines
A4316-Applied Thermodynamics

2. Course Outcomes (COs)

After the completion of the course, the student will be able to:

A4361.1:**Understand** the basic concepts and working of various refrigeration and air-conditioning systems.
A4361.2:**Compare** the performance of different refrigeration and air conditioning systems.
A4361.3:**Solve** problems of different refrigeration and air conditioning systems.
A4361.4:**Assess** merits and demerits of different refrigeration and air conditioning systems.
A4361.5:**Classify** refrigerants based on environmental considerations.

3. Course Syllabus

Introduction To Refrigeration: Fundamentals of refrigeration system and applications, Necessity and applications, Unit of refrigeration and C.O.P, Mechanical Refrigeration, Types of Ideal cycles of refrigeration.

Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Open and Dense air systems, Actual air refrigeration system problems, and Refrigeration needs of Air craft's

Vapour Compression Refrigeration Systems: 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.

Vapour Absorption Systems: Calculation of COP, description and working of NH_3-water system and LiBr-water (Two shell & System). Principle and operation of three fluid absorption system, salient features.

Refrigeration Equipment: Compressors, Condensers and Evaporators, classification, Working Principles, Expansion devices, Types, Working Principles.

Refrigerants: Desirable properties, classification, refrigerants Nomenclature, Ozone Depletion, and Global Warming, defrosting.
Principle and operation of (i) Steam Jet Refrigeration (ii) Thermoelectric refrigeration (iii) Vortex tube refrigeration.

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.

Comfort Air Conditioning: Requirements of human comfort and concept of effective temperature Comfort chart, Comfort Air conditioning, Requirements of Industrial air conditioning.

Air Conditioning System-Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers, Heat Pump, Heat sources, Different heat pump circuits.

3. Books and Materials

Text Books:

1. C.P. Arora(2017), Refrigeration and Air Conditioning, 3rd edition, Tata McGraw-Hill education (P) Ltd,New Delhi, India.
2. W.F.Stoecker and J.W.Jones (2008), Refrigeration and Air Conditioning, 2nd edition, Tata McGraw-Hill education (P) Ltd,New Delhi, India.

Reference Books:

1. Manohar Prasad (2015), Refrigeration and Air Conditioning, Revised 3rd edition, New Age International Pvt. Ltd., New Delhi, India.
2. S. S. Thipse (2005), Refrigeration and Air Conditioning, 1st edition, Jaico Publishing House, Mumbai, India.
3. Domkundwar, S. C. Arora (2009), A Course in Refrigeration and Air conditioning, 8th edition, Dhanpatrai Publications, New Delhi, India

VARDHAMAN COLLEGE OF ENGINEERING, HYDERABAD

COURSE STRUCTURE

A4362-MICRO ELECTRO MECHANICAL SYSTEMS

HOURS PER WEEK			HOURS PER SEMESTER			CREDITS	ASSESSMENT MARKS		
L	T	P	L	T	P	C	CIE	SEE	TOTAL
3	0	0	42	0	0	3	30	70	100

1. Course Description

Course Overview

This course will explore the world of micro electro mechanical systems (MEMS) . This requires an awareness of design, fabrication, and materials issues involved in micro systems. The course will cover fabrication technologies, material properties, structural mechanics, basic sensing and actuation principles, packaging, and MEMS markets and applications.

Course Pre/co requisites

"This course has no specific pre/co requisites"

1. Course Outcomes

After the completion of the course, the student will be able to:

A4362.1: Understand the construction, working and applications of different MEMS structures

A4362.2: Identify problems and suggest suitable MEMS material/ Devices/Process to get the Requisite Solution for a given application.

A4362.3: Design the micro devices, micro systems using the MEMS fabrication process.

A4362.4: Gain a knowledge of basic approaches for various actuator/Sensor design

A4362.5: Apply fundamental concepts of MEMS to solve real life engineering problems.

2. Course Syllabus

Introduction: Overview of microelectronics, manufacture and Microsystems technology, Definition - MEMS materials, Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators – Introduction to Micro fabrication - Silicon based MEMS processes –Applications of MEMS in various industries.

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.

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.

Magnetic Sensors And Actuators: Magnetic materials for MEMS and properties, magnetic sensing and detection, magneto resistive Mechanical Engineering 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.

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, micro fluid dispenser, micro needle, molecular gate, micro pumps.

4. Books And Materials

Text Books:

1. *Nitaigour Premchand Mahalik (2007)* MEMS, First Edition, Tata McGraw Hill Publication, India
2. *Stephen D Senturia (2000) '*Microsystem Design', First Edition, Springer Publication, India

Reference Books:

1. *Tai Ran Hsu (2002),* "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill,India.
2. *James J.Allen (2010),* "Micro Electro Mechanical System Design", CRC Press Publisher.
3. *Maluf N.(2000)* "An Introduction to Micro electromechanical Systems Engineering", Norwood, MA: Artech House.