NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Affiliated to

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY UTTAR PRADESH, LUCKNOW

Evaluation Scheme & Syllabus

For

Bachelor of Technology

Mechanical Engineering

Second Year

(Effective from the Session: 2022-23)

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Bachelor of Technology
Mechanical Engineering
EVALUATION SCHEME
SEMESTER -III

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	……. / AAS0301B	Engineering Science Course / Engineering Mathematics-III	3	1	0	30	20	50		100		150	4
2	AME0303	Engineering Mechanics	3	1	0	30	20	50		100		150	4
3	AME0304	Basic Thermodynamics	3	0	0	30	20	50		100		150	3
4	ACSE0303	Design thinking-I	3	0	0	30	20	50		100		150	3
5	AME0302	Materials Science and Engineering	3	0	0	30	20	50		100		150	3
6	AME0301	Manufacturing Technology-I	3	0	0	30	20	50		100		150	3
7	AME0353	Computer Aided Modelling Lab	0	0	2				25		25	50	1
8	AME0352	Material Testing Lab	0	0	2				25		25	50	1
9	AME0351	Manufacturing Technology-I Lab	0	0	2				25		25	50	1
10	AME0359	Internship Assessment-I	0	0	2				50			50	1
11	ANC0301/ ANC0302	Cyber Security/ Environmental Science	2	0	0	30	20	50		50		100	
		MOOCs (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**24**

List of MOOCs (Coursera) Based Recommended Courses for Second Year (Semester-III) B. Tech Students

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0025	Digital Thread: Implementation.	University at Buffalo, The State University of New York.	20	1.5
2	AMC0029	Introduction to battery-management systems.	University of Colorado Boulder, University of Colorado System.	25	2

PLEASE NOTE:-

- **Internship (3-4 weeks) shall be conducted during summer break after semester-II and will be assessed during semester-III**
- **Compulsory Audit Courses (Non Credit - ANC0301/ANC0302)**
  - All Compulsory Audit Courses (a qualifying exam) has no credit.
  - Total and obtained marks are not added in the Grand Total.

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Engineering Science Courses for B.Tech.(AICTE Model Curriculum) 2nd Year

(Effective from the session 2022-23)

Semester-III

Sl.No.	Subject Codes	Subject Name
1	AOE0361	Energy Science & Engineering
2	AOE0362	Sensor Instrumentation
3	AOE0363	Basics Data Structure & Algorithms
4	AOE0364	Introduction to Soft Computing
5	AOE0365	Analog Electronics Circuits
6	AOE0366	Electronics Engineering

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Bachelor of Technology
Mechanical Engineering
EVALUATION SCHEME
SEMESTER -IV

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme			End Semester		Total	Credit
			L	T	P	CT	TA	TOTAL	PS	TE	PE		
1	AAS0401B/	Engineering Mathematics-III / Engineering Science Course	3	1	0	30	20	50		100		150	4
2	AASL0401	Technical Communication	2	1	0	30	20	50		100		150	3
3	AME0402	Fluid Mechanics & Fluid Machines	3	1	0	30	20	50		100		150	4
4	AME0404	Applied Thermodynamics	3	0	0	30	20	50		100		150	3
5	AME0403	Strength of Materials	3	0	0	30	20	50		100		150	3
6	AME0401	Manufacturing Technology-II	3	0	0	30	20	50		100		150	3
7	AME0452	Fluid Mechanics Lab	0	0	2				25		25	50	1
8	AME0454	Applied Thermodynamics Lab	0	0	2				25		25	50	1
9	AME0451	Manufacturing Tech –II Lab	0	0	2				25		25	50	1
10	AME0459	Mini Project	0	0	2				50			50	1
11	ANC0402 / ANC0401	Environmental Science/ Cyber Security	2	0	0	30	20	50		50		100	
		MOOCs (For B.Tech. Hons. Degree)											
		GRAND TOTAL										**1100**	**24**

List of MOOCs (Coursera) Based Recommended Courses for Second Year (Semester-IV) B. Tech Students

S. No.	Subject Code	Course Name	University / Industry Partner Name	No of Hours	Credits
1	AMC0040	Advanced Manufacturing Process Analysis.	University at Buffalo, The State University of New York.	13	1
2	AMC0036	Intelligent Machining.	University at Buffalo, The State University of New York.	11	0.5

PLEASE NOTE:-

- **Compulsory Audit Courses (Non Credit - ANC0401/ANC0402)**
  - All Compulsory Audit Courses (a qualifying exam) has no credit.
  - Total and obtained marks are not added in the Grand Total.

Abbreviation Used:-

L: Lecture, T: Tutorial, P: Practical, CT: Class Test, TA: Teacher Assessment, PS: Practical Sessional, TE: Theory End Semester Exam., PE: Practical End Semester Exam.

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

Engineering Science Courses for B.Tech. (AICTE Model Curriculum) 2nd Year

(Effective from the session 2022-23)

Semester-IV

Sl.No.	Subject Codes	Subject Name
1	AOE0461	Energy Science &Engineering
2	AOE0462	Sensor Instrumentation
3	AOE0463	Basics Data Structure & Algorithms
4	AOE0464	Introduction to Soft Computing
5	AOE0465	Analog Electronics Circuits
6	AOE0466	Electronics Engineering

NOIDA INSTITUTE OF ENGG. & TECHNOLOGY, GREATER NOIDA, GAUTAM BUDDH NAGAR
(AN AUTONOMOUS INSTITUTE)

AICTE Guidelines in Model Curriculum:

A student will be eligible to get Under Graduate degree with Honours only, if he/she completes the additional MOOCs courses such as Coursera certifications, or any other online courses recommended by the Institute (Equivalent to 20 credits). During Complete B.Tech. Program Guidelines for credit calculations are as follows.

1. For 6 to 12 Hours =0.5 Credit
2. For 13 to18 =1 Credit
3. For 19 to 24 =1.5 Credit
4. For 25 to 30 =2 Credit
5. For 31 to 35 =2.5 Credit
6. For 36 to 41 =3 Credit
7. For 42 to 47 =3.5 Credit
8. For 48 and above =4 Credit

For registration to MOOCs Courses, the students shall follow Coursera registration details as per the assigned login and password by the Institute these courses may be cleared during the B. Tech degree program (as per the list provided). After successful completion of these MOOCs courses, the students shall provide their successful completion status/certificates to the Controller of Examination (COE) of the Institute through their coordinators/Mentors only.
The students shall be awarded Honours Degree as per following criterion.

i. If he / she secures 7.50 as above CGPA.
ii. Passed each subject of that degree program in the single attempt without any grace.
iii. Successful completion of MOOCs based 20 credits.

B.TECH. SECOND YEAR			
Course Code	**AAS0301B**	**L T P**	**Credits**
Course Title	**Engineering Mathematics-III**	**3 1 0**	**4**

Course Objective: The student will learn about

Concept of function of complex variables, Partial differential equations & their applications, Numerical techniques for various mathematical tasks and numerical aptitude. It aims to show case the students with standard concepts and tools from B. Tech to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Pre-requisites: Knowledge of Mathematics I and II of B. Tech or equivalent

Course Contents / Syllabus

UNIT-I	**Complex Variable – Differentiation**	**8 Hours**

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties.

UNIT-II	**Complex Variable –Integration**	**8 Hours**

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\sin\theta, \cos\theta)\,d\theta$ and $\int_{-\infty}^{\infty} f(x)\,dx$.

UNIT-III	**Partial Differential Equation and its Applications**	**8 Hours**

Introduction of partial differential equations, Second order linear partial differential equations with constant coefficients. Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one- and two-dimensional wave and heat conduction equations.

UNIT- IV	**Integral Transforms**	**8 Hours**

Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one-dimensional heat transfer equations and wave equations, Z-transform and its application to solve difference equations.

UNIT-V	**Aptitude-III**	**8 Hours**

Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement, Clock & Calendar.

Course Outcomes: After completion of this course students will be able to

CO 1	Apply the working methods of complex functions for finding analytic functions.	K_3
CO 2	Apply the concepts of complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals	K_3
CO 3	Apply the concept of partial differential equation to solve partial differential Equations and problems concerned with partial differential equations	K_4
CO 4	Apply the concept of Fourier transform and Z-transform to solve difference equations.	K_3
CO 5	Solve the problems of Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement , Clock & Calendar.	K_3

Text Books:

(1) B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.

(2) B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.

(3) R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.

(4) E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.	
Reference Books:	
Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.	
Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.	
NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/playlist?list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL
	https://www.youtube.com/playlist?list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT
	https://youtu.be/b5VUnapu-qs
	https://youtu.be/yV_v6zxADgY
	https://youtu.be/2ZBcbFhrfOg
	https://youtu.be/dlK0E0OG39k
	https://youtu.be/qjpLIlVo_6E
Unit 2	https://youtu.be/bkzKVsIEjxk
	https://youtu.be/nDD16hiutdc
	https://youtu.be/2kyBOVfflHw
	https://youtu.be/uliv9TzeD6o
	https://youtu.be/pulsluT8Uwk
	https://youtu.be/VBAeogiKH2A
	https://youtu.be/Mpmlk1H1aQo
	https://youtu.be/z03usEpsHRU
	https://youtu.be/fXybLUFmQBQ
Unit 3	https://youtu.be/kZ7Oa7iMiCs
	https://youtu.be/rj2Mb7JGyHk
	https://youtu.be/zpxe5yoB0xg
	https://youtu.be/MN4gUtsr0e8
	https://youtu.be/GmIcbqdvIgc
	https://youtu.be/eSKz2N0tKaA
	https://youtu.be/iiTOw0JqQFc
	https://youtu.be/M4U-T9jsNKQ
Unit 4	https://youtu.be/QH2WL92bzLs
	https://youtu.be/DGmNbs5Cywo
	https://youtu.be/FliKUWUVrEI
	https://youtu.be/7eHuQXMCOvA
	https://youtu.be/ZkvQR3ajm3k
	https://youtu.be/zdyUwzOm1zw
	https://youtu.be/BBuV14-isyU
	https://youtu.be/xPr7YFSnmiQ
	https://youtu.be/ajJD0Df5CsY
	https://youtu.be/iviiGB5vxLA
	https://youtu.be/Ym1EUjTWMnE
Unit 5	https://www.youtube.com/playlist?list=PLFqNfk5W2ZuzjUsRqDp1Zj3S8n9yfdmN9
	https://youtu.be/x3SEYdBUGaA

B.TECH SECOND YEAR					
Course Code	**AME0303**	**L**	**T**	**P**	**Credits**
Course Title	**Engineering Mechanics**	**3**	**1**	**0**	**4**

Course objective: To make the students able

1	To understand the effect of the force system on rigid body under static equilibrium condition.	K_1, K_2
2	To analyse and solve the problem based on force system	K_3, K_4
3	To apply the concept of friction and solve the problem based on friction.	K_3, K_4
4	To evaluate the centroid and moment of inertia.	K_4, k_5
5	To analyse the effect of force on bodies in motion.	K_3, K_4

Pre-requisites:

Course Contents / Syllabus

UNIT-I	**Force Analysis**	**10 hours**

Concept of force, types of force systems, principle of transmissibility, analysis of coplanar-concurrent force system (parallelogram law, resolution of forces, Lami's theorem) and coplanar non-concurrent force systems (moment of a force, moment for coplanar force system, couple, Varignon's theorem), Equilibrium of coplanar force system, free body diagrams, determination of reactions. equilibrium of co planar force system, problem based on equilibrium conditions.

UNIT-II	**Friction, Virtual Work and Simple Machines**	**8 hours**

Friction: Coulomb's law of friction, angle of friction, angle of repose, cone of friction, equilibrium of bodies involving dry friction, applications of friction force, problems involving friction of ladder, wedges and connected bodies. **Virtual Work:** Definition of work and virtual work, principle of virtual work for a system of connection bodies, problems on determinate beams. **Simple Machines:** mechanical advantages, velocity ratio, efficiency, relation among these, efficiency of screw jack.

UNIT-III	**Beam and Trusses**	**8 hours**

Beam: Introduction, shear force and bending moment, different equations of equilibrium, shear force and bending moment diagram for statically determined beams. **Trusses:** Introduction, simple truss and solution of simple truss, methods of joints and methods of sections.

UNIT-IV	**PROPERTIES OF SURFACES AND SOLIDS**	**8 hours**

PROPERTIES OF SURFACES AND SOLIDS: Centroids and center of mass, Centroids of lines and areas ,Rectangular, circular, triangular areas by integration, T section, I section, Angle section, Hollow section by using standard formula ,Theorems of Pappus ,Area moments of inertia of plane areas such as Rectangular, circular, triangular areas by integration ,T section, I section, Angle section, Hollow section by using standard formula, Parallel axis theorem and perpendicular axis theorem, Principal moments of inertia of plane areas, Principal axes of inertia-Mass moment of inertia, mass moment of inertia for prismatic, cylindrical and spherical solids from first principle Relation to area moments of inertia.

UNIT-V	**Kinematics and Kinetics of rigid body**	**8 hours**

Kinematics of rigid body: Introduction, plane motion of rigid body, velocity and acceleration under translational and rotational motion, relative velocity.

Kinetics of rigid body: Introduction, force, mass and acceleration, work and energy, impulse and momentum, D'Alembert's principle and dynamic equilibrium.

Course outcome: **After completion of this course students will be able to**

CO 1	Understand the effect of force system on static equilibrium of rigid bodies.	K_1, K_2
CO 2	Analyse and solve the problems based on equilibrium of force system in presence of frictional forces.	K_3, K_4
CO 3	Workout the effect of loads on statically determinate structures i.e. Beams and Trusses.	K_3, K_4

CO 4	Locate the centroid and center of gravity and calculate the moment of inertia & mass moment of inertia for various shapes.	K_4
CO 5	Analyse and solve the problems based on kinematics and kinetics.	K_3, K_4

Text books

A Textbook of Engineering Mechanics, R.K. Bansal, Laxmi Publications.

Bhavikatti, S.S and Rajashekarappa, K.G., "Engineering Mechanics", New Age International (P) Limited Publishers,

Reference Books

Beer, F.P and Johnston Jr. E.R., Vector Mechanics for Engineers (In SI Units): Statics and Dynamics, 8th Edition, Tata McGraw-Hill Publishing company, New Delhi (2004)

Vela Murali, Engineering Mechanics, Oxford University Press (2010).

Meriam J.L. and Kraig L.G., Engineering Mechanics-Statics-Volume 1, Dynamics-Volume 2, Third Edition, John Wiley & Sons (1993).

Engineering mechanics by Irving H. Shames, Prentice-Hall.

B.TECH SECOND YEAR					
Course Code	**AME0304**	**L**	**T**	**P**	**Credits**
Course Title	**Basic Thermodynamics**	**3**	**0**	**0**	**3**

Course objective: The student will learn about

1	work and heat interactions.	K_1, K_2
2	get appraised of application of First law to various energy conversion devices.	K_2, K_3
3	Analyse the difference between high grade and low-grade energies and limitations on energy conversion.	K_3 ,K_4
4	make them able to evaluate the thermodynamic properties of pure substance	K_3, K_5
5	make them able to analyse the changes in properties of undergoing various processes.	K_2 , K_3

Pre-requisites: Basic knowledge of physics, heat, work and energy.

Course Contents / Syllabus

UNIT-I	Basic Concept, Zeroth law of thermodynamics and First Law for thermodynamics	9 hours

Introduction- Basic Concepts: Concept of System, Control Volume, Surrounding, Boundaries, Universe, Types of Systems, Macroscopic and Microscopic viewpoints, Concept of Continuum, State, Property, Process, Differentials, Cycle Reversibility Quasi – static Process, Irreversible Process, Thermodynamic Equilibrium.

Zeroth law of thermodynamics: Concept of equality of Temperature and, Temperature measurement.

First law of thermodynamics: Thermodynamic definition of work, Displacement work and flow work ,concept of Heat and Work: Units for Work, types of work, Sign Convention. Displacement work for various non flow processes, Joules' experiment, First law analysis for closed system (non flow processes), Internal energy and enthalpy. Limitations of first law of thermodynamics, PMM-I.

UNIT-II	First law of thermodynamics applied to open systems and Second law of thermodynamics	9 hours

First law of thermodynamics applied to open systems, Concept of Steady flow system, unsteady flow system, uniform and non uniform system, Steady flow energy equation, Application of SFEE :Boilers, Condensers, Turbine, Throttling process, Pumps etc. Analysis of unsteady processes such as filling and evacuation of vessels with and without heat transfer.

Second law of thermodynamics: Thermal reservoirs, Energy conversion, Concept of Heat engines, Efficiency, Reversed heat engine, Heat pump, Refrigerator, Coefficient of Performance, Kelvin Planck and Clausius statement of second law of thermodynamics, Equivalence of the two statements. Reversible and irreversible processes, Carnot cycle and Carnot engine, Reversed Carnot Cycle, Carnot theorem and it's corollaries, Thermodynamic Temperature Scale, PMM-II.

UNIT-III	Entropy and Availability and Irreversibility	8 hours

Entropy : Clausius inequality, Concept of Entropy, Entropy change of pure substance in different thermodynamic processes, Tds equation, Principle of entropy increase, T-S diagram, Statement of the third law of thermodynamics.

Availability and Irreversibility: Available and unavailable energy, Availability and Irreversibility, Second law efficiency, Helmholtz & Gibb's function		
UNIT-IV	**Pure Substance, Properties and Rankine cycle**	**9 hours**
Properties of steam and Rankine cycle: Pure substance, Property of Pure Substance (steam), TriplePoint, Critical point, Saturation states, Sub-cooled liquid state, Superheated vapour state, Phase transformation process of water, Graphical representation of pressure, volume and temperature, P-T & PV diagrams, T-S and H-S diagrams, use of property diagram, Steam-Tables &Mollier chart, Dryness fraction and it's measurement, processes involving steam in closed and open systems. Simple Rankine cycle.		
UNIT-V	**Thermodynamic Relations and thermodynamic Cycles**	**7 hours**
Thermodynamic Relations: Maxwell relations, Joule-Thomson coefficient, coefficient of volume expansion, adiabatic and isothermal compressibility, Clapeyron and Clapeyron-Clausius equations. **Thermodynamic Cycles:** Air-standard cycles: Otto, Diesel and Dual cycle		

Course outcome:	**After completion of this course students will be able to**	
CO 1	Understand energy balance to systems and control volumes, in situation involving heat and work interactions.	K_1, K_2
CO 2	Apply the performance of energy conversion devices.	K_2, K_3
CO 3	Analyse the Difference between high grade and low grade energies.	K_3 ,K_4
CO 4	Evaluate the properties of pure substances and properties of steam and basic steam cycle.	K_4, K_5
CO 5	Analyse the changes in properties of various processes.	K_2 , K_3

Text books

Engineering Thermodynamics – P.K. Nag, Tata McGraw-Hill Education, 2005 - Thermodynamics

Power Plant Engineering–P.K. Nag, Tata McGraw-Hill Education.

Reference Books

Fundamentals of Thermodynamics -- Sonntag R.E., Borgnakke C. & Van Wylen C.J.

Fundamentals of Engineering Thermodynamics -- Moran M. J. & Shapiro H.N

Thermodynamics: Fundamentals for Applications – J P O'connell& J MJaile

Fundamentals of Engineering Thermodynamics -- Howell J.R.

LINK	
UNIT 1	https://youtu.be/9GMBpZZtjXM?list=PLD8E646BAB3366BC8 https://youtu.be/xQwi9fveGTQ?list=PLD8E646BAB3366BC8
UNIT 2	https://youtu.be/lvy8h-yWhRQ?list=PLD8E646BAB3366BC8 https://youtu.be/5q_MMdGINgQ?list=PLD8E646BAB3366BC8
UNIT 3	https://youtu.be/WFZCmGXJhYY?list=PLD8E646BAB3366BC8 https://youtu.be/bvqyQB9_N8M?list=PLD8E646BAB3366BC8
UNIT 4	https://youtu.be/pJM9Fh9Fp-I?list=PLD8E646BAB3366BC8 https://youtu.be/5HuZt0VJKB0?list=PLD8E646BAB3366BC8
UNIT 5	https://youtu.be/x9yirfC8niI https://youtu.be/4w3Obp8ILpA

B.TECH. SECOND YEAR			
Course Code	**ACSE0303**	**L T P**	**Credits**
Course Title	**Design Thinking-I**	**3 0 0**	**3**

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems

Pre-requisites: None

Course Contents / Syllabus

UNIT-I	Introduction	8 HOURS

Introduction to design thinking, traditional problem solving versus design thinking, history of design thinking, wicked problems. Innovation and creativity, the role of innovation and creativity in organizations, creativity in teams and their environments, design mindset. Introduction to elements and principles of design, 13 Musical Notes for Design Mindset, Examples of Great Design, Design Approaches across the world

UNIT-II	Ethical Values and Empathy	8 HOURS

Understanding humans as a combination of I (self) and body, basic physical needs up to actualization, prosperity, the gap between desires and actualization. Understanding culture in family, society, institution, startup, socialization process. Ethical behavior: effects on self, society, understanding core values and feelings, negative sentiments and how to overcome them, definite human conduct: universal human goal, developing human consciousness in values, policy, and character. Understand stakeholders, techniques to empathize, identify key user problems. Empathy tools- Interviews, empathy maps, emotional mapping, immersion and observations, customer journey maps, and brainstorming, Classifying insights after Observations, Classifying Stakeholders, Do's &Don'ts for Brainstorming, Individual activity- 'Moccasin walk'

UNIT-III	Problem Statement and Ideation	10 HOURS

Defining the problem statement, creating personas, Point of View (POV) statements. Research- identifying drivers, information gathering, target groups, samples, and feedbacks. Idea Generation-basic design directions, Themes of Thinking, inspirations and references, brainstorming, inclusion, sketching and presenting ideas, idea evaluation, double diamond approach, analyze – four W's, 5 why's, "How Might We", Defining the problem using Ice-Cream Sticks, Metaphor & Random Association Technique, Mind-Map, ideation activity games - six thinking hats, million-dollar idea, introduction to visual collaboration and brainstorming tools - Mural, Jam Board

UNIT-IV	Critical Thinking	6 HOURS

Fundamental concepts of critical thinking, the difference between critical and ordinary thinking, characteristics of critical thinkers, critical thinking skills- linking ideas, structuring arguments, recognizing incongruences, five pillars of critical thinking, argumentation versus rhetoric, cognitive bias, tribalism, and politics. Case study on applying critical thinking on different scenarios.

UNIT-V	Logic and Argumentation	8 HOURS

The argument, claim, and statement, identifying premises and conclusion, truth and logic conditions, valid/invalid arguments, strong/weak arguments, deductive argument, argument diagrams, logical reasoning, scientific reasoning, logical fallacies, propositional logic, probability, and judgment, obstacles to critical thinking. Group activity/role plays on evaluating arguments

Course outcome: After completion of this course, students will be able to

CO 1	Develop a strong understanding of the design process and apply it in a variety of business settings	K2,K3
CO 2	Analyze self, culture, teamwork to work in a multidisciplinary environment and exhibit empathetic behavior	K3

CO 3	Formulate specific problem statements of real time issues and generate innovative ideas using design tools	K3,K6
CO 4	Apply critical thinking skills in order to arrive at the root cause from a set of likely causes	K3
CO 5	Demonstrate an enhanced ability to apply design thinking skills for evaluation of claims and arguments	K3,K4

Textbooks

1. Arun Jain, UnMukt : Science & Art of Design Thinking, 2020, Polaris
2. Jeanne Liedta, Andrew King and Kevin Benett, Solving Problems with Design Thinking – Ten Stories of What Works,2013,Columbia Business School Publishing
3. RR Gaur, R Sangal, G P Bagaria, A Foundation Course in Human Values and Professional Ethics, First Edition, 2009, Excel Books: New Delhi

Reference Books

1. Vijay Kumar, 101 Design Methods: A Structured Approach for Driving Innovation in Your Organization, 2013, John Wiley and Sons Inc, New Jersey
2. BP Banerjee, Foundations of Ethics and Management, 2005, Excel Books
3. Gavin Ambrose and Paul Harris, Basics Design 08: Design Thinking, 2010, AVA Publishing SA
4. Roger L. Martin, Design of Business: Why Design Thinking is the Next Competitive Advantage, 2009, Harvard Business Press, Boston MA

NPTEL/ YouTube/ Web Link

Unit I	https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://designthinking.ideo.com/ https://blog.hypeinnovation.com/an-introduction-to-design-thinking-for-innovation-managers https://www.creativityatwork.com/design-thinking-strategy-for-innovation/ https://www.youtube.com/watch?v=GFffb2H-gK0
Unit II	https://aktu.ac.in/hvpe/ http://aktu.uhv.org.in/ https://nptel.ac.in/courses/110/106/110106124/ https://swayam.gov.in/nd1_noc19_mg60/preview
Unit III	https://nptel.ac.in/courses/110/106/110106124/ https://swayam.gov.in/nd1_noc19_mg60/preview https://www.udemy.com/course/design-thinking-for-beginners/ https://www.designthinking-methods.com/en/ https://www.interaction-design.org/literature/article/personas-why-and-how-you-should-use-them
Unit IV	https://www.forbes.com/sites/sap/2016/08/25/innovation-with-design-thinking-demands-critical-thinking/#340511486908 https://www.criticalthinking.org/pages/defining-critical-thinking/766
Unit V	https://www.udemy.com/course/critical-thinker-academy/ https://swayam.gov.in/nd2_aic19_ma06/preview

B.TECH SECOND YEAR					
Course Code	**AME0302**	**L**	**T**	**P**	**Credits**
Course Title	**Materials Science and Engineering**	**3**	**0**	**0**	**3**

Course objective: The student will learn about

1	To study basic engineering materials, their structure-property-performance.	K_1, K_2
2	To study strengthening processes including heat treatment processes in order to enhance properties.	K_2, K_3
3	To study new materials and their applications.	K_3
4	To study about Phase diagram	K2,k3
5	To study about Material characterization and Metallography	K_2

Pre-requisites: students have the knowledge of basics of science

Course Contents / Syllabus

UNIT-I	**Atomic structure and Properties of Materials**	**10 hours**

Crystal structure of materials, crystal systems, unit cells and space lattices, determination of structures of simple crystals, miller indices of planes and directions, packing geometry in metallic, ionic and covalent solids. Concept of amorphous, single and polycrystalline structures and their effect on properties of materials. Crystal growth techniques. Imperfections in crystalline solids and their role in influencing various properties. Mechanical Properties, Stress-strain response of metallic, ceramic and polymer materials, yield strength, tensile strength and modulus of elasticity, toughness, plastic deformation, hardenability, fatigue, creep and fracture.

UNIT-II	**Phase Diagram**	**8 hours**

Solid solutions, solubility limit, Gibb's phase rule, binary phase diagrams, intermetallic compounds, iron-carbon and iron-iron carbide phase diagram, cold and hot working of metals, recrystallization and grain growth. Microstructure, properties and applications of ferrous and non-ferrous alloys.

UNIT-III	**Diffusion and Heat Treatment**	**6 hours**

Powder synthesis, sintering, chemical methods, zone refining, preparation of nano-particles and thin films. Fick's laws and application of diffusion in sintering, doping of semiconductors and surface hardening of metals. Various types of heat treatments such as Annealing, Normalizing, Quenching, Tempering (Aus-tempering, Martempering), and various case hardening processes. Time Temperature Transformation (TTT) diagram.

UNIT-IV	**Smart and Advanced Materials**	**8 hours**

Smart materials: classification, piezo electric materials, Rheological materials, smart gets, chromic materials, thermo-responsive materials magneto strictive materials, elertrostricitve materials, nanotechnology materials synthesis, properties, carbon nanotechnology tubes and applications. Biomaterials and applications, super-alloys, shape memory alloys, nanomaterials, lasers and optical fibres, exhibiting ferroelectric, piezoelectric, opto-electric, semi-conductive, photoconductive and superconductive properties and applications, composite materials, classification and applications of composite materials.

UNIT-V	**Material characterization and Metallography**	**8 hours**

Materials characterization and Metallographic techniques such as X-Ray diffraction, scanning electron microscopy, transmission electron microscopy, atomic force microscopy, scanning tunnelling microscopy, atomic absorption spectroscopy, and differential scanning calorimetry.		
Course outcome: **After completion of this course students will be able to**		
CO1	Understand the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.	K2,K3
CO2	Analyse the concept of phase & phase diagram & understand the basic terminologies associated with metallurgy.	K_2
CO3	Comply and suggest the heat treatment process & types. Significance of properties Vs microstructure. Surface hardening & its types.	K2, K_3
CO4	Interpret features, classification, applications of newer class materials like smart materials, piezoelectric materials, biomaterials, composite materials etc.	K_3
CO5	Interpret Materials characterization and Metallographic techniques such as X-Ray diffraction, scanning electron microscopy.	K_2
Text books		
William D., Jr. Callister and David G. Rethwisch, "Materials Science and Engineering: An Introduction". Wiley and Sons; 8th edition (December 30, 2009); Language: English; ISBN-10: 0470419970.		
R. K. Rajput**, "**A Textbook of Material Science**".** S.K. Kataria& Sons, 2013, ISBN 13: 9789350144183		
James F. Shackelford, "Introduction to Material Science for Engineers". Pearson Education, 2014, ISBN 13: 9780133826654		
Reference Books		
1.Tariq A. Khraishi and Marwan S. Al-Haik, "Experiments in Materials Science and Engineering".		
2.V. Raghavan, "Materials Science and Engineering: A First Course". PHI Learning, ISBN 13: 9788120350922		

B.TECH SECOND YEAR					
Course Code	**AME0301**	**L**	**T**	**P**	**Credits**
Course Title	**Manufacturing Technology – I**	**3**	**0**	**0**	**3**

Course Objectives: The students should be able to

1	Classify manufacturing processes; understand the significance and steps involved in metal casting processes
2	Design, analyze gating systems for casting and explain different special casting processes
3	Understand and apply principles concerned with metal forming processes to solve forming problems.
4	Identify, evaluate different sheet metal forming operations, sheet metal dies, arc welding processes and welding defects

Pre-requisites:Studentshave the knowledge of science

Course Contents / Syllabus

UNIT-I	**Metal casting processes**	**10 hours**

Manufacturing processes: introduction and Classification of Manufacturing Processes.

Metal-Casting Processes: Advantages, Limitations and Applications. **Patterns,** Pattern allowances, Core prints, Types of patterns. **Types of Moulding sands** -Properties of moulding sands. **Types of Sand Moulds -**Green-sand, Dry-sand and Skin-dried Moulds. **Cores –**Functions and Desired Characteristics of Cores, Core sands, Types of Cores, Core Prints and Chaplets. **Gating and Riser Design for Casting:** Elements of Gating System, Types of Gates and gating systems. Pouring time calculations, Top Gating, Bottom Gating and Relation (condition) to Avoid Aspiration Effect (Derivations and Numerical)**Design of Risers:** Types of Risers, Directional Solidification, Chvorinov's Rule and Caine's method (Numerical).

UNIT-II	**Advance casting processes**	**8 hours**

Special Casting Processes:CO2Moulding, Shell Moulding, Investment Casting, Die Casting, Hot and Cold Chamber Processes; Centrifugal casting; Continuous Casting **Defects –** Types, Causes and Remedies.

Advances in Casting Process: Sheet Moulding, casting, V-process, flask less Moulding, evaporative casting, plaster Mould casting, design for plaster Mould casting quality accuracy, uniformity and other considerations in casting and Moulding. Recent developments in pattern and casting designing, Use of CAD/CAM in foundries, Casting simulation and analysis

UNIT-III	**Metal forming processes**	**10 hours**

Metal Forming: Classification of Metal Forming Operations.

Forging: Processes and operations**,** Lubrication in Metal Forming Operations. **Forces and Stresses during Forging–** Analysis of Pressure distribution in Rectangular Block under Sticking, Sliding and Mixed Friction Condition. (Simple Numerical)

Extrusion: Direct and Indirect Extrusion, Impact Extrusion, Hydrostatic Extrusion, Defects in Extruded Products.

Drawing: Wire drawing, Rod and Tube Drawing. **Rolling:** Types of Rolling mills and Defects in Rolling. **Flat Rolling and Terminology:** Draft (Reduction), Forward and Backward Slip, Roll strip contact length, Bite angle, Ragging, Neutral Plane and Angle of **Nip (Simple Numerical)**

UNIT-IV	**Sheet metal forming and Additive Manufacturing processes**	**8 hours**

Sheet Metal Forming: Classification of press tool operations; Punch and Die

Clearances, Ironing, Coining and Embossing, Lancing, Twisting, Spinning, Stretch forming.

Sheet Metal Drawing: Drawing, Cupping and Deep drawing Draw Die Design –Factors considered for designing a Draw Die (Simple Numerical). Defects in drawing. Sheet Metal Dies: Progressive, Compound and Combination Dies. Bending and Bending Allowance, Rubber Forming.

Powder Metallurgy: P/M process, different methods of producing powders, different techniques to form the shape, advantages, disadvantages,

Additive manufacturing: Product development cycle and importance of prototyping, types prototypes, principles and advantages, different types of generative manufacturing process, viz. stereolithography, FDM, and SLS

UNIT-V	**Metal Joining Processes**	**8 hours**

Electric Arc Welding: Introduction, Characteristic curves of constant-current and constant voltage, arc welding transformer (Simple Numerical);

Electrodes – consumable and non-consumable electrodes, Functions of coatings on the electrodes, Arc blow.

Arc Welding Processes – Shielded metal arc welding (SMAW), Inert Gas Arc Welding – Tungsten Inert Gas (TIG) welding and Metal Inert Gas (MIG) arc welding, Submerged arc welding (SAW), Atomic Hydrogen welding (AHW), Plasma arc welding (PAW).

Resistance welding: Principle and types of resistance welding. **Metallurgy of Arc welding:** Principal zones in the joint and typical grain structure, Welding defects.

Course outcome: **After completion of this course students will be able to**

CO 1	Understand the concept of manufacturing processes	K_1, K_2
CO 2	Analyse and solve the problems based on Metal forming processes.	K_3, K_4
CO 3	Analyze and solve the problems based on Gating Design	K_3, K_4
CO 4	Understand the metal joining processes	K_4
CO 5	Understand the concept of powder metallurgy.	K2

Text books

P N Rao, Manufacturing Technology – Foundry, Forming, and Welding, 4th edition, McGraw Hill Education (India) Private Limited.

Kalpakjian&Schmid, “Manufacturing Engineering & Technology”, 6th Edition, Pearson.

Manufacturing science by A. Ghosh and AK Mallick Eat and west publishing house.

Reference Books

Production Engineering by PC Sharma S. Chand Publishers Pvt Ltd

B. L. Juneja Sekhon, Fundamentals of Metal Cutting and Machine Tools, New Age Intl.

W A J Chapman, Workshop Technology Part 1,2,&3 , Edward Arnold,

B.TECH SECOND YEAR					
Course Code	**AME0353**	**L**	**T**	**P**	**Credits**
Course Title	**Computer Aided Modelling Lab**	**0**	**0**	**2**	**1**

On Completion of the lab, the students will be able: -

CO1	To apply some basic concepts and methods from design engineering to explore creative solutions of real-world problems.
CO2	To create parts, assemblies, flexible & sheet metal modelling, diagram complex systems and detailed engineering concept drawings.
CO3	To apply industry standards in the sketching, 3D modelling, validation and visualization of the products & assemblies.

List of experiment:There are fourteen experiments out of which minimum ten experiments are to be carried out.

Name of experiment

1. To draw polygons using a modeling software.
2. To draw isometric projections of a given solid using a modeling software.
3. Modeling of simple machine components (bracket, flange, nut and bolt).
4. Modeling of carburetor parts I: body and plate.
5. Modeling of carburetor parts II: shaft, arm and cover.
6. Modeling of I.C. engine components I: connecting rod and cylinder block.
7. Modeling of I.C. engine components II: piston and crankshaft.
8. To assemble pre modelled carburetor parts that are body, plate, shaft, arm and cover in a CAD/Solid works /CREO software.
9. To assemble pre modelled internal combustion engine components that are connecting rod, cylinder block, piston and crankshaft in a CAD/Solid works /CREO software.
10. To place a punch and die form on a Sheetmetal using a CAD/Solid works /CREO software.
11. To model a structural component using welding in a CAD/Solid works /CREO software.
12. To modeling and force simulation of a structural component.
13. Flow simulation of a fan using a CAD/Saladworks /CREO software.
14. To create a drawing with different views of a 3D modeled component.

B.TECH SECOND YEAR					
Course Code	**AME0352**	**L**	**T**	**P**	**Credits**
Course Title	**Material Testing Lab**	**0**	**0**	**2**	**1**

On Completion of the lab, the students will be able: -

CO1	Demonstrate the understanding of the procedure to prepare samples for studying microstructure using microscope (metallography).
CO2	Interpret different phases present in different plain carbon steels and cast irons.
CO3	Perform different heat treatment processes for a steel and observe microstructures in these conditions.
CO4	Identify effects of Annealing, Normalizing and Hardening on microstructure of medium carbon steel.

List of experiment:There are fourteen experiments out of which minimum ten experiments are to be carried out.

S. No	List of Practical's
1	To determine the micro structures of a prepared specimen using optical microscopy.
2	To study Bravais lattices with the help of models.
3	To perform heat treatment processes (hardening and tempering) of steel specimen.
4	To study the creep behavior of a given specimen.
5	To perform the molecular simulation using open form software
6	To study the mechanism of chemical corrosion and its protection.
7	To study crystal structures and crystals imperfections using ball models.
8	To find the hardness of materials using Rockwell and Brinell hardness test.
9	Determination of mechanical properties from stress-strain curves obtained from tensile tests on universal testing machine.
10	Determination of fatigue strength of a metallic specimen.
11	Determination of impact strength of a metallic specimen using Izod and Charpy methods.
12	Determination of torsional strength of a metallic specimen using the torsion testing machine.
13	To perform shear test and compressive test on Universal testing Machine (UTM)

B.TECH SECOND YEAR			
Course Code	**AME0351**	**L T P**	**Credits**
Course Title	**Manufacturing Technology-I Lab**	**0 0 2**	**1**

S. No	LIST OF EXPERIMENTS
1	To study and observe various stages of casting through demonstration of Sand Casting Process.
2	Pattern making with proper allowance.
3	Making a Mould (with core) and casting.
4	To Study Various Characteristics of copper Powders and Evaluate Green Density as well as Strength Characteristics (hardness) of Cold-compacted and sintered (Conventional) compact.
5	Forging - power hammer study & operation
6	To prepare a sheet metal product (Funnel) and Report the various parameters for the various passes during the rolling of the given metal piece.
7	To make a corner joint using Gas welding experiment
8	To prepare Lap joint using spot welding.
9	To prepare a butt joint with mild steel strip using MAG& MMAW technique.
10	Development of a designed model with given parameters on FDM RP System
11	Development of a designed model with given parameters on SLA RP System
12	Development of a designed model with given parameters on LDM RP System
Course Outcomes: The students would be able to	
CO 1	Practice making Moulds using different types of patterns and core and acquire practical knowledge involved in designing prototypes/components
CO 2	Know and practice the skill of smithy and learn to modify the shapes of hard metal physically
CO 3	Know how to perform welding operations and how to join different metals.
CO 4	Understand and implement the concept of rapid prototyping

B. TECH. SECOND YEAR

Course Code	ANC0301	L	T	P	Credit
Course Title	Cyber Security	2	0	0	0

Course objective:

Achieve knowledge about Security of Information system and Risk factors and examine security threats and vulnerability in various scenarios, understand concept of cryptography and encryption technique to protect the data from cyber-attack and provide protection for software and hardware.

Pre-requisites: Basics recognition in the domain of Computer Science.
Concept of network and operating system.
Commands of programming language.

Course Contents / Syllabus

UNIT-I	Introduction	8 Hours

Introduction to Information Systems: Types of Information Systems, Development of Information Systems, Need for Information Security, Threats to Information Systems, Information Assurance, Guidelines for Secure Password and WI-FI Security and social media and Windows Security, Security Risk Analysis, and Risk Management.

UNIT-II	Application Layer Security	8 Hours

Data Security Considerations-Backups, Archival Storage and Disposal of Data,Security Technology-Firewall, Intrusion Detection, Access Control, Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software,Network and Denial of Services Attack, Security, Threats to E-Commerce: Electronic Payment System, e- Cash, Issues with Credit/Debit Cards.

UNIT-III	Secure System Development	8 Hours

Application Development Security, Architecture & Design, Security Issues in Hardware: Data Storage and Downloadable Devices, Mobile Protection,Security Threats involving in social media, Physical Security of IT Assets, Access Control, CCTV and Intrusion Detection Systems, Backup Security Measures.

UNIT-IV	Cryptography And Network Security	8 Hours

Public key cryptography: RSA Public Key Crypto with implementation in Python,Digital Signature Hash Functions,Public Key Distribution.

Symmetric key cryptography: DES (Data Encryption Standard), AES (Advanced Encryption Standard), Secure hash algorithm(SHA-1).

Real World Protocols: Basic Terminologies, VPN, Email Security Certificates, Transport Layer Security, TLS, IP security, DNS Security.

UNIT-V	Security Policy	8 Hours

Policy design Task, WWW Policies, Email based Policies, Policy Revaluation Process-Corporate Policies-Sample Security Policies,Publishing and Notification Requirement of the updated and new Policies.

Resent trends in security.

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

CO 1	Analyze the cyber security needs of an organization.	K4
CO 2	Identify and examine software vulnerabilities and security solutions.	K1,K3
CO 3	Comprehend IT Assets security (hardware and Software) and performance indicators	K2
CO 4	Measure the performance and encoding strategies of security systems.	K3, K5
CO 5	Understand and apply cyber security methods and policies to enhance current scenario security.	K2, K3

Text books:

1) Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analyzing Computer Security", Pearson Education India
2) V.K.Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India
3) Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House
4) Michael E.Whitman and Herbert J Mattord "Principle of Information Security" Cengage

Reference Books:

1) Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.
2) CHANDER, HARISH," Cyber Laws and It Protection", PHI Learning Private Limited, Delhi
3) V.K. Jain, Cryptography and Network Security, Khanna Publishing House, Delhi
4) William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010

E-books& E-Contents:

1) https://prutor.ai/welcome/
2) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf
3) https://cybermap.kaspersky.com/stats
4) https://www.fireeye.com/cyber-map/threat-map.html

Reference Links:

1) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf
2) https://cs155.stanford.edu/lectures/03-isolation.pdf
3) http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

NPTEL/ Youtube/ Faculty Video Link:

1) https://www.youtube.com/watch?v=vv1ODDhXW8Q
2) https://www.youtube.com/watch?v=fQ3ESFfvchg&list=PLUtfVcb-iqn834VGI9faVXGIGSDXZMGp8
3) https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2
4) https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev
5) https://www.youtube.com/watch?v=_9QayISruzo

B. TECH. SECOND YEAR

Course Code	ANC0302	L T P	Credits
Course Title	Environmental Science	2 0 0	0

Course objective: The student will learn about

1	the inter-relationship between man and environment. and help the students in acquiring basic knowledge about environment.
2	sense of awareness among the students about environment and its various problems.
3	positive attitude about environment among the student.
4	To develop proper skill required for the fulfilment of the aims of environmental education and educational evaluations
5	To develop the capability of using skills to fulfil the required aims, to realize and solve environmental problems through social, political, cultural and educational processes

Pre-requisites: Basic knowledge of nature.

Course Contents / Syllabus

UNIT-I Basic Principle of Ecology — 8 Hours

Definition, Scope and basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem. Food chains and food webs. Ecological pyramids, Energy flow in ecological systems, Characteristics of different ecosystems. Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles.

Basic concepts of sustainable development, SDGs, Ecosystem services, UN Decade for E restoration.

UNIT-II Natural Resources and Associated Problems — 8 Hours

Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Land resources: Land as a resource, land degradation, man induced landslides. Equitable use of resources for sustainable lifestyles.

Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects, Renewable Energy Resources: hydropower, Solar energy, geothermal, tidal and wind energy, Biomass energy, biogas and its advantages.

UNIT-III Biodiversity Succession and Non-Renewable Energy Resources — 8 Hours

Biodiversity and their importance, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book.

Strategies for biodiversity conservation, principles of biodiversity conservation in-situ and ex-situ conservation strategies Mega diversity zones and Hot spots, concepts, distribution and importance.

Succession: Concepts of succession, Types of Succession. Trends in succession. Climax and stability.

UNIT-IV Pollution and Solid Waste Management — 8 Hours

Air pollution: sources of air pollution, Primary and secondary air pollutants. Origin and effects of SOX, NOX, Cox, CFC, Hydrocarbon, control of air pollution. Water pollution: sources and types of water pollution, Effects of water pollution, Eutrophication, Soil pollution: Causes of soil pollution, Effects of soil pollution, Major sources of and effects of noise pollution on health, Radioactive and thermal pollution sources and their effects on surrounding environment.

Solid waste disposal and its effects on surrounding environment, Climate change, global warming, acid rain, ozone layer depletion.

UNIT-V Role of Community and Environmental Protection Acts — 8 Hours

Role of community, women and NGOs in environmental protection, Bioindicators and their role, Natural hazards, Chemical accidents and disasters risk management, Environmental Impact Assessment (EIA), Salient features of following Acts: a. Environmental Protection Act, 1986, Wildlife (Protection) Act, 1972.b. Water (Prevention and control of pollution) Act, 1974.c. Air (Prevention and control of pollution) Act, 1981. Forest (Conservation) Act, 1980.d. Wetlands (Conservation and Management) Rules, 2017; e. Chemical safety and Disaster Management law. F. District Environmental Action Plan. Climate action plans.

Course outcome: After completion of this course students will be able to

CO 1	Understand the basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem., food chains and food webs. Ecological pyramids	K2
CO 2	Understand the different types of natural recourses like food, forest, minerals and energy and their conservation	K2
CO 3	Understand the importance of biodiversity, Threats of biodiversity and different methods of biodiversity conservation.	K2
CO 4	Understand the different types of pollution, pollutants, their sources, effects and their control methods	K3
CO 5	Understand the basic concepts of sustainable development, Environmental Impact Assessment (EIA) and different acts related to environment	K3

Text books:

1. Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
2. Botkin, D.B and Kodler E.A., 2000, Environmental Studies: The earth as a living planet. John Wiley and Sons Inc.
3. Rao M.N. and H.V.N. Rao, 1989: Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
5.Environmental Studies -Benny Joseph-Tata McgrawHill-2005
6. Environmental Studies- Dr. D.L. Manjunath, Pearson Education-2006.
7. Environmental studies- R, Rajagopalan -Oxford Pubtiotion2005.

Reference Books:

1.Sodhi G.S. 2005, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.
2.Dash, M.C. (1994), Fundamentals of Ecology, Tata Mc Graw Hill, New Delhi.
3. Sharma P. D. (1996). Environmental Biology, Rastogi Publications, Meerut.
4. Verma P.S. and V.K. Agarwal. (1985). Principles of Ecology. S. Chand and Company (Pub.), New Delhi.
5.Principles of Environmental Sciences and Engineering -P. Venugopalan Rao, Prenitice Hall of India.
6. Environmental Science and Engineering Meenakshi, Prentice Hall India.

NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=T21OO0sBBfc, https://www.youtube.com/watch?v=qt8AMjKKPDohttps://www.youtube.com/watch?v=yAK-m91Nxrshttps://www.youtube.com/watch?v=ha_O-1uOWkk, https://www.youtube.com/watch?v=brF0RWJyx9w
Unit 2	https://www.youtube.com/watch?v=mOwyPENHhbc, https://www.youtube.com/watch?v=yqev1G2iy20, https://www.youtube.com/watch?v=_74S3z3IO_I, https://www.youtube.com/watch?v=jXVw6M6m2g0
Unit 3	https://www.youtube.com/watch?v=GK_vRtHJZu4, https://www.youtube.com/watch?v=b6Ua_zWDH6U, https://www.youtube.com/watch?v=7tgNamjTRkk, https://www.youtube.com/watch?v=ErATB1aMiSU, https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-human-impact-on-ecosystems/v/conservation-and-the-race-to-save-biodiversity
Unit 4	https://www.youtube.com/watch?v=7qkaz8ChelI, https://www.youtube.com/watch?v=NuQE5fKmfME, https://www.youtube.com/watch?v=9CpAjOVLHII, https://www.youtube.com/watch?v=yEci6iDkXYw, https://www.youtube.com/watch?v=yEci6iDkXYw
Unit 5	https://www.youtube.com/watch?v=ad9KhgGw5iA, https://www.youtube.com/watch?v=nW5g83NSH9M, https://www.youtube.com/watch?v=xqSZL4Ka8xo, https://www.youtube.com/watch?v=WAI-hPRoBqs, https://www.youtube.com/watch?v=o-WpeyGlV9Y, https://www.youtube.com/watch?v=EDmtawhADnY

B. TECH. SECOND YEAR			
Course Code	**AOE0361**	**L T P**	**Credit**
Course Title	**Energy Science and Engineering**	**3 1 0**	**4**

Course objective: Students will able to learn

1	Iintroduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application •	K2, K3
2	society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear.	K2, K3
3	Energy conservation methods will be emphasized from Mechanical Engineering perspective.	K2, K3

Pre-requisites:

-

Course Content / Syllabus

UNIT-I	**Energy and its Usage**	**10 Hours**

- Units and scales of energy use, Mechanical energy, and transport, Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Introduction to the quantum, energy quantization, Energy in chemical systems and processes, flow of CO2, Entropy, and temperature, Carnot and Stirling heat engines, Phase change energy conversion, refrigeration and heat pumps, Internal combustion engines, Steam and gas power cycles, the physics of power plants. Solid-state phenomena including photo, thermal and electrical aspects

UNIT-II	**Nuclear Energy**	**7 Hours**

- Fundamental forces in the universe, Quantum mechanics relevant for nuclear physics, nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles

UNIT-III	**Solar Energy**	**9 Hours**

- Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, Carrier transport, generation and recombination in semiconductors, Semiconductor junctions: metal-semiconductor junction & p-n junction, Essential characteristics of solar photovoltaic devices, First Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells

UNIT-IV	**Conventional & non-conventional energy source**	**8 Hours**

- Biological energy sources and fossil fuels, Fluid dynamics and power in the wind, available resources, fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms, Geothermal power and ocean thermal energy conversion, Tidal/wave/hydro power

UNIT-V	**Systems and Synthesis**	**8 Hours**

- Overview of World Energy Scenario, Nuclear radiation, fuel cycles, waste and proliferation, Climate change, Energy storage, Energy conservation. Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts, LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Course outcome: At the end of the course the students will be able to		Levels
CO 1	Understand the various types of energy resources and their applications.	L2
CO 2	Understand the concept of nuclear energy and its applications	L3
CO 3	Understand the fundamentals of solar energy and their applications	L2
CO 4	Describe the conventional and non-conventional energy resources.	L3
CO 5	Apply the energy conservation methods.	L3

Text books

1. **Energy and the Challenge of Sustainability,** World Energy Assessment, UNDP, New York, (2000).

Reference Books

1. **Perspective of Modern Physics,** A. Beiser, McGraw-Hill International Editions (1968).

2. **Introduction to Modern Physics,** H.S. Mani and G.K.Mehta, East-West Press (1988)

3. **Introduction to Electrodynamics,** D. J. Griffiths, Fourth Edition, Prentice Hall (2013).

4. **Introductory Nuclear Physics,** R. K. Puri and V.K. Babbar, Narosa Publishing House (1996).

5. **Physics of Solar Cells: From Basic Principles to Advanced Concepts by Peter Wurfel,** John Wiley & Sons, 2016

6**. Principles of Solar Engineering,** D.Y. Goswami, F.Kreith and J.F. Kreider, Taylor and Francis, Philadelphia, 2000.

7. **Perspective of Modern Physics,** A. Beiser, McGraw-Hill International Editions (1968)

B. TECH SECOND YEAR			
Course Code	**AOE0362**	**L T P**	**Credit**
Course Title	**Sensor and Instrumentation**	**3 1 0**	**4**

Course objective:Student will able to learn

CO1	The use of sensors for measurement of displacement, force and pressure.	K3
CO2	commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.	K3
CO3	The Demonstrate the use of virtual instrumentation in automation industries.	K2
CO4	Identify and use data acquisition methods.	K3
CO5	Comprehend intelligent instrumentation in industrial automation.	K2

Pre-requisites:

-

Course Content / Syllabus

UNIT-I	**10 Hours**

Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor

UNIT-II	**7 Hours**

Measurement of Temperature: Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive

UNIT-III	**9 Hours**

- **Virtual Instrumentation:** Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, Need of software based instruments for industrial automation

UNIT-IV	**8 Hours**

- **Data Acquisition Methods:** Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.

UNIT-V	**8 Hours**

- **Intelligent Sensors:** General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control

Course outcome:

At the end of the course the students will be able to Levels

CO 1	Apply the use of sensors for measurement of displacement, force and pressure.	K2

CO 2	Employ commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.	K4
CO 3	Demonstrate the use of virtual instrumentation in automation industries.	K2
CO 4	Identify and use data acquisition methods.	K3
CO 5	Comprehend intelligent instrumentation in industrial automation.	K3
Text books		
1. **DVS Murthy,** Transducers and Instrumentation, PHI 2nd Edition 2013		
Reference Books		
2. **D Patranabis,** Sensors and Transducers, PHI 2nd Edition 2013		
3. **S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control,** 2nd ED / Instrument Society of America, 1994.		
4. **Gary Johnson / Lab VIEW** Graphical Programming II Edition / McGraw Hill 1997.		

B. TECH SECOND YEAR			
Course Code	**AOE0363**	**L T P**	**Credit**
Course Title	**Basics Data Structure and Algorithms**	**3 1 0**	**4**

Course objective: Students will able to

CO1	**Aanalyze the time and space complexity of an algorithm**	**K2,K4**
CO2	**understand and implement fundamental algorithms (including sorting algorithms, graph algorithms, and dynamic programming)**	**K3**
CO3	**Discuss various algorithm design techniques for developing algorithms**	**K2**
CO4	**Discuss various algorithm design techniques for developing algorithms**	**K3**
CO5	**Discuss various algorithm design techniques for developing algorithms**	**K2**

Pre-requisites:

-

Course Content / Syllabus

UNIT-I	**10 Hours**

Introduction to data structure and Algorithms: Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.

UNIT-II	**7 Hours**

Stack And Queue and Link List: Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish expression, Representation Queue, operation on Queue , Priority Queue , D-Queue , Singly and circularly linked list, List operations Lists implementations

UNIT-III	**9 Hours**

Trees : Basic terminology, Binary Trees, Binary tree representation, Algebraic/expressions, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.

UNIT-IV	**8 Hours**

- **Graphs: Terminology & representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees, Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.**

UNIT-V	**8 Hours**

Searching and Sorting: Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two-way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices : Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to

B tree and B+ tree, File organization and storage management, Introduction to hoisting.		
Course outcome: **At the end of the course the students will be able to**		**Levels**
CO 1	Understand and Aanalyze the time and space complexity of an algorithm	**K2**
CO 2	understand and implement fundamental algorithms (including sorting algorithms, graph algorithms, and dynamic programming)	K4
CO 3	Discribe various algorithm design techniques for developing algorithms	K2
CO 4	Explain various algorithm design techniques for developing algorithms	K3
CO 5	Discuss various algorithm design techniques for developing algorithms	K3

Text books

1. **Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest,** Introduction to Algorithms, PHI.

2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication.

3. Weiss, "Data Structure & Algorithm Analysis in C", Addision Wesley.

4. Basse, "computer Algorithms: Introduction to Design & Analysis", Addision Wesley.

5. Lipschutz, "Data structure, "Schaum series.

6. Aho, hopcropt, Ullman, "Data Structure & Algorithm", Addision Wesley.

7. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008

B. TECH SECOND YEAR			
Course Code	**AOE0364**	**L T P**	**Credit**
Course Title	**Introduction to Soft Computing**	**3 1 0**	**4**

Course objective:Student will able to

CO1	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	K2
CO2	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic	K3
CO3	Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.	K4
CO4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	K3
CO5	Develop some familiarity with current research problems and research methods in Soft Computing Techniques	K5

Pre-requisites:

-

Course Content / Syllabus

UNIT-I		**10 Hours**

Introduction to Soft Computing

ARTIFICIAL NEURAL NETWORKS

Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohen's self-organizing networks - Hopfield network.

UNIT-II		**7 Hours**

FUZZY SYSTEMS

Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

UNIT-III		**9 Hours**

NEURO - FUZZY MODELING

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation

UNIT-IV		**8 Hours**

GENETIC ALGORITHMS

Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.

UNIT-V		**8 Hours**

APPLICATION OF SOFT COMPUTING

Optimisation of traveling salesman problem using Genetic Algorithm, Genetic algorithm-based Internet Search Techniques, Soft computing-based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.

Course outcome: At the end of thecourse the students will be able to		Levels
CO 1	Describe fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	K2
CO 2	Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic	K4
CO 3	Apply the concept of genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.	K2
CO 4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	K3
CO 5	Develop familiarity with current research problems .	K3

Text books

1. **An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)**
2. **Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition),** Collelo, Lament, Veldhnizer (Springer)
3. **Fuzzy Logic with Engineering Applications** Timothy J. Ross (Wiley)
4. **Neural Networks and Learning Machines** Simon Haykin (PHI)
5. **Sivanandam, Deepa,** " Principles of Soft Computing", Wiley
6. **Jang J.S.R, Sun C.T. and Mizutani E,** "Neuro-Fuzzy and Soft computing", Prentice Hall
7. **Timothy J. Ross,** "Fuzzy Logic with Engineering Applications", McGraw Hill
8. **Laurene Fausett,** "Fundamentals of Neural Networks", Prentice Hall
9. **D.E. Goldberg,** "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley
10. **Wang,** "Fuzzy Logic", Springer

B. TECH SECOND YEAR			
Course Code	**AOE0365**	**L T P**	**Credit**
Course Title	**Analog Electronics Circuits**	**3 1 0**	**4**

Course objective: Students will learn

CO1	The characteristics of diodes and transistors.	K2
CO2	various rectifier and amplifier circuits	K3
CO3	sinusoidal and non-sinusoidal oscillators.	K4
CO4	The functioning of OP-AMP and design OP-AMP based circuits.	K3
CO5	LPF, HPF, BPF, BSF.	K5

Pre-requisites:

-

Course Content / Syllabus

UNIT-I **10 Hours**

Diode circuits, amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output resistance etc., design procedure for particular-specifications, low frequency analysis of multistage amplifiers.

UNIT-II **7 Hours**

High frequency transistor: models, frequency response of single stage and multistage amplifiers, cascade amplifier, various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues, feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin

UNIT-III **9 Hours**

Oscillators: Review of the basic concept, Barkhuizen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators

UNIT-IV **8 Hours**

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load, differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR, Op-Amp design: Design of differential amplifier for a given specification, design of gain stages and output stages, compensation

UNIT-V **8 Hours**

Op-Amp applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, active filters: Low pass, high pass, band pass and band stop, design guidelines.

Course outcome:

At the end of the course the students will be able to Levels

CO 1	Understand the characteristics of diodes and transistors.	K2
CO 2	Design and analyze various rectifier and amplifier circuits	K4
CO 3	Design sinusoidal and non-sinusoidal oscillators.	K2

CO 4	Understand the functioning of OP-AMP and design OP-AMP based circuits.	K3
CO 5	Design LPF, HPF, BPF, BSF.	K3
Text books		
1. J.V. Wait, L.P. Huelsman and GA Korn, "Introduction to Operational Amplifier theory and applications," McGraw Hill, 1992.		
2. J. Millman and A. Grabel, "Microelectronics," 2ndedition, McGraw Hill, 1988.		
3.P. Horowitz and W. Hill, "The Art of Electronics," 2ndedition, Cambridge University Press, 1989.		
4. A.S. Sedra and K.C. Smith, "Microelectronic Circuits, "Saunder's College11 Publishing, 4th edition.		
5. Paul R. Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits," John Wiley, 3rd edition		
6. Muhammad H. Rashid, "Electronic Devices and Circuits," Cengage publication, 2014.		

B TECH SECOND YEAR			
Course Code	**AOE0366**	**L T P**	**Credit**
Course Title	**Electronics Engineering**	**3 1 0**	**4**
Course objective:Students will learn			
CO1	the concept of PN junction and special purpose diodes		K2
CO2	The application of conventional diode and semiconductor diode.		K3
CO3	The I-V characteristics of BJT and FET		K4
CO4	The of Op-Amp, amplifiers, integrator, and differentiator.		K3
CO5	The concept of digital storage oscilloscope and compare of DSO with analog oscilloscope		K5
Pre-requisites: •			
Course Content / Syllabus			
UNIT-I			**10 Hours**
P-N junction diode: Introduction of semiconductor materials; Semiconductor diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, diode equivalent circuits, transition and diffusion capacitance, Zener diodes breakdown mechanism (Zener and avalanche)			
UNIT-II			**7 Hours**
Diode application: Series, parallel and series, parallel diode configuration, half and full wave rectification, clippers, clampers, Zener diode as shunt regulator, voltage-multiplier circuits special purpose two terminal devices : light-emitting diodes, Varactor (Varicap) diodes, tunnel diodes, liquidcrystal displays.			
UNIT-III			**9 Hours**
Bipolar junction transistors and field effect transistor: Bipolar junction transistor: Transistor construction, operation, amplification action, common base, common emitter, common collector configuration dc biasing BJTs: operating point, fixed-bias, emitter bias, voltage-divider bias configuration. Collector feedback, emitter-follower configuration. Bias stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model), Field effect transistor: Construction and characteristic of JFETs. AC analysis of CS amplifier, MOSFET (depletion and enhancement) type, transfer characteristic.			
UNIT-IV			**8 Hours**
Operational amplifiers: Introduction and block diagram of Op-Amp, ideal & practical characteristics of Op-Amp, differential amplifier circuits, practical Op-Amp circuits (inverting amplifier, non-inverting amplifier, unity gain amplifier, summing amplifier, integrator, differentiator), OpAmp parameters: input offset voltage, output offset voltage, input biased current, input offset current differential and common-mode operation.			
UNIT-V			**8 Hours**
Electronic instrumentation and measurements: Digital voltmeter: Introduction, RAMP techniques digital multimeters: Introduction Oscilloscope: introduction, basic principle, CRT, block diagram of oscilloscope, simple, measurement of voltage, current phase and frequency using CRO, introduction of digital storage oscilloscope and comparison of DSO with analog oscilloscope.			

Course outcome: At the end of the course the students will be able to		Levels
CO 1	Understand the concept of PN junction and special purpose diodes	K2
CO 2	Study the application of conventional diode and semiconductor diode.	K4
CO 3	Analyse the I-V characteristics of BJT and FET	K2
CO 4	Analyze the of Op-Amp, amplifiers, integrator, and differentiator.	K3
CO 5	Understand the concept of digital storage oscilloscope and compare of DSO with analog oscilloscope	K3
Text books		
1. Robert L. Boylestand / Louis Nashelsky, "Electronic Devices and Circuit Theory," Latest Edition, Pearson Education		
2. H.S Kalsi, "Electronic Instrumentation", Latest Edition, TMH Publication.		
3. **M**eetidehran/ A.K. singh "fundamental of electronics Engineering", New age international publisher.		

B.TECH. SECOND YEAR			
Course Code	**AAS0401B**	**L T P**	**Credits**
Course Title	**Engineering Mathematics-III**	**3 1 0**	**4**

Course Objective: The student will learn about

Concept of function of complex variables, Partial differential equations & their applications, Numerical techniques for various mathematical tasks and numerical aptitude. It aims to show case the students with standard concepts and tools from B. Tech to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Pre-requisites: Knowledge of Mathematics I and II of B. Tech or equivalent

Course Contents / Syllabus

UNIT-I	**Complex Variable – Differentiation**	**8 Hours**

Limit, Continuity and differentiability, Functions of complex variable, Analytic functions, Cauchy- Riemann equations (Cartesian and Polar form), Harmonic function, Method to find Analytic functions, Conformal mapping, Mobius transformation and their properties.

UNIT-II	**Complex Variable –Integration**	**8 Hours**

Complex integrals, Contour integrals, Cauchy- Goursat theorem, Cauchy integral formula, Taylor's series, Laurent's series, Liouvilles's theorem, Singularities, Classification of Singularities, zeros of analytic functions, Residues, Methods of finding residues, Cauchy Residue theorem, Evaluation of real integrals of the type $\int_0^{2\pi} f(\sin\theta, \cos\theta)\,d\theta$ and $\int_{-\infty}^{\infty} f(x)\,dx$.

UNIT-III	**Partial Differential Equation and its Applications**	**8 Hours**

Introduction of partial differential equations, Second order linear partial differential equations with constant coefficients. Classification of second order partial differential equations, Method of separation of variables for solving partial differential equations, Solution of one and two dimensional wave and heat conduction equations.

UNIT- IV	**Integral Transforms**	**8 Hours**

Complex Fourier transform, Inverse Transforms, Convolution Theorems, Fourier sine and cosine transform, Applications of Fourier transform to simple one dimensional heat transfer equations and wave equations, Z-transform and its application to solve difference equations.

UNIT-V	**Aptitude-III**	**8 Hours**

Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement, Clock & Calendar.

Course Outcomes: After completion of this course students will be able to

CO 1	Apply the working methods of complex functions for finding analytic functions.	K_3
CO 2	Apply the concepts of complex functions for finding Taylor's series, Laurent's series and evaluation of definite integrals	K_3
CO 3	Apply the concept of partial differential equation to solve partial differential Equations and problems concerned with partial differential equations	K_4
CO 4	Apply the concept of fourier transform and Z-transform to solve difference equations.	K_3
CO 5	Solve the problems of Time & Work, Pipe & Cistern, Time, Speed & Distance, Boat & Stream, Sitting Arrangement , Clock & Calendar.	K_3

Text Books:

(1) B. V. Ramana, Higher Engineering Mathematics, Tata McGraw-Hill Publishing Company Ltd., 2008.

(2) B. S. Grewal, Higher Engineering Mathematics, Khanna Publisher, 2005.	
(3) R K. Jain & S R K. Iyenger , Advance Engineering Mathematics, Narosa Publishing House 2002.	
(4) E. Kreyszig, Advance Engineering Mathematics, John Wiley & Sons, 2005.	
Reference Books:	
Peter V. O'Neil, Advance Engineering Mathematics, Thomson (Cengage) Learning, 2007.	
Ray Wylie C and Louis C Barret, Advanced Engineering Mathematics, Tata Mc-Graw-Hill; Sixth Edition.	
NPTEL/ YouTube/ Faculty Video Link:	
Unit 1	https://www.youtube.com/playlist?list=PLzJaFd3A7DZuyLLbmVpb9e9VLf3Q9cYBL https://www.youtube.com/playlist?list=PLbMVogVj5nJS_i8vfVWJG16mPcoEKMuWT https://youtu.be/b5VUnapu-qs https://youtu.be/yV_v6zxADgY https://youtu.be/2ZBcbFhrfOg https://youtu.be/dlK0E0OG39k https://youtu.be/qjpLIlVo_6E
Unit 2	https://youtu.be/bkzKVsIEjxk https://youtu.be/nDD16hiutdc https://youtu.be/2kyBOVfflHw https://youtu.be/uliv9TzeD6o https://youtu.be/pulsluT8Uwk https://youtu.be/VBAeogiKH2A https://youtu.be/Mpmlk1H1aQo https://youtu.be/z03usEpsHRU https://youtu.be/fXybLUFmQBQ
Unit 3	https://youtu.be/kZ7Oa7iMiCs https://youtu.be/rj2Mb7JGyHk https://youtu.be/zpxe5yoB0xg https://youtu.be/MN4gUtsr0e8 https://youtu.be/GmIcbqdvlgc https://youtu.be/eSKz2N0tKaA https://youtu.be/iiTOw0JqQFc https://youtu.be/M4U-T9jsNKQ
Unit 4	https://youtu.be/QH2WL92bzLs https://youtu.be/DGmNbs5Cywo https://youtu.be/FliKUWUVrEI https://youtu.be/7eHuQXMCOvA https://youtu.be/ZkvQR3ajm3k https://youtu.be/zdyUwzOm1zw https://youtu.be/BBuV14-isyU https://youtu.be/xPr7YFSnmiQ https://youtu.be/ajJD0Df5CsY https://youtu.be/iviiGB5vxLA https://youtu.be/Ym1EUjTWMnE
Unit 5	https://www.youtube.com/playlist?list=PLFqNfk5W2ZuzjUsRqDp1Zj3S8n9yfdmN9 https://youtu.be/x3SEYdBUGaA

B. TECH. SECOND YEAR

Course Code	AASL0401	L T P	Credit
Course Title	Technical Communication	2 1 0	3

Course objective: The student will learn

1	communication and critical thinking skills necessary for securing a job, and succeeding in the diverse and ever-changing workplace of the twenty first century
2	To enable students to communicate effectively in English at the workplace.

Pre-requisites:

- The student must have a good degree of control over simple grammatical forms and some complex grammatical forms of English language.
- The student should be able to speak English intelligibly.

Course Content / Syllabus

UNIT-I — Introduction to Technical Communication and Reading — 4 Hours

- Fundamentals of technical communication
- Role of technical communication
- Reading Comprehension - central idea, tone, and intention
- Critical reading strategies

UNIT-II — Technical Writing 1 — 5 Hours

- Characteristics of technical writing; technical vocabulary, etymology
- Business letters /emails – types, format, style and language
- Notices, agenda and minutes
- Job application, CV and resume

UNIT-III — Technical Writing 2 — 5 Hours

- Technical reports – types & formats
- Structure of a report
- Technical Proposal - structure and types
- Technical/ Scientific paper writing

UNIT-IV — Public Speaking — 5 Hours

- Components of effective speaking (emphasis on voice dynamics)
- Seminar and conference presentation
- Conducting/ participating in meetings
- Appearing for a job interview
- Mobile etiquettes

UNIT-V — Manuscript Preparation — 5 Hours

- Short report writing
- Copy editing and referencing
- Developing writing style – Jargons, Abbreviations
- Ethical writing

Course outcome: At the end of the course the students will be able to Levels.

CO 1	Comprehend the fundamental principles of technical communication with special reference to reading.	K2
CO 2	Write various kinds of professional correspondence.	K5

CO 3	Recognise and produce different kinds of technical documents.	K2
CO 4	Apply effective speaking skills to communicate at the workplace.	K3
CO 5	Demonstrate their understanding of various ethical concerns in written communication.	K3

Textbook:

1. Technical Communication – Principles and Practices by Meenakshi Raman & Sangeeta Sharma, Oxford Univ. Press, 2016, New Delhi.

Reference Books:

1. Personality Development and Soft Skills by Barun K Mitra, Oxford Univ. Press, 2012, New Delhi.
2. Spoken English- A Manual of Speech and Phonetics by R K Bansal & J B Harrison, Orient Blackswan, 2013, New Delhi.
3. Business Correspondence and Report Writing by Prof. R C Sharma & Krishna Mohan, Tata McGraw Hill & Co. Ltd., 2001, New Delhi.
4. Practical Communication: Process and Practice by L U B Pandey; A.I.T.B.S. Publications India Ltd.; Krishan Nagar, 2014, Delhi.
5. Modern Technical Writing by Sherman, Theodore A (et.al); Apprentice Hall; New Jersey; USA.
6. A Textbook of Scientific and Technical Writing by S D Sharma; Vikas Publication, Delhi.
7. Skills for Effective Business Communication by Michael Murphy, Harvard University, USA.
8. A Complete Guide to Write Right by Agarwal, Deepa. Scholastic, 1st edition.
9. Technical writing and communication, R S Sharma, V.P. Publication, 1st edition.
10. Business Communication for Managers by Payal Mehra, Pearson Publication, Delhi.

B. TECH. SECOND YEAR

Course Code	AME0402	L T P	Credit
Course Title	Fluid Mechanics & Machines	3 1 0	4

Course objective: The student will learn about

1	the application of mass and momentum conservation laws for fluid flows.
2	the importance of and working of flow measuring devices, application of dimensional analysis.
3	the velocity and pressure variations in various types of simple flows.
4	the flow in water pumps and turbines.

Pre-requisites:

- The student should have basic knowledge of general laws of Science and Mathematical Calculations.

Course Content / Syllabus

UNIT-I	Fluid properties	10 Hours

Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Capillarity effect, Pressure Scale, manometers, buoyancy, Bernoulli's equation and its applications - Pitot tube, orifice meter, venturi meter and bend meter, Magnus effect, notches and weirs, Hydrostatic force analysis

UNIT-II	Fluid Flow Analysis	8 Hours

Continuum & free molecular flows; Steady and unsteady, uniform and non-uniform, laminar and turbulent flows, rotational and irrotational flows, compressible and incompressible flows, subsonic, sonic and supersonic flows, sub-critical, critical and supercritical flows, one, two- and three-dimensional flows, streamlines, path lines, streak lines and flow net, continuity equation and applications (3D), circulation and vorticity, stream function and velocity potential function. Drag and lift, aerofoil, Buckingham Pi theorem, important dimensionless numbers and their significance.

UNIT-III	Pipe Flow and Boundary Layer Analysis	8 Hours

Equation of motion for laminar flow through pipes, turbulent flow, isotropic, homogenous turbulence, scale and intensity of turbulence, measurement of turbulence, eddy viscosity, resistance to flow, minor losses, pipe in series and parallel, power transmission through a pipe, siphon, water hammer, three reservoir problems and pipe networks. Boundary layer thickness, boundary layer over a flat plate, laminar boundary layer, application of momentum equation, turbulent boundary layer, laminar sub layer, separation and its control.

UNIT-IV	Prime Movers and Thrust Analysis	8 Hours

Momentum equation and its applications, Introduction to hydrodynamic thrust of jet on a fixed, moving surface, hinged surface and series of vanes, Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel. Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

UNIT-V	Fluid Pumps and devices	8 Hours

Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics. Reciprocating pump theory, Slip, Indicator diagram, Effect of acceleration, air vessels, Comparison of centrifugal and reciprocating pumps, Performance characteristics, Hydraulic lifts, torque convertor, Air jet pump, Vacuum pumps, Pressure regulators, Introduction to Compressors

Course outcome: At the end of the course the students will be able to Levels.		
CO 1	Define the fluid properties, types of flow and to apply Bernoulli's equation in different devices.	K2
CO 2	Mathematically analyze simple flow problems and dimensional analysis.	K4
CO 3	Apply the Equation of Motion for laminar and turbulent flow, to calculate loss of head in pipe flows and to analyze the Boundary Layer Phenomena.	K2
CO 4	Calculate impact of jet, classify different turbines and to evaluate the performance of Turbines.	K3
CO 5	Distinguish different pumps and to evaluate the performance of Pumps.	K3

Reference Books:

1. Introduction to fluid mechanics and Fluid machines by S.K. Som, Gautam Biswas, S Chakraborty.
2. F. M. White, Fluid Mechanics, 6th Ed., Tata McGraw-Hill, 2008.
3. Fluid Mechanics and Its Applications by V.K.Gupta et.al.
4. Fluid Mechanics by YunusCengel.
5. Batchelor, G. K. (1999). Introduction to fluid dynamics. New Delhi, India: Cambridge University Press. 7. Acheson, D. J. (1990). Elementary fluid dynamics. New York, USA: Oxford University Press.
6. R.W. Fox, A.T. McDonald and P.J. Pritchard, Introduction to Fluid Mechanics, 6th Ed., John Wiley, 2004.
7. Fluid mechanics and machines by R.K Bansal.

B. TECH. SECOND YEAR			
Course Code	**AME0404**	**L T P**	**Credit**
Course Title	**Applied Thermodynamics**	**3 0 0**	**3**

Course objective: The student will

1	To learn about of fuels and heating value of fuels.
2	To learn about the components and working of boilers and condensers,
3	To learn about gas and vapor cycles and their first law and second law efficiencies.
4	To learn about gas dynamics of air flow and steam through nozzles and analyze the performance of steam turbines.
5	To learn about the analysis of the reciprocating compressors and gas turbines.

Pre-requisites:

-

Course Content / Syllabus

UNIT-I	Fuels and combustions Analysis	10 Hours

Introduction to solid, liquid and gaseous fuels, Stoichiometry, air / fuel ratio for combustion of fuels, exhaust gas analysis, analysis of combustion reactions (conversion of mass analysis to volumetric analysis and vice versa), Calorific value, Combustion efficiency, standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, Fuel properties, Calorimetry, Adiabatic flame temperature. Alternative fuels, blended fuels. Introduction to nuclear fuels.

UNIT-II	Boilers and condensers	8 Hours

Boilers : Classifications and working of boilers, High pressure and super critical boilers: spiral . Vertical tube universal pressure boilers, boilers mountings and accessories, Draught and its calculations, air pre-heater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance.

Condenser: Classification of condenser, air leakage, condenser performance parameters.

UNIT-III	Gas and Vapour Power cycles	8 Hours

Vapour Power cycles: Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis .Modification in Rankine cycles for efficiency improvements

Gas power cycles: Brayton cycle, open and closed cycle analysis, Gas turbine cycles with intercooling, reheat and regeneration and their combinations, Stage efficiency, Polytropic efficiency.

Aero plane and Rocket propulsion: principles of jet propulsion, Turbojet and turboprop engines and their processes, Principle of rocket propulsion.

UNIT-IV	Nozzles and Steam Turbines	8 Hours

Steam and Gas Nozzles: Flow through Convergent and convergent-divergent nozzles, variation of velocity, area and specific volume, choked flow, throat area, Nozzle efficiency, Off design operation of nozzle, Shock waves stationary normal shock waves, Effect of friction on nozzle, Super saturated flow.

Steam Turbines: Classification of steam turbine, Impulse and Reaction turbines, Stage and Overall efficiency, reheat factor, Bleeding, Velocity diagram of simple, compound multistage impulse turbines, Velocity diagram of reaction turbines and related calculations, efficiency of reaction, Impulse reaction turbines, state point locus, Losses in steam turbines, Governing of turbines.

UNIT-V	Modernization of thermodynamic systems	8 Hours

Methods and means of controls of fuel combustion process. Boiler operation using computerized

system, Introduction to Turbine control system, digital steam turbine control. Electrically actuated Nozzles, Nozzle analogy to predict steam turbine performance, An introduction to electronic control of gas turbine engines. Automatic spray nozzles.

Course outcome: At the end of the course the students will be able to Levels.

CO1	understand the use of fuels and apply combustion equations.	K2
CO2	understand the working of boilers and condensers.	K2
CO3	analyze the power generation using gas and steam based cycles.	K3
CO4	analyze the flow of fluids through nozzles and turbines.	K3
CO5	understand the working of reciprocating compressors and gas turbines.	K2

Reference Books:

1. Basic and Applied Thermodynamics by P.K. Nag, McGraw hill India.

2.Applied Thermodynamics for Engineering Technologists by Eastop and McConkey, Pearson Education.

3.Fundamentals of Thermodynamics by Sonntag, R. E, Borgnakke, C. and Van Waylen, G. J., 2003, 6th Edition,

4.John Wiley and Sons.

5.Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

6.Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

7.Thermal Engineering by P. L. Ballaney, Khanna Publishers, 1994

B. TECH. SECOND YEAR

Course Code	AME0403	L T P	Credit
Course Title	Strength of Materials	3 0 0	3

Course objective: The student will

1	To learn simple and compound stress strain
2	understand the concept of bending of beams, deflection of beams.
3	learn the types of spring and analysis of spring
4	understand the concept, of thick and thin cylinders

Pre-requisites: Student know the Mechanics and basics of mathematics

-

Course Content / Syllabus

UNIT-I	Simple Stress and Strain	10 Hours

Compound stress and strains: Introduction, normal stress and strain, shear stress and strain, stresses on inclines sections, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr's circle for plane stress, generalized Hook's law,theories of failure. Thermal Stresses.

UNIT-II		8 Hours

Stresses in Beams: Pure Bending, normal stresses in beams, shear stresses in beams due to transverse and axial loads, composite beams.
Deflection of Beams: Differential equation of the elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams.
Torsion: Torsion,combinedbending&torsionofsolid&hollowshafts,torsionofthinwalledtubes.

UNIT-III		8 Hours

Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.
ColumnsandStruts: Bucklingandstability,slendernessratio,combinedbendinganddirectstress,middle third and middle quarter rules, struts with different end conditions, Euler's theory for pin endedcolumns,effectofendconditionsoncolumnbuckling,RankingGordonformulae,examplesofcolumnsin mechanicalequipmentandmachines.

UNIT-IV		8 Hours

Thin cylinders & spheres: Introduction, difference between thin walled and thick-walled pressure vessels, thin walled spheres and cylinders, hoop and axial stresses and strain, volumetric strain.
Thick cylinders: Radial, axial and circumferential stresses in thick cylinders subjected to internal orexternalpressures,compoundcylinders,stressesinrotatingshaftandcylinders,stressesduetointerference fits.

UNIT-V		8 Hours

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.
Unsymmetrical Bending: Properties of beam cross-section, slope of neutral axis, stress and

deflection inunsymmetrical bending, determination of shear center and flexural axis (for symmetry about both axisandaboutone axis) for I-sectionandchannelsection.		
Course outcome: At the end of the course the students will be able to Levels.		
CO 1	Understand the concept of stress and strain under different conditions of loading	K2
CO 2	Determine the principal stresses and strains in structural members	K4
CO 3	Determine the principal stresses and strains in structural members.	K2
CO 4	Apply the concepts of stresses and strain in solving problems related to springs, column and pressure vessels	K3
CO 5	Analyze the stresses developed in straight and curved beams of different cross sections	K3
Reference Books:		
1. Mechanics of Materials by Hibbeler, Pearson.		
2.Mechanics of material by Gere, Cengage Learning		
3.Mechanics of Materials by Beer, Johnston, DE wolf and Mazurek, Mc Graw Hill India		
4. Strength of Materials by Pytel andSinger, Harper Collins		
5.Strength of Materials by Ryder, Macmillan.		
6.StrengthofMaterialsbyTimoshenkoandYoung,EastWestPress.		
7.IntroductiontoSolidMechanicsbyShames,Pearson		

B. TECH. SECOND YEAR			
Course Code	**AME0401**	**L T P**	**Credit**
Course Title	**Manufacturing Technology-II**	**3 0 0**	**3**

Course objective: The student will learn

1	To apply the concept of mechanics of metal cutting,
2	Working of standard machine tools such as lathe, shaping and allied machines, milling, drilling and allied machines,
3	The concept of abrasive machining process such as grinding and allied machines and broaching .
4	The basic concepts of Computer Numerical Control (CNC) of machine tools and CNC Programming
5	The basic concepts of Non-Traditional Manufacturing Methods.

Pre-requisites: Students have the knowledge of material science and basics of manufacturing

-

Course Content / Syllabus

UNIT-I	Mechanics OF Metal Cutting	10 Hours

Tool Engineering: Cutting Tool geometry and definition of principles tool angles of single point cutting tools,

Mechanics of Metal Cutting: Features of machining processes, mechanism of chip formation, chip reduction coefficient, force analysis, Merchants circle of cutting forces, expression for shear plane angle and coefficient of friction in terms of cutting forces and tool angles, Merchants theory-original and modified, effect of various parameters on cutting forces , Different types of dynamometers and their operations, Tool life definition, mechanism of tool wear and measurement, preliminary and ultimate feature, factors influencing tool life such as speed, feed, depth of cut, tool material, cutting fluids etc., Machinability, factors affecting surface finish.

UNIT-II	Machine tool: introduction, classification of machine tool.	8 Hours

Lathe machine tool: Centre lathe, constructional features, specification, operations , taper turning methods, thread cutting methods, special attachments, machining time and power estimation.– automatic lathes, Capstan and turret lathes- tool layout

Milling Machine Tool: Clasiisfication of mailing machine, up milling, down milling, maximum chip thickness**.**Gear Manufacturing.

Drilling Machining tool: Introduction to hole making process, classification of drilling machines, radial drilling machine, and time calculation. Twist drill Geometry.principles of location, Drill bushes-their types and applications, Milling fixture and turning fixture**.**

Reciprocating Machine Tools: Introduction of reciprocating machine tools, working principles of shaper and planer machine tools. Drive mechanism of reciprocating machine tools.

UNIT-III	Abrasive Machining Processes and Computer controlled manufacturing process	8 Hours

Abrasive Machining Processes and Computer controlled manufacturing process:

Abrasive processes: grinding wheel specifications and selection, types of grinding process cylindrical grinding, surface grinding, centreless grinding and internal grinding- Mechanics of grinding. Common shaping processes for plastics.

Computer controlled manufacturing process: Numerical Control (NC) machine tools, CNC types,

constructional details, special features, machining centre. part programming (turning, milling and drilling).

UNIT-IV	Non-traditional Machining Processes	8 Hours

Non-traditional Machining: introduction, principle advantages over conventional machining process, classification of non-traditional machining process.

Mechanical energy based processes: Abrasive Jet Machining (AJM) Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Machining (USM). Working Principles ,equipment used, Process parameters, MRR,Applications.

Electrical energy based processes: Electric Discharge Machining (EDM)- working Principle-equipment's, Process Parameters, Surface Finish and MRR- electrode / Tool Power and control Circuits-Tool Wear, Dielectric, Flushing, Wire cut EDM ,Applications.

.

UNIT-V	Thermal & electrochemical energy based processes	8 Hours

Thermal energy based processes: Laser Beam machining and drilling (LBM), plasma Arc machining (PAM) and Electron Beam Machining (EBM). Principles – Equipment Types, Beam control techniques Applications.

Chemical and electrochemical energy based processes: Chemical machining and Electro-Chemical machining (CHM and ECM)-Etchants, Maskant techniques of applying maskants. Process Parameters, Surface finish and MRR,Applications. Principles of ECM, ECM Set up,Surface Roughness and MRR Electrical circuit-Process Parameters. ECG and ECH Applications. Introduction to Hybrid Machining Process.

.

Course outcome: At the end of the course the students will be able

CO1	To Analyze the mechanics of metal cutting	K3, K4
CO2	To understand and demonstrate the working of Machine tools.	K2
CO3	To analyze the Abrasive finishing processes.	K3
CO4	To analyze the non traditional machining process	K3
CO5	To understand the concept of computer controlled manufacturing processes	K2

Reference Books:

1. P N Rao, Manufacturing Technology – Vol II, 4th edition, McGraw Hill Education (India) Private Limited.
1. Mikell P. Groover, "Fundamentals of modern manufacturing: materials, processes and systems", John Wiley & Sons, Inc
2. Kalpakjian &Schmid, "Manufacturing Engineering & Technology", 6th Edition, Pearson.
3. Manufacturing science by A. Ghosh and AK Mallick Eat and west publishing house.
4. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
5. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007
6. Production Engineering by PC Sharma S. Chand Publishers Pvt Ltd.
7. G. Boothroyd & W.A. Knight, " Fundamental of Machining and Machine Tools, third edition"CRC Press

B.TECH SECOND YEAR			
Course Code	**AME0452**	**L T P**	**Credits**
Course Title	**Fluid Mechanics Lab**	**0 0 2**	**1**

S. No	**LIST OF EXPERIMENTS**
1.	To verify the Bernoulli's Theorem.
2.	To determine the coefficient of discharge of venturi meter.
3.	To determine coefficient of discharge of an orifice meter.
4.	To determine the coefficient of discharge of Notch (V and Rectangular types).
5.	To determine the minor losses due to sudden enlargement, sudden contraction and bends.
6.	To determine the coefficient of discharge, contraction & velocity of an orifice.
7.	To determine the coefficient of impact for vanes.
8.	To find critical Reynolds number for a pipe flow.
9.	To find overall efficiency of pelton wheel.
10.	Theoretical & practical study of operation of single acting cylinder
11.	Theoretical & practical study of operation of double acting cylinder
12.	Operation of a double acting cylinder using quick exhaust valve
Course Outcomes: The students would be able to	
CO 1	To understand the principles and performance characteristics of flow and flow measuring devices working with the water as well as air.
CO 2	To know about the measurement of the fluid properties.
CO 3	To understand about the application of mass and momentum conservation laws for fluid flows.

B.TECH SECOND YEAR			
Course Code	**AME0454**	**L T P**	**Credits**
Course Title	**Applied Thermodynamics Lab**	**0 0 2**	**1**

S. No	**LIST OF EXPERIMENTS**
1.	To study low pressure boilers and their accessories and mountings.
2.	To study high pressure boilers and their accessories and mountings.
3.	To study the working of impulse and reaction steam turbines.
4.	To find dryness fraction of steam by separating and throttling calorimeter.
5.	To find calorific value of a sample of fuel using Bomb calorimeter
6.	Determination of brake power, indicated power, friction power and mechanical efficiency of a multi-cylinder petrol engine running at constant speed (Morse Test)
7.	Performance of a diesel engine from no load to full load (at constant speed) for a single cylinder engine in terms of brake power indicated power, mechanical efficiency
8.	Study and working of two stroke and four stroke Diesel Engine
9.	Study and working of two stroke and four stroke Petrol Engine
10.	To study and find volumetric efficiency of a reciprocating air compressor.
11.	Study of Positive Displacement Air Compressor

Course Outcomes: The students would be able to	
CO 1	Understand the construction and working of Steam Generators
CO 2	Understand the working of steam turbines
CO 3	Analyse the performance of I.C.Engines
CO 4	Understand the working of air compressors

B.TECH SECOND YEAR			
Course Code	**AME0451**	**L T P**	**Credits**
Course Title	**Manufacturing Technology-II Lab**	**0 0 2**	**1**

S. No	**LIST OF EXPERIMENTS**
1.	To study Centre Lathe machine and perform operations such as Facing, Plain Turning, Step Turning, and Thread Cutting on center lathe machine.
2.	To make a single Point cutting tool on grinding machine with use of mild steel materials
3.	Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine
4.	To Study surface grinding machine and perform operation on surface grinding machine.
5.	To make Spur gear on milling machine tool.
6.	To study shaper M/C tool and perform operation on shaper M/c tool
7.	To study Twist drill geometry and drill a hole on drilling M/c.
8.	To study about CNC and perform operation.
9.	Part Programming (in word address format) experiment for turning operation (including operations such as grooving and threading) and running on CNC machine
10.	Part Programming (in word address format or ATP) experiment for drilling operation (point to point) and running on CNC machine.
11.	Part Programming (in word address format or ATP) experiment for milling operation and running on CNC machine.
Course Outcomes: The students would be able to	
CO 1	Practice making parts on lathe machine tool.
CO 2	Students are able to identify, manipulate and control machining parameters for various manufacturing processes used in industry
CO 3	Students are able to demonstrate and practice CNC Machining.
CO 4	Practice making parts on Milling and drilling machine tools.

B. TECH. SECOND YEAR

Course Code	ANC0402	L T P	Credits
Course Title	Environmental Science	2 0 0	0

Course objective:

1	To help the students in realizing the inter-relationship between man and environment. and help the students in acquiring basic knowledge about environment.
2	To develop the sense of awareness among the students about environment and its various problems.
3	To create positive attitude about environment among the student.
4	To develop proper skill required for the fulfilment of the aims of environmental education and educational evaluations
5	To develop the capability of using skills to fulfil the required aims, to realize and solve environmental problems through social, political, cultural and educational processes

Pre-requisites: Basic knowledge of nature.

Course Contents / Syllabus

UNIT-I Basic Principle of Ecology — 8 Hours

Definition, Scope and basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem. Food chains and food webs. Ecological pyramids, Energy flow in ecological systems, Characteristics of different ecosystems. Biogeochemical Cycles: Importance, gaseous and sedimentary cycles. Carbon, Nitrogen, Phosphorus and Sulphur Cycles.

Basic concepts of sustainable development, SDGs, Ecosystem services, UN Decade for E restoration.

UNIT-II Natural Resources and Associated Problems — 8 Hours

Natural resources and associated problems. Forest resources: Use and over-exploitation, deforestation. Timber extraction, mining, dams and their effects on forest and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and over-grazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity.

Land resources: Land as a resource, land degradation, man induced landslides. Equitable use of resources for sustainable lifestyles.

Non-Renewable Energy Resources: Fossil fuels and their reserves, Nuclear energy, types, uses and effects, Renewable Energy Resources: hydropower, Solar energy, geothermal, tidal and wind energy, Biomass energy, biogas and its advantages.

UNIT-III Biodiversity Succession and Non-Renewable Energy Resources — 8 Hours

Biodiversity and their importance, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, IUCN threat categories, Red data book.

Strategies for biodiversity conservation, principles of biodiversity conservation in-situ and ex-situ conservation strategies Mega diversity zones and Hot spots, concepts, distribution and importance.

Succession: Concepts of succession, Types of Succession. Trends in succession. Climax and stability.

UNIT-IV Pollution and Solid Waste Management — 8 Hours

Air pollution: sources of air pollution, Primary and secondary air pollutants. Origin and effects of SOX, NOX, Cox, CFC, Hydrocarbon, control of air pollution. Water pollution: sources and types of water pollution, Effects of water pollution, Eutrophication, Soil pollution: Causes of soil pollution, Effects of soil pollution, Major sources of and effects of noise pollution on health, Radioactive and thermal pollution sources and their effects on surrounding environment.

Solid waste disposal and its effects on surrounding environment, Climate change, global warming, acid rain, ozone layer depletion.

UNIT-V Role of Community and Environmental Protection Acts — 8 Hours

Role of community, women and NGOs in environmental protection, Bioindicators and their role, Natural hazards, Chemical accidents and disasters risk management, Environmental Impact Assessment (EIA), Salient features of following Acts: a. Environmental Protection Act, 1986, Wildlife (Protection) Act, 1972.b. Water (Prevention and control of pollution) Act, 1974.c. Air (Prevention and control of pollution) Act, 1981. Forest (Conservation) Act, 1980.d. Wetlands (Conservation and Management) Rules, 2017; e. Chemical safety and Disaster Management law. F. District Environmental Action Plan. Climate action plans.

Course outcome: After completion of this course students will be able to

CO 1	Understand the basic principles of ecology and environment. Ecosystem: Basic concepts, components of ecosystem., food chains and food webs. Ecological pyramids	K2
CO 2	Understand the different types of natural recourses like food, forest, minerals and energy and their conservation	K2
CO 3	Understand the importance of biodiversity, Threats of biodiversity and different methods of biodiversity conservation.	K2
CO 4	Understand the different types of pollution, pollutants, their sources, effects and their control methods	K3
CO 5	Understand the basic concepts of sustainable development, Environmental Impact Assessment (EIA) and different acts related to environment	K3

Text books:

1. Brady, N.C. 1990. The nature and properties of Soils, Tenth Edition. Mac Millan Publishing Co., New York.
2. Botkin, D.B and Kodler E.A., 2000, Environmental Studies: The earth as a living planet. John Wiley and Sons Inc.
3. Rao M.N. and H.V.N. Rao, 1989: Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi
4. Singh J.S., Singh S.P. and Gupta S.R., 2006, Ecology Environment and Resource Conservation, Anamaya Publishers, New Delhi.
5.Environmental Studies -Benny Joseph-Tata McgrawHill-2005
6. Environmental Studies- Dr. D.L. Manjunath, Pearson Education-2006.
7. Environmental studies- R, Rajagopalan -Oxford Pubtiotion2005.

Reference Books:

1.Sodhi G.S. 2005, Fundamentals of Environmental Chemistry: Narosa Publishing House, New Delhi.
2.Dash, M.C. (1994), Fundamentals of Ecology, Tata Mc Graw Hill, New Delhi.
3. Sharma P. D. (1996). Environmental Biology, Rastogi Publications, Meerut.
4. Verma P.S. and V.K. Agarwal. (1985). Principles of Ecology. S. Chand and Company (Pub.), New Delhi.
5.Principles of Environmental Sciences and Engineering -P. Venugopalan Rao, Prenitice Hall of India.
6. Environmental Science and Engineering Meenakshi, Prentice Hall India.

NPTEL/ YouTube/ Faculty Video Link:

Unit 1	https://www.youtube.com/watch?v=T21OO0sBBfc, https://www.youtube.com/watch?v=qt8AMjKKPDohttps://www.youtube.com/watch?v=yAK-m91Nxrshttps://www.youtube.com/watch?v=ha_O-1uOWkk, https://www.youtube.com/watch?v=brF0RWJyx9w
Unit 2	https://www.youtube.com/watch?v=mOwyPENHhbc, https://www.youtube.com/watch?v=yqev1G2iy20, https://www.youtube.com/watch?v=_74S3z3IO_I, https://www.youtube.com/watch?v=jXVw6M6m2g0
Unit 3	https://www.youtube.com/watch?v=GK_vRtHJZu4, https://www.youtube.com/watch?v=b6Ua_zWDH6U, https://www.youtube.com/watch?v=7tgNamjTRkk, https://www.youtube.com/watch?v=ErATB1aMiSU, https://www.khanacademy.org/science/high-school-biology/hs-ecology/hs-human-impact-on-ecosystems/v/conservation-and-the-race-to-save-biodiversity
Unit 4	https://www.youtube.com/watch?v=7qkaz8ChelI, https://www.youtube.com/watch?v=NuQE5fKmfME, https://www.youtube.com/watch?v=9CpAjOVLHII, https://www.youtube.com/watch?v=yEci6iDkXYw, https://www.youtube.com/watch?v=yEci6iDkXYw
Unit 5	https://www.youtube.com/watch?v=ad9KhgGw5iA, https://www.youtube.com/watch?v=nW5g83NSH9M, https://www.youtube.com/watch?v=xqSZL4Ka8xo, https://www.youtube.com/watch?v=WAI-hPRoBqs, https://www.youtube.com/watch?v=o-WpeyGlV9Y, https://www.youtube.com/watch?v=EDmtawhADnY

B. TECH. SECOND YEAR					
Course Code	**ANC0401**	**L**	**T**	**P**	**Credit**
Course Title	**Cyber Security**	**2**	**0**	**0**	**0**

Course objective:

Achieve knowledge about Security of Information system and Risk factors and examine security threats and vulnerability in various scenarios, understand concept of cryptography and encryption technique to protect the data from cyber-attack and provide protection for software and hardware.

Pre-requisites: Basics recognition in the domain of Computer Science.
Concept of network and operating system.
Commands of programming language.

Course Contents / Syllabus

UNIT-I	**Introduction**	**8 Hours**

Introduction to Information Systems: Types of Information Systems, Development of Information Systems, Need for Information Security, Threats to Information Systems, Information Assurance, Guidelines for Secure Password and WI-FI Security and social media and Windows Security, Security Risk Analysis, and Risk Management.

UNIT-II	**Application Layer Security**	**8 Hours**

Data Security Considerations-Backups, Archival Storage and Disposal of Data,Security Technology-Firewall, Intrusion Detection, Access Control, Security Threats -Viruses, Worms, Trojan Horse, Bombs, Trapdoors, Spoofs, E-mail Viruses, Macro Viruses, Malicious Software,Network and Denial of Services Attack, Security, Threats to E-Commerce: Electronic Payment System, e- Cash, Issues with Credit/Debit Cards.

UNIT-III	**Secure System Development**	**8 Hours**

Application Development Security, Architecture & Design, Security Issues in Hardware: Data Storage and Downloadable Devices, Mobile Protection,Security Threats involving in social media, Physical Security of IT Assets, Access Control, CCTV and Intrusion Detection Systems, Backup Security Measures.

UNIT-IV	**Cryptography And Network Security**	**8 Hours**

Public key cryptography: RSA Public Key Crypto with implementation in Python,Digital Signature Hash Functions,Public Key Distribution.

Symmetric key cryptography: DES (Data Encryption Standard), AES (Advanced Encryption Standard), Secure hash algorithm(SHA-1).

Real World Protocols: Basic Terminologies, VPN, Email Security Certificates, Transport Layer Security, TLS, IP security, DNS Security.

UNIT-V	**Security Policy**	**8 Hours**

Policy design Task, WWW Policies, Email based Policies, Policy Revaluation Process-Corporate Policies-Sample Security Policies,Publishing and Notification Requirement of the updated and new Policies.

Resent trends in security.

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

CO 1	Analyze the cyber security needs of an organization.	K4
CO 2	Identify and examine software vulnerabilities and security solutions.	K1,K3
CO 3	Comprehend IT Assets security (hardware and Software) and performance indicators	K2
CO 4	Measure the performance and encoding strategies of security systems.	K3, K5
CO 5	Understand and apply cyber security methods and policies to enhance current scenario security.	K2, K3

Text books:

5) Charles P. Pfleeger, Shari Lawerance Pfleeger, "Analyzing Computer Security", Pearson Education India

6) V.K.Pachghare, "Cryptography and information Security", PHI Learning Private Limited, Delhi India

7) Sarika Gupta & Gaurav Gupta, Information Security and Cyber Laws, Khanna Publishing House

8) Michael E.Whitman and Herbert J Mattord "Principle of Information Security" Cengage

Reference Books:

5) Schou, Shoemaker, "Information Assurance for the Enterprise", Tata McGraw Hill.

6) CHANDER, HARISH," Cyber Laws and It Protection", PHI Learning Private Limited, Delhi

7) V.K. Jain, Cryptography and Network Security, Khanna Publishing House, Delhi

8) William Stallings, Network Security Essentials: Applications and Standards, Prentice Hall, 4th edition, 2010

E-books& E-Contents:

5) https://prutor.ai/welcome/

6) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf

7) https://cybermap.kaspersky.com/stats

8) https://www.fireeye.com/cyber-map/threat-map.html

Reference Links:

4) https://crypto.stanford.edu/cs155old/cs155-spring11/lectures/03-ctrl-hijack.pdf

5) https://cs155.stanford.edu/lectures/03-isolation.pdf

6) http://uru.ac.in/uruonlinelibrary/Cyber_Security/Cryptography_and_Network_Security.pdf

NPTEL/ Youtube/ Faculty Video Link:

6) https://www.youtube.com/watch?v=vv1ODDhXW8Q

7) https://www.youtube.com/watch?v=fQ3ESFfvchg&list=PLUtfVcb-iqn834VGI9faVXGIGSDXZMGp8

8) https://www.youtube.com/watch?v=iTVyKbDCJrA&list=PLgMDNELGJ1CbdGLyn7OrVAP-IKg-0q2U2

9) https://www.youtube.com/watch?v=1plMO7ChXMU&list=PLJ5C_6qdAvBFAuGoLC2wFGruY_E2gYtev

10) https://www.youtube.com/watch?v=_9QayISruzo

B. TECH. SECOND YEAR			
Course Code	**AOE0461**	**L T P**	**Credit**
Course Title	**Energy Science and Engineering**	**3 1 0**	**4**

Course objective: Students will able to learn

1	Iintroduction to energy systems and renewable energy resources, with a scientific examination of the energy field and an emphasis on alternative energy sources and their technology and application •	K2, K3
2	society's present needs and future energy demands, examine conventional energy sources and systems, including fossil fuels and nuclear energy, and then focus on alternatives, renewable energy sources such as solar, biomass (conversions), wind power, waves and tidal, geothermal, ocean thermal, hydro and nuclear.	K2, K3
3	Energy conservation methods will be emphasized from Mechanical Engineering perspective.	K2, K3

Pre-requisites:

-

Course Content / Syllabus

UNIT-I	**Energy and its Usage**	**10 Hours**

- Units and scales of energy use, Mechanical energy, and transport, Heat energy: Conversion between heat and mechanical energy, Electromagnetic energy: Storage, conversion, transmission and radiation, Introduction to the quantum, energy quantization, Energy in chemical systems and processes, flow of CO2, Entropy, and temperature, Carnot and Stirling heat engines, Phase change energy conversion, refrigeration and heat pumps, Internal combustion engines, Steam and gas power cycles, the physics of power plants. Solid-state phenomena including photo, thermal and electrical aspects

UNIT-II	**Nuclear Energy**	**7 Hours**

- Fundamental forces in the universe, Quantum mechanics relevant for nuclear physics, nuclear forces, energy scales and structure, Nuclear binding energy systematics, reactions and decays, Nuclear fusion, Nuclear fission and fission reactor physics, Nuclear fission reactor design, safety, operation and fuel cycles

UNIT-III	**Solar Energy**	**9 Hours**

- Introduction to solar energy, fundamentals of solar radiation and its measurement aspects, Basic physics of semiconductors, Carrier transport, generation and recombination in semiconductors, Semiconductor junctions: metal-semiconductor junction & p-n junction, Essential characteristics of solar photovoltaic devices, First Generation Solar Cells, Second Generation Solar Cells, Third Generation Solar Cells

UNIT-IV	**Conventional & non-conventional energy source**	**8 Hours**

- Biological energy sources and fossil fuels, Fluid dynamics and power in the wind, available resources, fluids, viscosity, types of fluid flow, lift, Wind turbine dynamics and design, wind farms, Geothermal power and ocean thermal energy conversion, Tidal/wave/hydro power

UNIT-V	**Systems and Synthesis**	**8 Hours**

- Overview of World Energy Scenario, Nuclear radiation, fuel cycles, waste and proliferation, Climate change, Energy storage, Energy conservation. Engineering for Energy conservation: Concept of Green Building and Green Architecture; Green building concepts, LEED ratings; Identification of energy related enterprises that represent the breath of the industry and prioritizing these as candidates; Embodied energy analysis and use as a tool for measuring sustainability. Energy Audit of Facilities and optimization of energy consumption.

Course outcome:		
At the end of the course the students will be able to		Levels
CO 1	Understand the various types of energy resources and their applications.	L2
CO 2	Understand the concept of nuclear energy and its applications	L3
CO 3	Understand the fundamentals of solar energy and their applications	L2
CO 4	Describe the conventional and non-conventional energy resources.	L3
CO 5	Apply the energy conservation methods.	L3

Text books

1. **Energy and the Challenge of Sustainability,** World Energy Assessment, UNDP, New York, (2000).

Reference Books

1. **Perspective of Modern Physics,** A. Beiser, McGraw-Hill International Editions (1968).
2. **Introduction to Modern Physics,** H.S. Mani and G.K.Mehta, East-West Press (1988)
3. **Introduction to Electrodynamics,** D. J. Griffiths, Fourth Edition, Prentice Hall (2013).
4. **Introductory Nuclear Physics,** R. K. Puri and V.K. Babbar, Narosa Publishing House (1996).
5. **Physics of Solar Cells: From Basic Principles to Advanced Concepts by Peter Wurfel,** John Wiley & Sons, 2016
6. **Principles of Solar Engineering,** D.Y. Goswami, F.Kreith and J.F. Kreider, Taylor and Francis, Philadelphia, 2000.
7. **Perspective of Modern Physics,** A. Beiser, McGraw-Hill International Editions (1968)

B. TECH SECOND YEAR			
Course Code	**AOE0462**	**L T P**	**Credit**
Course Title	**Sensor and Instrumentation**	**3 1 0**	**4**
Course objective:Student will able to learn			
CO1	The use of sensors for measurement of displacement, force and pressure.	K3	
CO2	commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.	K3	
CO3	The Demonstrate the use of virtual instrumentation in automation industries.	K2	
CO4	Identify and use data acquisition methods.	K3	
CO5	Comprehend intelligent instrumentation in industrial automation.	K2	

Pre-requisites:

-

Course Content / Syllabus		
UNIT-I		**10 Hours**
Sensors & Transducer: Definition, Classification & selection of sensors, Measurement of displacement using Potentiometer, LVDT & Optical Encoder, Measurement of force using strain gauge, Measurement of pressure using LVDT based diaphragm & piezoelectric sensor		
UNIT-II		**7 Hours**
Measurement of Temperature: Measurement of temperature using Thermistor, Thermocouple & RTD, Concept of thermal imaging, Measurement of position using Hall effect sensors, Proximity sensors: Inductive & Capacitive, Use of proximity sensor as accelerometer and vibration sensor, Flow Sensors: Ultrasonic & Laser, Level Sensors: Ultrasonic & Capacitive		
UNIT-III		**9 Hours**
• **Virtual Instrumentation:** Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, Need of software based instruments for industrial automation		
UNIT-IV		**8 Hours**
• **Data Acquisition Methods:** Basic block diagram, Analog and Digital IO, Counters, Timers, Types of ADC: successive approximation and sigma-delta, Types of DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication.		
UNIT-V		**8 Hours**
• **Intelligent Sensors:** General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control		
Course outcome:		
At the end of the course the students will be able to		Levels
CO 1	Apply the use of sensors for measurement of displacement, force and pressure.	K2
CO 2	Employ commonly used sensors in industry for measurement of temperature, position, accelerometer, vibration sensor, flow and level.	K4
CO 3	Demonstrate the use of virtual instrumentation in automation industries.	K2
CO 4	Identify and use data acquisition methods.	K3
CO 5	Comprehend intelligent instrumentation in industrial automation.	K3
Text books		
1. **DVS Murthy,** Transducers and Instrumentation, PHI 2nd Edition 2013		
Reference Books		
2. **D Patranabis,** Sensors and Transducers, PHI 2nd Edition 2013		
3. **S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control,** 2nd ED / Instrument Society of America, 1994.		
4. **Gary Johnson / Lab VIEW** Graphical Programming II Edition / McGraw Hill 1997.		

B. TECH SECOND YEAR			
Course Code	**AOE0463**	**L T P**	**Credit**
Course Title	**Basics Data Structure and Algorithms**	**3 1 0**	**4**
Course objective: Students will able to			
CO1	**Aanalyze the time and space complexity of an algorithm**		**K2,K4**
CO2	**understand and implement fundamental algorithms (including sorting algorithms, graph algorithms, and dynamic programming)**		**K3**
CO3	**Discuss various algorithm design techniques for developing algorithms**		**K2**
CO4	**Discuss various algorithm design techniques for developing algorithms**		**K3**
CO5	**Discuss various algorithm design techniques for developing algorithms**		**K2**
Pre-requisites: •			
Course Content / Syllabus			
UNIT-I			**10 Hours**

Introduction to data structure and Algorithms: Performance analysis of Algorithm, time complexity, Big-oh notation, Elementary data organization data structure operations, Recurrences, Arrays, Operation on arrays, representation of arrays in memory, single dimensional and multidimensional arrays, spare matrices, Character storing in C, String operations.		
UNIT-II		**7 Hours**
Stack And Queue and Link List: Stack operation, PUSH and POP, Array representation of stacks, Operation associated with stacks Application of stacks, Recursion, Polish expression, Representation Queue, operation on Queue , Priority Queue , D-Queue , Singly and circularly linked list, List operations Lists implementations		
UNIT-III		**9 Hours**
Trees : Basic terminology, Binary Trees, Binary tree representation, Algebraic/expressions, Complete Binary Trees, Extended binary tree, representing binary tress in memory, linked representation of Binary trees, Traversing binary trees & Searching in binary trees, Inserting in binary search trees, Complexity of searching algorithm, Heaps, general trees, Threaded binary tree.		
UNIT-IV		**8 Hours**
• **Graphs: Terminology & representations, Graphs & Multigraphs, Directed Graphs, Sequential representation of graphs, adjacency Matrices, Transversal, connected component and spanning trees, Minimum Cost spanning tree, Prims and Kruskal Algorithm, BFS, DFS, Shortest path and transitive closure, Activity networks, topological sort and critical paths.**		
UNIT-V		**8 Hours**
Searching and Sorting: Linear search, binary Search, Internal and External sorting, Bubble sorting, selection sort, Insertion sort, quick sort, Two-way merge sort, Heap sort, sorting on different keys, practical consideration for internal sorting, External Sorting, Storage Devices : Magnetic tapes, Disk Storage, Sorting with disks and Indexing techniques, introduction to B tree and B+ tree, File organization and storage management, Introduction to hoisting.		
Course outcome: **At the end of the course the students will be able to**		**Levels**
CO 1	Understand and Aanalyze the time and space complexity of an algorithm	**K2**
CO 2	understand and implement fundamental algorithms (including sorting algorithms, graph algorithms, and dynamic programming)	K4
CO 3	Discribe various algorithm design techniques for developing algorithms	K2
CO 4	Explain various algorithm design techniques for developing algorithms	K3
CO 5	Discuss various algorithm design techniques for developing algorithms	K3
Text books		

1. **Thomas H. Coreman, Charles E. Leiserson and Ronald L. Rivest,** Introduction to Algorithms, PHI.
2. Horowitz and Sahani, "Fundamentals of Data Structures", Galgotia Publication.
3. Weiss, "Data Structure & Algorithm Analysis in C", Addision Wesley.
4. Basse, "computer Algorithms: Introduction to Design & Analysis", Addision Wesley.
5. Lipschutz, "Data structure, "Schaum series.
6. Aho, hopcropt, Ullman, "Data Structure & Algorithm", Addision Wesley.
7. Aho, Hopcraft, Ullman, "The Design and Analysis of Computer Algorithms" Pearson Education, 2008

B. TECH SECOND YEAR			
Course Code	**AOE0464**	**L T P**	**Credit**
Course Title	**Introduction to Soft Computing**	**3 1 0**	**4**
Course objective:Student will able to			
CO1	Comprehend the fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.		K2
CO2	Understand the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic		K3
CO3	Describe with genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.		K4
CO4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.		K3
CO5	Develop some familiarity with current research problems and research methods in Soft Computing Techniques		K5
Pre-requisites:			

•

Course Content / Syllabus

UNIT-I		**10 Hours**

Introduction to Soft Computing

ARTIFICIAL NEURAL NETWORKS

Basic concepts - Single layer perception - Multilayer Perception - Supervised and Unsupervised learning – Back propagation networks - Kohen's self-organizing networks - Hopfield network.

UNIT-II		**7 Hours**

FUZZY SYSTEMS

Fuzzy sets, Fuzzy Relations and Fuzzy reasoning, Fuzzy functions - Decomposition - Fuzzy automata and languages - Fuzzy control methods - Fuzzy decision making.

UNIT-III		**9 Hours**

NEURO - FUZZY MODELING

Adaptive networks based Fuzzy interface systems - Classification and Regression Trees - Data clustering algorithms - Rule based structure identification - Neuro-Fuzzy controls - Simulated annealing – Evolutionary computation

UNIT-IV		**8 Hours**

GENETIC ALGORITHMS

Survival of the Fittest - Fitness Computations - Cross over - Mutation - Reproduction - Rank method - Rank space method.

UNIT-V		**8 Hours**

APPLICATION OF SOFT COMPUTING

Optimisation of traveling salesman problem using Genetic Algorithm, Genetic algorithm-based Internet Search Techniques, Soft computing-based hybrid fuzzy controller, Introduction to MATLAB Environment for Soft computing Techniques.

Course outcome:

At the end of thecourse the students will be able to		Levels
CO 1	Describe fuzzy logic and the concept of fuzziness involved in various systems and fuzzy set theory.	K2
CO 2	Apply the concepts of fuzzy sets, knowledge representation using fuzzy rules, approximate reasoning, fuzzy inference systems, and fuzzy logic	K4
CO 3	Apply the concept of genetic algorithms and other random search procedures useful while seeking global optimum in self-learning situations.	K2
CO 4	Understand appropriate learning rules for each of the architectures and learn several neural network paradigms and its applications.	K3
CO 5	Develop familiarity with current research problems .	K3

Text books

1. **An Introduction to Genetic Algorithm Melanic Mitchell (MIT Press)**

2. **Evolutionary Algorithm for Solving Multi-objective, Optimization Problems (2nd Edition),**

Collelo, Lament, Veldhnizer (Springer)
3. **Fuzzy Logic with Engineering Applications** Timothy J. Ross (Wiley)
4. **Neural Networks and Learning Machines** Simon Haykin (PHI)
5. **Sivanandam, Deepa,** " Principles of Soft Computing", Wiley
6. **Jang J.S.R, Sun C.T. and Mizutani E,** "Neuro-Fuzzy and Soft computing", Prentice Hall
7. **Timothy J. Ross,** "Fuzzy Logic with Engineering Applications", McGraw Hill
8. **Laurene Fausett,** "Fundamentals of Neural Networks", Prentice Hall
9. **D.E. Goldberg,** "Genetic Algorithms: Search, Optimization and Machine Learning", Addison Wesley
10. **Wang,** "Fuzzy Logic", Springer

B TECH SECOND YEAR			
Course Code	**AOE0465**	**L T P**	**Credit**
Course Title	**Analog Electronics Circuits**	**3 1 0**	**4**
Course objective: Students will learn			
CO1	The characteristics of diodes and transistors.		K2
CO2	various rectifier and amplifier circuits		K3
CO3	sinusoidal and non-sinusoidal oscillators.		K4
CO4	The functioning of OP-AMP and design OP-AMP based circuits.		K3
CO5	LPF, HPF, BPF, BSF.		K5
Pre-requisites: •			
Course Content / Syllabus			
UNIT-I			**10 Hours**
Diode circuits, amplifier models: Voltage amplifier, current amplifier, trans-conductance amplifier and trans-resistance amplifier. biasing schemes for BJT and FET amplifiers, bias stability, various configurations (such as CE/CS, CB/CG, CC/CD) and their features, small signal analysis, low frequency transistor models, estimation of voltage gain, input resistance, output			

resistance etc., design procedure for particular-specifications, low frequency analysis of multistage amplifiers.

UNIT-II		**7 Hours**

High frequency transistor: models, frequency response of single stage and multistage amplifiers, cascade amplifier, various classes of operation (Class A, B, AB, C etc.), their power efficiency and linearity issues, feedback topologies: Voltage series, current series, voltage shunt, current shunt, effect of feedback on gain, bandwidth etc., calculation with practical circuits, concept of stability, gain margin and phase margin

UNIT-III		**9 Hours**

Oscillators: Review of the basic concept, Barkhuizen criterion, RC oscillators (phase shift, Wien bridge etc.), LC oscillators (Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators

UNIT-IV		**8 Hours**

Current mirror: Basic topology and its variants, V-I characteristics, output resistance and minimum sustainable voltage (VON), maximum usable load, differential amplifier: Basic structure and principle of operation, calculation of differential gain, common mode gain, CMRR and ICMR, Op-Amp design: Design of differential amplifier for a given specification, design of gain stages and output stages, compensation

UNIT-V		**8 Hours**

Op-Amp applications: Review of inverting and non-inverting amplifiers, integrator and differentiator, summing amplifier, precision rectifier, Schmitt trigger and its applications, active filters: Low pass, high pass, band pass and band stop, design guidelines.

Course outcome:

At the end of the course the students will be able to

		Levels
CO 1	Understand the characteristics of diodes and transistors.	K2
CO 2	Design and analyze various rectifier and amplifier circuits	K4
CO 3	Design sinusoidal and non-sinusoidal oscillators.	K2
CO 4	Understand the functioning of OP-AMP and design OP-AMP based circuits.	K3
CO 5	Design LPF, HPF, BPF, BSF.	K3

Text books

1. J.V. Wait, L.P. Huelsman and GA Korn, "Introduction to Operational Amplifier theory and applications," McGraw Hill, 1992.

2. J. Millman and A. Grabel, "Microelectronics," 2ndedition, McGraw Hill, 1988.

3.P. Horowitz and W. Hill, "The Art of Electronics," 2ndedition, Cambridge University Press, 1989.

4. A.S. Sedra and K.C. Smith, "Microelectronic Circuits, "Saunder's College11 Publishing, 4th edition.

5. Paul R. Gray and Robert G. Meyer, "Analysis and Design of Analog Integrated Circuits," John Wiley, 3rd edition

6. Muhammad H. Rashid, "Electronic Devices and Circuits," Cengage publication, 2014.

B TECH SECOND YEAR			
Course Code	**AOE0466**	**L T P**	**Credit**
Course Title	**Electronics Engineering**	**3 1 0**	**4**
Course objective:Students will learn			
CO1	the concept of PN junction and special purpose diodes		K2
CO2	The application of conventional diode and semiconductor diode.		K3
CO3	The I-V characteristics of BJT and FET		K4
CO4	The of Op-Amp, amplifiers, integrator, and differentiator.		K3
CO5	The concept of digital storage oscilloscope and compare of DSO with analog oscilloscope		K5
Pre-requisites: •			
Course Content / Syllabus			
UNIT-I			**10 Hours**
P-N junction diode: Introduction of semiconductor materials; Semiconductor diode: Depletion layer, V-I characteristics, ideal and practical, diode resistance, capacitance, diode equivalent circuits, transition and diffusion capacitance, Zener diodes breakdown mechanism (Zener and			

avalanche)

UNIT-II		7 Hours

Diode application: Series, parallel and series, parallel diode configuration, half and full wave rectification, clippers, clampers, Zener diode as shunt regulator, voltage-multiplier circuits special purpose two terminal devices : light-emitting diodes, Varactor (Varicap) diodes, tunnel diodes, liquidcrystal displays.

UNIT-III		9 Hours

Bipolar junction transistors and field effect transistor: Bipolar junction transistor: Transistor construction, operation, amplification action, common base, common emitter, common collector configuration dc biasing BJTs: operating point, fixed-bias, emitter bias, voltage-divider bias configuration. Collector feedback, emitter-follower configuration. Bias stabilization. CE, CB, CC amplifiers and AC analysis of single stage CE amplifier (re Model), Field effect transistor: Construction and characteristic of JFETs. AC analysis of CS amplifier, MOSFET (depletion and enhancement) type, transfer characteristic.

UNIT-IV		8 Hours

Operational amplifiers: Introduction and block diagram of Op-Amp, ideal & practical characteristics of Op-Amp, differential amplifier circuits, practical Op-Amp circuits (inverting amplifier, non-inverting amplifier, unity gain amplifier, summing amplifier, integrator, differentiator), OpAmp parameters: input offset voltage, output offset voltage, input biased current, input offset current differential and common-mode operation.

UNIT-V		8 Hours

Electronic instrumentation and measurements: Digital voltmeter: Introduction, RAMP techniques digital multimeters: Introduction Oscilloscope: introduction, basic principle, CRT, block diagram of oscilloscope, simple, measurement of voltage, current phase and frequency using CRO, introduction of digital storage oscilloscope and comparison of DSO with analog oscilloscope.

Course outcome:

At the end of the course the students will be able to		Levels
CO 1	Understand the concept of PN junction and special purpose diodes	K2
CO 2	Study the application of conventional diode and semiconductor diode.	K4
CO 3	Analyse the I-V characteristics of BJT and FET	K2
CO 4	Analyze the of Op-Amp, amplifiers, integrator, and differentiator.	K3
CO 5	Understand the concept of digital storage oscilloscope and compare of DSO with analog oscilloscope	K3

Text books

1. Robert L. Boylestand / Louis Nashelsky, “Electronic Devices and Circuit Theory,” Latest Edition, Pearson Education

2. H.S Kalsi, “Electronic Instrumentation”, Latest Edition, TMH Publication.

3. **M**eetidehran/ A.K. singh “fundamental of electronics Engineering”, New age international publisher.