JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

=== B.Tech (Mechanical Engineering) (R20) 2020 Admitted Batch Course Structure

Induction Program – 3 weeks

I- Year B.Tech.

Semester-1(Theory-4,Lab -5)					
S.No	**CourseNo**	**CourseName**	**Category**	**L-T-P**	**Credits**
1.	20A15101	Linear Algebra and Calculus Common to All branches of Engineering	BS	3-0-0	3
2.	20A15301	Engineering Chemistry Common to CE, MECH, CHEM	BS	3-0-0	3
3.	20A10506	C-Programming & Data Structures Common to CE, MECH, CHEM	ES	3-0-0	3
4.	20A10804	Materials Science & Engineering	ES	3-0-0	3
5	20A10303	EngineeringWorkshop Common to CE, MECH, CHEM	LC	0-0-3	1.5
6	20A10508	IT Workshop Common to CE, MECH, CHEM	LC	0-0-3	1.5
7.	20A10805	Materials Science & Engineering Lab	ES	0-0-3	1.5
8.	20A15302	Engineering Chemistry Lab Common to CE, MECH, CHEM	ES	0-0-3	1.5
9.	20A10507	C-Programming & Data Structures Lab Common to CE, MECH, CHEM	ES	0-0-3	1.5
				Total	**19.5**

Semester–2(Theory–5,Lab –4, MC-1)					
S.No	**CourseNo**	**CourseName**	**Category**	**L-T-P**	**Credits**
1.	20A15102	**Differential Equations and Vector Calculus** Common to all branches of Engineering except CSE	BS	3-0-0	3
2.	20A15203	Engineering Physics Common to CE, MECH, CHEM	BS	3-0-0	3
3.	20A15501	CommunicativeEnglish Common to CE, MECH,	HS	3-0-0	3
4.	20A12401	Basic Electrical & Electronic Engineering Common to MECH, CSE & CHEM	ES	3-0-0	3
5.	20A10301	Engineering Drawing Common to CE, MECH, CHEM	LC	1-0-2	2
6.	20A10302	Engineering Graphics Lab Common to CE, MECH, CHEM	LC	0-0-2	1
7.	20A15502	CommunicativeEnglish Lab Common to CE, MECH,	HS	0-0-3	1.5
8.	20A15204	EngineeringPhysics Lab Common to CE, MECH, CHEM	BS	0-0-3	1.5
9.	20A12402	Basic Electrical & Electronic Engineering Common to MECH, CSE & CHEM	ES	0-0-3	1.5
10	20A19101	Universal Human Values Common to CE, MECH, CHEM	MC	3-0-0	0
*FOR 2020 Admitted Batch only				**Total**	**19.5**

JNTUA COLLEGE OF ENGINEERING (Autonomous) ANANTHAPURAMU
DEPARTMENT MECHANICAL ENGINEERING
COURSE STRUCTURE – R20 REGULATIONS II-
B.Tech Course Structure- 2020 Admitted Batch

II-B.Tech Semester-I							
S.No	**Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
1	20A35102	Complex variables, and Transforms Techniques Common to EEE, MECH, ECE	**BS**	**3**	**0**	**0**	**3**
2	20A30108	Theory-2 Fluid Mechanics& Hydraulic Machines	**PC/ES**	**3**	**0**	**0**	**3**
3	20A30301	Theory-3 Manufacturing Processes	**PC/ES**	**3**	**0**	**0**	**3**
4	20A30302	Theory-4 Thermodynamics	**PC/ES**	**3**	**0**	**0**	**3**
5	20A30303	Theory-5 Mechanics of Materials	**PC/ES**	**3**	**0**	**0**	**3**
6	20A30109	Laboratory-1 Fluid Mechanics& Hydraulic Machines lab	**PC/ES**	**0**	**0**	**3**	**1.5**
7	20A30304	Laboratory-2 Manufacturing Processes Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
8	20A30305	Laboratory-3 Mechanics of Materials Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
9	20A30306	**Skill oriented Course-I** Essential for NX Designer	**SC**	**1**	**0**	**2**	**2**
10	20A10803	**Mandatory non-credit Course- II Common to CE,Mech, CHEM** Environmental Science	**MC**	**3**	**0**	**0**	**0**
					Total		**21.5**

JNTUA COLLEGE OF ENGINEERING (Autonomous) ANANTHAPURAMU
DEPARTMENT MECHANICAL ENGINEERING
COURSE STRUCTURE – R20 REGULATIONS II-
B.Tech Course Structure- 2020 Admitted Batch

II-B.Tech Semester-II							
S. No	**Code**	**Course Name**	**Category**	**L**	**T**	**P**	**Credits**
1	20A45101	Numerical Methods &Probability Theory Common to EEE, MECH	**BS**	**3**	**0**	**0**	**3**
2	20A40301	Theory-2 Applied Thermodynamics	**PC/ES**	**3**	**0**	**0**	**3**
3	20A40302	Theory-3 Kinematics of Machinery	**PC/ES**	**3**	**0**	**0**	**3**
4	20A40303	Theory-4 Manufacturing Technology	**PC/ES**	**3**	**0**	**0**	**3**
5	0 20A49101 a	**Humanities Elective-I Common to Civil, Mech, chemical** 1.Managerial Economics & Financial Analysis	**HS**	**3**	**0**	**0**	**3**
	20A49101 b	Entrepreneurship and incubation					
	20A49101 c	Business Ethics and Corporate Governance					
6	20A40304	Laboratory-1 Applied Thermodynamics Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
7	20A40305	Laboratory-2 Manufacturing Technology Lab	**PC/ES**	**0**	**0**	**3**	**1.5**
8	20A40306	Laboratory-3 Computer Aided Machine Drawing	**PC/ES**	**0**	**0**	**3**	**1.5**
9	20A40307	Skill oriented Course-II Application Development with Python	**SC**	**1**	**0**	**2**	**2**
10	20A49102	Mandatory non-credit Course-III Common to All Branches Design Thinking for Innovation	**MC**	**2**	**0**	**0**	**0**
11	20A49901	NSS/NCC/NSO Activities	**-**	**0**	**0**	**2**	**0**
						Total	**21.5**

Community Service Internship/Project (Mandatory) for 6 weeks during Summer vacation

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

Department of Mechanical Engineering

Course Structure III -I B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester–V						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50301	Theory – 1 Design of Machine Members	3	0	0	3
2.	20A50302	Theory – 2 Metrology and Measurements	3	0	0	3
3.	20A50303	Theory – 3 Dynamics of Machinery	2	0	1	3
4.	20A50304a 20A50304b 20A50304c	**Professional Elective Course – I** 1. Power Plant Engineering 2. Tool Design 3. Automation and robotics	3	0	0	3
5.	20A50305	**Open Elective Course – I** **Common to All Branches** **Optimization Techniquies** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A50306	Lab-1 Metrology and Measurements	0	0	3	1.5
7.	20A50307	Lab-2 Dynamics Laboratory	0	0	3	1.5
8.	20A50308	**Skill oriented course - III** Computer Aided Modeling	1	0	2	2
9.	20A50309	Evaluation of Community Service Project				1.5
10.	20A59101	**Mandatory Non-credit Course** Indian Constitution (CIV, ME, CHEM)	2	0	0	0
Total						**21.5**

Note:

A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.

A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.

A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
Department of Mechanical Engineering
Course Structure III -II B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester–VI						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60301	Theory – 1 CAD/CAM	3	0	0	3
2.	20A60302	Theory – 2 Finite Elements Methods	3	0	0	3
3.	20A60303	Theory – 3 Heat Transfer	3	0	0	3
4.	 20A60304a 20A60304b 20A60304c	**Professional Elective Course– II** 1. Production and Operation Management 2. Non-Destructive Testing 3. Total Quality management	3	0	0	3
5.	20A60305	**Open Elective Course – II** **Common to all Branches** **Solar Energy Systems** (Each department offer one course including Mathematics, Physics, Chemistry andHSS)	3	0	0	3
6.	20A60306	Lab-1 Computer Aided design Laboratory	0	0	3	1.5
7.	20A60307	Lab-2 Computer Aided Manufacturing	0	0	3	1.5
8.	20A60308	Lab-3HeatTransferLaboratory	0	0	3	1.5
9.	20A65502	**Skill oriented course - IV** Soft Skills (CIV, ME, Chemical)	1	0	2	2
10.	20A69901	**Mandatory Non-credit Course** Intellectual Property Rights & Patents (CIV, ME, CHEM)	2	0	0	0
Total						**21.5**
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Department of Mechanical Engineering

Course Structure IV -I B.TECH. – < ME> (R20)- 2020 Admitted Batch

Semester-VII						
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	 20A70301a 20A70301b 20A70301c	**Professional Elective Course– III** 1. Refrigeration & Air Conditioning 2. Operation Research 3. Design for Manufacturing	3	0	0	3
2.	 20A70302a 20A70302b 20A70302c	**Professional Elective Course– IV** 1. Automobile Engineering 2. Mechanical Vibrations 3. Modern Manufacturing Methods	3	0	0	3
3.	 20A70303a 20A70303b 20A70303c	**Professional Elective Course– V (MOOC)** 1.Heat exchangers, Fundamentals and design analysis 2. Mechatronics 3.Theory of Composite Materials	3	0	0	3
4.	20A75401a 20A75401b 20A75401c	**Humanities Elective** **Common to All Branches** 1. Management Science 2. Business Environment 3. Organizational Behavior	3	0	0	3
5.	20A70304	**Open Elective Course – III** **Common to All Branches** **Modern Manufacturing Methods** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
6.	20A70305	**Open Elective Course – IV** **Material Handling Equipment** **Common to All Branches** (Each department offer one course including Mathematics, Physics, Chemistry and HSS)	3	0	0	3
7.	20A70306	**Skill oriented course – V** INDUSTRIALAUTOMATION	1	0	2	2
8.	20A70307	Evaluation of Industry Internship				3
Total						**23**

JNTUA COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

Department of Mechanical Engineering

Course Structure IV -II B.TECH. – < ME> R20- 2020 Admitted Batch

Semester-VIII							
S.No.	**Course Code**	**Course Name**	**Category**	**L**	T	**P**	**Credits**
1.	20A80301	Full Internship & Project work	PR				12
						Total	**12**

Common to All Branches

		Open Elective Course – I*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A50105	Experimental Stress Analysis	3	0	0	3
2.	20A50205	Electric Vehicle Engineering	3	0	0	3
3.	20A50305	Optimization Techniques	3	0	0	3
4.	20A50405	Basics of Electronics and Communication	3	0	0	3
5.	20A50505	Introduction to Java Programming	3	0	0	3
6.	20A50805	Energy Conversion and Storage Devices	3	0	0	3
7.	20A55101	Optimization Methods (Mathematics)	3	0	0	3
8.	20A55201	Material Characterization Techniques(Physics)	3	0	0	3
9.	20A55401	E-Business (H & SS)	3	0	0	3
10.	20A55301	Chemistry Of Energy Materials (Chemistry)	3	0	0	3

***It is mandatory that the candidate should select any subject other than parent branch subject.**

		Open Elective Course – II				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A60105	Disaster Management(CIVIL)	3	0	0	3
2.	20A60205	Renewable Energy Systems(EEE)	3	0	0	3
3.	20A60305	Solar Energy Systems(MECH)	3	0	0	3
4.	20A60405	Basics of Integrated Circuits Applications(ECE)	3	0	0	3
5.	20A60505	Introduction to Linux Programming (CSE) (CSE)	3	0	0	3
6.	20A60805	Green Technology(CHEM)	3	0	0	3
7.	20A65101	Mathematical Modelling & Simulation (Common for CIVIL,MECH &CHEM)(Mathemtics)	3	0	0	3
8.	20A65102	Wavelet transforms and its Applications (Common for EEE&ECE) (Mathemtics)	3	0	0	3
9.	20A65103	Statistical Methods for Data Science CSE (Data Science) (Mathemtics)	3	0	0	3
10.	20A65201	Physics Of Electronic Materials And Devices (Physics)	3	0	0	3
11.	20A65501	Academic Writing and Public Speaking(H & SS)	3	0	0	3
12.	20A65301	Chemistry Of Polymers And Its Applications (Chemistry)	3	0	0	3

***It is mandatory that the candidate should select any subject other than parent branch subject.**

Common to All Branches

		Open Elective Course – III*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70103	Building Technology for Engineers (CIVIL)	3	0	0	3
2.	20A70204	Battery Management Systems (EEE)	3	0	0	3
3.	20A70304	Modern Manufacturing Methods (MECH)	3	0	0	3
4.	20A70404	Digital Electronics (ECE)	3	0	0	3
5.	20A70504	Cyber Security (CSE)	3	0	0	3
6.	20A70804	Industrial Pollution Control Engineering (CHEM)	3	0	0	3
7.	20A75101	Numerical Methods for Engineers	3	0	0	3
8.	20A75201	SMART MATERIALS AND DEVICES (Physics)	**3**	**0**	**0**	**3**
9.	20A75501	Employability Skills (H&SS)	**3**	**0**	**0**	**3**
10.	20A75301	GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (Chemistry)	**3**	**0**	**0**	**3**

***It is mandatory that the candidate should select any subject other than parent branch subject.**

		Open Elective Course – IV*				
S.No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**Credits**
1.	20A70104	Environmental Impact and Assessment (CIVIL)	3	0	0	3
2.	20A70205	IOT Applications in Electrical Engineering (EEE)	3	0	0	3
3.	20A70305	Material Handling Equipment (MECH)	3	0	0	3
4.	20A70405	Principles of Digital Signal Processing (ECE)	3	0	0	3
5.	20A70505	Introduction to DBMS (CSE)	3	0	0	3
6.	20A70805	Solid Waste management (CHEM)	3	0	0	3
7.	20A75102	Number theory and its Applications (Mathemtics)	3	0	0	3
8.	20A75202	Sensors and Actuators For Engineering Applications (Physics)	**3**	**0**	**0**	**3**
9.	20A79102	English Literary Spectrum (H & Ss)	**3**	**0**	**0**	**3**
10.	20A75302	Chemistry Of Nanomaterials And Applications (Chemistry)	**3**	**0**	**0**	**3**

***It is mandatory that the candidate should select any subject other than parent branch subject.**

HONOURS DEGREE IN MECHANICAL ENGINEERING
INTERNAL COMBUSTION ENGINE (R20)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1	20A03H11	Internal combustion Engine Design	3	1	4
2	20A03H12	Engine Auxiliary Systems	3	1	4
3	20A03H13	Alternative fuels for I.C.Engines	3	1	4
4	20A03H14	Engine pollution and control	3	1	4
5	20A03H15	MOOC I**: Hybrid and Electric vehicles			2
6	20A03H16	MOOC II**: Automotive safety			2

**** Based on the availability of courses offered by NPTEL SWAYAM with a minimum of 12 weeks duration.**

ANANTAPUR COURSES OFFERED FOR MINOR DEGREE IN THE STREAM OF MECHANICAL ENGINEERING -3D PRINTING (Offered to other Engineering Branches R20)
3D PRINTING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M11	Material Science for engineering	3	1	0	4
2	20A03M12	Computer Aided Machine Drawing	3	1	0	4
3	20A03M13	3D Printing Materials	3	1	0	4
4	20A03M14	Applications of 3D Printing	3	1	0	4
5	20A03M15a	MOOC I**: Metal Additive Manufacturing https://onlinecourses.nptel.ac.in/noc22_me130/preview				2
6	20A03M16a	MOOC II**: Introduction to Composites https://nptel.ac.in/courses/112104168				2

**** Based on the availability of courses offered by NPTEL SWAYAM with a minimum of 12 weeks duration.**

JNTUACEA **R20**

2020-21

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

I- Year B.Tech. I-Sem

L	P	T	C
3	0	1	3

Linear Algebra & Calculus

Common to All Branches of Engineering

Course Objectives:

This course will illuminate the students in the concepts of calculus and linear algebra.

To equip the students with standard concepts and tools at an intermediate to advanced level mathematics to develop the confidence and ability among the students to handle various real world problems and their applications.

Bridge Course: Limits, continuity, Types of matrices

Unit 1: Matrices **10 hrs**

Rank of a matrix by echelon form, normal form. Solving system of homogeneous and non-homogeneous equations linear equations. Eigenvalues and Eigenvectors and their properties, Properties of Eigen values and Eigen vectors on special matrices, Cayley-Hamilton theorem (without proof), finding inverse and power of a matrix by Cayley-Hamilton theorem, diagonalisation of a matrix.

Learning Outcomes:

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

solving systems of linear equations, using technology to facilitate row reduction determine the rank, eigenvalues and eigenvectors (L3).

identify special properties of a matrix, such as positive definite, etc., and use this information to facilitate the calculation of matrix characteristics; (L3)

Unit 2: Mean Value Theorems **6hrs**

Rolle"s Theorem, Lagrange"s mean value theorem, Cauchy"s mean value theorem, Taylor"s and Maclaurin theorems with remainders (without proof), related problems.

Learning Outcomes:

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

Translate the given function as series of Taylor"s and Maclaurin"s with remainders (L3)

analyze the behaviour of functions by using mean value theorems (L3)

Unit 3: Multivariable calculus **10 hrs**

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

Learning Outcomes:

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

- Find partial derivatives numerically and symbolically and use them to analyze and interpret the way a function varies. (L3)
- Acquire the Knowledge maxima and minima of functions of several variable (L1)
- Utilize Jacobian of a coordinate transformation to deal with the problems in change of variables (L3)

Unit 4: Multiple Integrals **10hrs**

Double integrals, change of order of integration, change of variables. Evaluation of triple integrals, change of variables between Cartesian, cylindrical and spherical polar co-ordinates. Finding areas and volumes using double and triple integrals.

Learning Outcomes:

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

- Evaluate double integrals of functions of several variables in two dimensions using Cartesian and polar coordinates (L5)
- Apply double integration techniques in evaluating areas bounded by region (L4)
- Evaluate multiple integrals in Cartesian, cylindrical and spherical geometries (L5)

Unit 5: Beta and Gamma functions **6 hrs**

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

Learning Outcomes:

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

- understand beta and gamma functions and its relations (L2)
- Conclude the use of special function in evaluating definite integrals (L4)

Text Books:

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

Reference Books:

R. K. Jain and S. R. K. Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

George B. Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.

Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 201.

Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn

Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press

Peter O‟neil, Advanced Engineering Mathematics, Cengage Learning.

R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education

B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education

H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.

N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

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

Utilize mean value theorems to real life problems (L3)

familiarize with functions of several variables which is useful in optimization (L3)

Students will also learn important tools of calculus in higher dimensions. Students will become familiar with 2- dimensional coordinate systems (L5)

Students will become familiar with 3- dimensional coordinate systems and also learn the utilization of special functions

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

I- Year B.Tech. I-Sem	**L**	**T**	**P**	**C**
	2	**1**	**0**	**3**

(Common to CE, MECH, CHEM)

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

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

COURSE OUTCOMES	
CO1	**list** the differences between temporary and permanent hardness of water, **explain**the principles of reverse osmosis and electrodialysis. **compare**quality ofdrinking water with BIS and WHO standards. **illustrate**problems associated with hard water - scale and sludge**. explain** the working principles of different Industrial water treatment processes
CO2	**apply** Nernst equation for calculating electrode and cell potentials, **apply** Pilling Bedworth rule for corrosion and corrosion prevention, **demonstrate** the corrosion prevention methods and factors affecting corrosion, **compare** different batteries and their applications
CO3	**explain** different types of polymers and their applications, **Solve the numerical problems based on Calorific value, select** suitable fuels for IC engines, **explain** calorific values, octane number, refining of petroleum and cracking of oils
CO4	explain the constituents of Composites and its classification Identify the factors affecting the refractory material, Illustrate the functions and properties of lubricants, demonstrate the phases and reactivity of concrete formation, identify the constituents of Portland cement, enumerate the reactions at setting and hardening of the cement
CO5	**summarize** the applications of SEM, TEM and X-ray diffraction in surface characterization, **explain** the synthesis of colloids with examples, **outline** the preparation of nanomaterials and metal oxides **identify** the application of colloids and nanomaterials in medicine, sensors and catalysis

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

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

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

Unit 2: Electrochemistry and Applications: (10 hrs)
Electrodes – concepts, electrochemical cell, Nernst equation, cell potential calculations.

Primary cells – Zn-MnO_2 (Leclanche cell), Li Battery
Secondary cells – lead acid and lithium ion batteries- working of the batteries including cell reactions.

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

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

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

Introduction to polymers, functionality of monomers, Mechanism of chain growth, step growth and coordination polymerization,

Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of PVC and Bakelite

Elastomers – Preparation, properties and applications of Buna S, Buna N, Thiokol
Fuels – Types of fuels, calorific value, numerical problems based on calorific value; Analysis of coal, Liquid Fuels refining of petroleum, fuels for IC engines, knocking and anti-knock agents,

Octane and Cetane values, cracking of oils; alternative fuels- propane, methanol and ethanol, bio fuels.

UNIT-4 Advanced Engineering Materials **(8 hrs)**

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

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

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

Text Books:

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

References:

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

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

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

I- Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Common to CE, ME, , CHEM

C-Programming & Data Structures 20A10506

Course Objectives:

To illustrate the basic concepts of C programming language.
To discuss the concepts of Functions, Arrays, Pointers and Structures.
To familiarize with Stack, Queue and Linked lists data structures.
To explain the concepts of non-linear data structures like graphs and trees.
To learn different types of searching and sorting techniques.

Unit-1

Introduction to C Language - C language elements, variable declarations and data types, operators and expressions, decision statements - If and switch statements, loop control statements - while, for, do-while statements, arrays.

At the end of the Unit, students should be able to:

Use C basic concepts to write simple C programs. (L3)
Use iterative statements for writing the C programs (L3)
Use arrays to process multiple homogeneous data. (L3)
Test and execute the programs and correct syntax and logical errors. (L4)
Translate algorithms into programs. (L4)
Implement conditional branching, iteration and recursion. (L2)

Unit – 2

Functions, types of functions, Recursion and argument passing, pointers, storage allocation, pointers to functions, expressions involving pointers, Storage classes – auto, register, static, extern, Structures, Unions, Strings, string handling functions, and Command line arguments.

At the end of the Unit, students should be able to:

Writing structured programs using C Functions. (L5)
Writing C programs using various storage classes to control variable access. (L5)
Apply String handling functions and pointers. (L3)
Use arrays, pointers and structures to formulate algorithms and write programs.(L3)

Unit-3

Data Structures, Overview of data structures, stacks and queues, representation of a stack, stack related terms, operations on a stack, implementation of a stack, evaluation of arithmetic expressions, infix, prefix, and postfix notations, evaluation of postfix expression, conversion of expression from infix to postfix, recursion, queues - various positions of queue, representation of queue, insertion, deletion, searching operations.

At the end of the Unit, students should be able to:

Describe the operations of Stack. (L2)
Explain the different notations of arithmetic expression. (L5)
Develop various operations on Queues. (L6)

Unit – 4

Linked Lists – Singly linked list, dynamically linked stacks and queues, polynomials using singly linked lists, using circularly linked lists, insertion, deletion and searching operations, doubly linked lists and its operations, circular linked lists and its operations.

At the end of the Unit, students should be able to:

Analyze various operations on singly linked list. (L4)
Interpret operations of doubly linked lists. (L2)
Apply various operations on Circular linked lists. (L6)

Unit-5

Trees - Tree terminology, representation, Binary trees, representation, binary tree traversals. binary tree operations, **Graphs** - graph terminology, graph representation, elementary graph operations, Breadth First Search (BFS) and Depth First Search (DFS), connected components, spanning trees. **Searching and Sorting** – sequential search, binary search, exchange (bubble) sort, selection sort, insertion sort.

At the end of the Unit, students should be able to:

Develop the representation of Tress. (L3)
Identify the various Binary tree traversals. (L3)
Illustrate different Graph traversals like BFS and DFS. (L2)
Design the different sorting techniques (L6)
Apply programming to solve searching and sorting problems. (L3)

Text Books:

The C Programming Language, Brian W Kernighan and Dennis M Ritchie, Second Edition, Prentice Hall Publication.

Fundamentals of Data Structures in C, Ellis Horowitz, SartajSahni, Susan Anderson-Freed, Computer Science Press.

Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. AnandaRao, Pearson Education.

B.A. Forouzon and R.F. Gilberg, “COMPUTER SCIENCE: A Structured Programming Approach Using C”, Third edition, CENGAGE Learning, 2016.

Richard F. Gilberg & Behrouz A. Forouzan, “Data Structures: A Pseudocode Approach with C”, Second Edition, CENGAGE Learning, 2011.

Reference Books:

Pradip Dey and Manas Ghosh, Programming in C, Oxford University Press, 2nd Edition 2011.

E. Balaguruswamy, “C and Data Structures”, 4^{th} Edition, Tata Mc Graw Hill.

A.K. Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

M.T. Somashekara, “Problem Solving Using C”, PHI, 2^{nd} Edition 2009.

Course Outcomes:

Analyse the basicconcepts of C Programming language. (L4)

Design applications in C, using functions, arrays, pointers and structures. (L6)

Apply the concepts of Stacks and Queues in solving the problems. (L3)

Explore various operations on Linked lists. (L5)

Demonstrate various tree traversals and graph traversal techniques. (L2)

Design searching and sorting methods (L3)

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

I-Year B.Tech. I-Sem

L	T	P	C
3	0	0	3

Material Science & Engineering 20A10804

Course Objectives:

- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams.
- Expose commercially important metals and alloys (both ferrous and non ferrous) with engineering constraints.
- Explain the methods to change the properties of materials through heat treatment processes
- Familiarize properties and applications of ceramics, polymers and composite materials.
- Demonstrate the fundamental properties of nano-materials and their applications.

UNIT I

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions-Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron-Iron-carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

Learning Outcomes:

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

- Understand the importance of material science in engineering.(L2)
- Recall the definitions and terminology of crystallography. (L1)
- Distinguish metals and alloys. (L4)
- Make use of the principles of construction of binary phase diagrams. (L3)
- Identify various invariant reactions in binary phase diagrams. (L3)
- Know the concept of metallography in studying the microstructures of metals and alloys. (L2)

UNIT II

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels-stainless steels and tool steels.

Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

Learning Outcomes:

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

- Classify various types of steels, their properties and applications. (L2)
- Identify various types of cast irons, their properties and applications. (L3)
- Compare steels and cast irons and their limitations in applications. (L3)

UNIT III

Heat Treatment of Steels: Annealing, tempering, normalizing and hardening, isothermal transformation diagrams for Fe-Fe_3C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening - carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

Learning Outcomes:

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

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

UNIT IV

Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper, aluminium, titanium, nickel and their alloys. Study of Al-Cu phase diagram

Learning Outcomes:

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

- Understand the importance of non-ferrous metals and alloys in engineering applications. (L2)
- Demonstrate various properties and applications of non-ferrous alloys. (L4)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

UNIT V

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Learning Outcomes:

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

- Understand the properties of ceramics and their applications. (L2)
- Summarize the properties of polymers and composites and their use. (L2)
- Interpret the properties of nano materials and their applications. (L2)
- Identify the difference between the micro and nano scale materials and their uses. (L3)

Course Outcomes:

After completing the course, the student will be able to

- Explain the principles of binary phases. (L2)
- Select steels and cast irons for a given application. (L3)
- Apply heat treatment to different applications. (L3)
- Utilize nonferrous metals and alloys in engineering. (L3)
- Choose composites for various applications. (L3)
- Assess the properties of nano-scale materials and their applications. (L2)
- Differentiate between hardening of ferrous and non-ferrous alloys. (L4)

Text Book(s)

V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997R.

References

Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
Balasubramaniam, Callister‟s Material Science and Engineering, 2/e, Wiley India, 2014.

L.H.Van Vlack, Elements of Material Science and Engineering, 6/e, Pearson

Education, 2008.

4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

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

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Engineering Workshop
(Common to CE, MECH, CHEM)

Course Objective: 20A10303	
1	To familiarize students with wood working, sheet metal operations, fitting and electrical house wiring skills.

Wood Working:

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

Half – Lap joint
Mortise and Tenon joint
Corner Dovetail joint or Bridle joint

Sheet Metal Working:

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

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

Fitting:

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

a) V-fit b) Dovetail fit c) Semi-circular fit
d) Bicycle tyre puncture and change of two wheeler tyre

Electrical Wiring:

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

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

Power tools:

Demonstration of a) Circular Saw b) Power Planer
c) Zig Saw d) Buffing Machine

After completion of t lab the student will be able to

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

Note: In each section a minimum of three exercises are to be carried out.

(w.e.f 2020-21)

JNTUA College of Engineering (Autonomous) Ananthapuramu
Department of Computer Science and Engineering B.Tech (R20)

B.Tech I Year

IT Workshop 20A10508

(Common to CE, ME, CHEM)

L-T-P-C: 0-0-3-1.5

Note: Use open source tools for implementation of the following exercises.

Course Objectives:

- To make the students know about the internal parts of a computer, assembling and dissembling a computer from the parts, preparing a computer for use by installing the operating system
- To provide Technical training to the students on Productivity tools like Word processors, Spreadsheets, Presentations and LAteX
- To learn about Networking of computers and use Internet facility for Browsing and Searching
- To learn about Google Forms and Google Sites

Preparing your Computer

Task 1: Learn about Computer: Identify the internal parts of a computer, and its peripherals. Represent the same in the form of diagrams including Block diagram of a computer. Write specifications for each part of a computer including peripherals and specification of Desktop computer. Submit it in the form of a report.

Task 2: Assembling a Computer: Disassemble and assemble the PC back to working condition. Students should be able to trouble shoot the computer and identify working and non-working parts. Student should identify the problem correctly by various methods

Task 3: Install Operating system: Student should install Linux on the computer. Student may install another operating system (including proprietary software) and make the system dual boot or multi boot. Students should record the entire installation process.

Task 4: **Operating system features**: Students should record the various features that are supported by the operating system(s) installed. They have to submit a report on it. Students should be able to access CD/DVD drives, write CD/DVDs, access pen drives, print files, etc. Students should install new application software and record the installation process.

Networking and Internet

Task 5: Networking: Students should connect two computers directly using a cable or wireless connectivity and share information. Students should connect two or more computers using switch/hub and share information. Crimpling activity, logical configuration etc. should be done by the student. The entire process has to be documented.

Task 6: Browsing Internet: Student should access the Internet for Browsing. Students should search the Internet for required information. Students should be able to create e-mail account and send email. They should get acquaintance with applications like Facebook, skype etc. If Intranet mailing facility is available in the organization, then students should share the information using it. If the operating system supports sending messages to multiple users (LINUX supports it) in the same network, then it should be done by the student. Students are expected to submit the information about different browsers available, their features, and search process using different natural languages, and creating e-mail account.

Task 7: Antivirus: Students should download freely available Antivirus software, install it and use it to check for threats to the computer being used. Students should submit information about the features of the antivirus used, installation process, about virus definitions, virus engine etc.

Productivity tools

Task 8: Word Processor: Students should be able to create documents using the word processor tool. Some of the tasks that are to be performed are inserting and deleting the characters, words and lines, Alignment of the lines, Inserting header and Footer, changing the font, changing the colour, including images and tables in the word file, making page setup, copy and paste block of text, images, tables, linking the images which are present in other directory, formatting paragraphs, spell checking, etc. Students should be able to prepare project cover pages, content sheet and chapter pages at the end of the task using the features studied. Students should submit a user manual of the word processor considered, Image Manipulation tools.

Task 9: Presentations: creating, opening, saving and running the presentations, selecting the style for slides, formatting the slides with different fonts, colours, creating charts and tables, inserting and deleting text, graphics and animations, bulleting and numbering, hyperlinking, running the slide show, setting the timing for slide show.

Task 10: Spreadsheet: Students should be able to create, open, save the application documents and format them as per the requirement. Some of the tasks that may be practiced are Managing the worksheet environment, creating cell data, inserting and deleting cell data, format cells, adjust the cell size, applying formulas and functions, preparing charts, sorting cells. Students should submit a user manual of the Spreadsheet

Task 11: LateX: Introduction to Latex and its installation and different IDEs. Creating first document using Latex, using content into sections using article and book class of LaTeX. Styling

Pages: reviewing and customizing different paper sizes and formats. Formatting text (styles, size, alignment, colors and adding bullets and numbered items, inserting mathematical symbols, and images, etc.). Creating basic tables, adding simple and dashed borders, merging rows and columns. Referencing and Indexing: cross-referencing (refer to sections, table, images), bibliography (references).

References:

Introduction to Computers, Peter Norton, McGraw Hill

MOS study guide for word, Excel, Powerpoint& Outlook Exams, Joan Lambert, Joyce Cox, PHI.

Introduction to Information Technology, ITL Education Solutions limited, Pearson Education.

Networking your computers and devices, Rusen, PHI

Trouble shooting, Maintaining & Repairing PCs, Bigelows, TMH

Lamport L. LATEX: a document preparation system: user's guide and reference manual. Addison-wesley; 1994.

Course Outcomes:

Disassemble and Assemble a Personal Computer and prepare the computer ready to use.

Prepare the Documents using Word processors and Prepare spread sheets for calculations .using excel and also the documents using LAteX.

Prepare Slide presentations using the presentation tool.

Interconnect two or more computers for information sharing.

Access the Internet and Browse it to obtain the required information.

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

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Engineering Chemistry Lab
(Common to CE, MECH, CHEM)

Subject Code	Title of the Lab	L	T	P	C
19A15302	Engineering Chemistry lab	-	-	4	2

COURSE OBJECTIVES	
1	Verify the fundamental concepts with experiments

COURSE OUTCOMES	
CO1	**determine** the cell constant and conductance of solutions (L3)
CO2	**prepare** advanced polymer materials (L2)
CO3	**determine** the physical properties like surface tension, adsorption and viscosity (L3)
CO4	**estimate** the Iron and Calcium in cement (L3)
CO5	**calculate** the hardness of water (L4)

Mapping between Course Outcomes and Programme Outcomes

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

LIST OF EXPERIMENTS

Determination of Hardness of a groundwater sample.
pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base
Determination of cell constant and conductance of solutions
Potentiometry - determination of redox potentials and emfs
Determination of Strength of an acid in Pb-Acid battery
Preparation of a polymer
Determination of percentage of Iron in Cement sample by colorimetry
Estimation of Calcium in port land Cement
Adsorption of acetic acid by charcoal
Determination of percentage Moisture content in a coal sample

Determination of Viscosity of lubricating oil by Red Viscometer 1
Determination of Flash and Fire points of fuels
Determination of Calorific value of gases by Junker‟s gas Calorimeter

TEXT BOOKS:

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

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

I- Year B.Tech. I-Sem **L T P C 0**
031.5

(Common to CE, MECH, CHEM)

20A10507

C-Programming & Data Structures Lab

Course Objectives:

To get familiar with the basic concepts of C programming.
To design programs using arrays, strings, pointers and structures.
To illustrate the use of Stacks and Queues
To apply different operations on linked lists.
To demonstrate Binary search tree traversal techniques.
To design searching and sorting techniques.

Week l

Write C programs that use both recursive and non-recursive functions

To find the factorial of a given integer.
To find the GCD (greatest common divisor) of two given integers.
To solve Towers of Hanoi problem.

Week 2

Write a C program to find both the largest and smallest number in a list of integers.
Write a C program that uses functions to perform the following:
Addition of Two Matrices ii) Multiplication of Two Matrices

Week 3

Write a C program that uses functions to perform the following operations:
To insert a sub-string in to a given main string from a given position.
To delete n characters from a given position in a given string.

Week 4

Write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn„t contain T.

Write a C program to count the lines, words and characters in a given text.

Week 5

Write a C Program to perform various arithmetic operations on pointer variables.

Write a C Program to demonstrate the following parameter passing mechanisms:

i) call-by-value ii) call-by-reference

Week 6

Write a C program that uses functions to perform the following operations:

Reading a complex number
Writing a complex number
Addition of two complex numbers
Multiplication of two complex numbers

(Note: represent complex number using a structure.)

Week 7

Write C programs that implement stack (its operations) using

Arrays
Pointers

Week 8

Write C programs that implement Queue (its operations) using

Arrays
Pointers

Week 9

Write a C program that uses Stack operations to perform the following:

Converting infix expression into postfix expression
Evaluating the postfix expression

Week 10

Write a C program that uses functions to perform the following operations on singly linked list.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 11

Write a C program that uses functions to perform the following operations on Doubly linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 12

Write a C program that uses functions to perform the following operations on circular linkedlist.

i) Creation ii) Insertion iii) Deletion iv) Traversal

Week 13

Write a C program that uses functions to perform the following:

Creating a Binary Tree of integers

Traversing the above binary tree in preorder, inorder and postorder.

Week 14

Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a key value in a given list of integers:

Linear search
Binary search

Week 15

Write a C program that implements the following sorting methods to sort a given list of integers in ascending order

Bubble sort
Selection sort
Insertion sort

Text Books:

Programming in C and Data Structures, J.R.Hanly, Ashok N. Kamthane and A. Ananda Rao, Pearson Education.

B.A. Forouzon and R.F. Gilberg, "COMPUTER SCIENCE: A Structured Programming Approach Using C", Third edition, CENGAGE Learning, 2016.

Richard F. Gilberg & Behrouz A. Forouzan, "Data Structures: A Pseudocode Approach with C", Second Edition, CENGAGE Learning, 2011.

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radipDey and ManasGhosh, Programming in C, Oxford University Press, 2nd Edition 2011.

栀 Ā Ā Ā Ā
.Balaguruswamy, "C and Data Structures", 4th Edition, Tata Mc Graw Hill.

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.K.Sharma, Computer Fundamentals and Programming in C, 2nd Edition, University Press.

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.T.Somashekara, "Problem Solving Using C", PHI, 2nd Edition 2009.

Course Outcomes

ℜ ℜ ℜ ℜ
emonstrate basic concepts of C programming language. (L2)

ℜ ℜ ℜ ℜ
evelop C programs using functions, arrays, structures and pointers. (L6)

ℜ ℜ ℜ ℜ
llustrate the concepts Stacks and Queues. (L2)
ℜ ℜ ℜ ℜ
esign operations on Linked lists. (L6)
ℜ ℜ ℜ ℜ
pply various Binary tree traversal techniques. (L3)
ℜ ℜ ℜ ℜ
evelop searching and sorting methods. (L6)

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

I- Year B.Tech. I-Sem

L	T	P	C
0	0	3	1.5

Material Science & Engineering Lab 20A10805

Course Objectives:

To understand the microstructure and hardness of engineering materials.
To explain grain boundaries and grain sizes of different engineering materials.

List of Experiments:

Metallography sample preparation
Microstructure of pure metals – Iron, copper and aluminum as per ASTM standards
Microstructure of low carbon steel, mild steel and high carbon microstructure of cast irons.

Microstructure of non-ferrous alloys – aluminum, copper, titanium, nickel and their alloys.

Hardenability of steels by Jominy End Quench Test.
Microstructure of heat treated steels.
Hardness of various untreated and treated steels.
Microstructure of ceramics, polymeric materials.
Microstructure of super alloy and nano-materials.
Hardness of ceramics, super alloys, nano-materials and polymeric materials (one sample on each)

Course Outcomes:

The student is able to

Differentiate various microstructures of ferrous and non-ferrous metals and alloys. (L4)
Visualize grains and grain boundaries. (L3)
Importance of hardening of steels. (L2)
Evaluate hardness of treated and untreated steels. (L4)
Differentiate hardness of super alloys, ceramics and polymeric materials.

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

I- Year B.Tech. II-Sem	L	P	T	C
20A15102	3	0	0	3

Differential Equations and Vector Calculus

(Common to all branches of Engineering except CSE)

Course Objectives:

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

UNIT 1: Linear differential equations of higher order (Constant Coefficients) **10hrs**

Definitions, homogenous and non-homogenous, complimentary function, general solution, particular integral, Wronskian, method of variation of parameters.Simultaneous linear equations, Applications to L-C-R Circuit problems and Mass spring system.

Learning Outcomes:

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

identify the essential characteristics of linear differential equations with constant coefficients (L3)
solve the linear differential equations with constant coefficients by appropriate method (L3)
classify and interpret the solutions of linear differential equations (L3)
formulate and solve the higher order differential equation by analyzing physical situations (L3)

UNIT 2:Partial Differential Equations **8hrs**

Introduction and formation of Partial Differential Equations by elimination of arbitrary constants and arbitrary functions, solutions of first order equations using Lagrange‟s method and non-linear PDEs (Standard Forms)

Learning Outcomes:

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

apply a range of techniques to find solutions of standard PDEs (L3)
outline the basic properties of standard PDEs (L2)

UNIT 3: Applications of Partial Differential Equations **10 hrs**

Classification of PDE, method of separation of variables for second order equations. Applications of Partial Differential Equations: One dimensional Wave equation, One dimensional Heat equation.

Learning Outcomes:

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

calcify the PDE (L3)

learn the applications of PDEs(L2)

UNIT4: Vector differentiation **6hrs**

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

Learning Outcomes:

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

apply del to Scalar and vector point functions (L3)

illustrate the physical interpretation of Gradient, Divergence and Curl (L3)

UNIT 5: Vector integration **8hrs**

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

Learning Outcomes:

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

find the work done in moving a particle along the path over a force field (L4)

evaluate the rates of fluid flow along and across curves (L4)

apply Green"s, Stokes and Divergence theorem in evaluation of double and triple integrals (L3)

Erwin Kreyszig, Advanced Engineering Mathematics, 10/e, John Wiley & Sons, 2011.

B.S. Grewal, Higher Engineering Mathematics, 44/e, Khanna publishers, 2017.

Reference Books:

Dennis G. Zill and Warren S. Wright, Advanced Engineering Mathematics, Jones and Bartlett, 2011.

Michael Greenberg, Advanced Engineering Mathematics, 2/e, Pearson, 2018

George B.Thomas, Maurice D. Weir and Joel Hass, Thomas Calculus, 13/e, Pearson Publishers, 2013.

R.K.Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 3/e, Alpha Science International Ltd., 2002.

Glyn James, Advanced Modern Engineering Mathematics, 4/e, Pearson publishers, 2011.

Micheael Greenberg, Advanced Engineering Mathematics, 9th edition, Pearson edn

Dean G. Duffy, Advanced engineering mathematics with MATLAB, CRC Press

Peter O"neil, Advanced Engineering Mathematics, Cengage Learning.

R.L. Garg Nishu Gupta, Engineering Mathematics Volumes-I &II, Pearson Education

B. V. Ramana, Higher Engineering Mathematics, Mc Graw Hill Education.

H. k Das, Er. Rajnish Verma, Higher Engineering Mathematics, S. Chand.
N. Bali, M. Goyal, C. Watkins, Advanced Engineering Mathematics, Infinity Science Press.

Course Outcomes:

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

- solve the differential equations related to various engineering fields (L6)
- Identify solution methods for partial differential equations that model physical processes (L3)
- interpret the physical meaning of different operators such as gradient, curl and divergence (L5)
- estimate the work done against a field, circulation and flux using vector calculus (L6)

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

I- Year B.Tech. II-Sem

L	T	P	C
2	1	0	3

Common to Civil, Mechanical, Chemical

Subject Code	Title of the Subject	L	T	P	C
20A15203	ENGINEERING PHYSICS	2	1		3

COURSE OBJECTIVES

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

COURSE OUTCOMES

After studying this course, the student will be able to:

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

Mapping between Course Outcomes and Programme Outcomes

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

Unit-I: Wave Optics
12hrs

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

Diffraction- Introduction – Fresnel and Fraunhofer diffraction – Fraunhofer diffraction due to single slit, double slit and N-slits (qualitative) – Grating spectrum.

Polarization- Introduction – Types of polarization – Polarization by reflection, refraction and double refraction – Nicol"s Prism – Half wave and Quarter wave plates with applications.

Unit Outcomes:

The students will be able to

Explain the need of coherent sources and the conditions for sustained interference (L2)
Identify engineering applications of interference (L3)
Analyze the differences between interference and diffraction with applications (L4)
Illustrate the concept of polarization of light and its applications (L2)
Classify ordinary polarized light and extraordinary polarized light (L2)

Unit-II: Lasers and Fiber optics
8hrs

Lasers- Introduction – Characteristics of laser – Spontaneous and Stimulated emission of radiation – Einstein"s coefficients – Population inversion – Lasing action – Pumping mechanisms – Nd-YAG laser – He-Ne laser – Applications of lasers.

Fiber optics- Introduction – Principle of optical fiber – Acceptance Angle – Numerical Aperture – Classification of optical fibers based on refractive index profile and modes – Propagation of electromagnetic wave through optical fibers – Fiber optic communication system – Losses in optical fibers – Applications.

Unit Outcomes:

The students will be able to

Understand the basic concepts of LASER light Sources (L2)
Apply the concepts to learn the types of lasers (L3)
Identifies the Engineering applications of lasers (L2)
Explain the working principle of optical fibers (L2)
Classify optical fibers based on refractive index profile and mode of propagation (L2)
Identify the applications of optical fibers in various fields (L2)

UNIT III: Engineering Materials
10hrs

Dielectric Materials- Introduction – Dielectric polarization – Dielectric polarizability, Susceptibility and Dielectric constant – Types of polarizations: Orientation polarization (Qualitative), Electronic and Ionic – Lorentz internal field – Clausius-Mossotti equation – Dielectric breakdown – Dielectric Loss – Piezoelectricity and Ferro electricity.

Magnetic Materials- Introduction – Magnetic dipole moment – Magnetization – Magnetic susceptibility and permeability – Origin of permanent magnetic moment – Classification of magnetic materials: Dia, Para Ferro, Ferri & Antiferro – Domain concept of Ferromagnetism (Qualitative) – Hysteresis – Soft and Hard magnetic materials.

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

Unit Outcomes:

The students will be able to

Explain the concept of dielectric constant and polarization in dielectric materials (L2)
Summarize various types of polarization of dielectrics (L2)
Interpret Lorentz field and Claussius- Mosotti relation in dielectrics(L2)
Apply the concept of polarization to materials like piezoelectric and ferroelectrics (L3)
Classify the magnetic materials based on susceptibility and their temperature dependence (L2)
Explain the applications of dielectric and magnetic materials (L2)
Apply the concept of magnetism to magnetic devices (L3)
Identify the nano size dependent properties of nanomaterials (L2)
Illustrate the methods for the synthesis and characterization of nanomaterials (L2)
Apply the basic properties of nanomaterials in various Engineering branches (L3).

Unit-IV:AcousticsandUltrasonics **10hrs**

Acoustics- Introduction – Requirements of acoustically good hall – Reverberation – Reverberation time – Sabine‟s formula (Derivation using growth and decay method) – Absorption coefficient and its determination – Factors affecting acoustics of buildings and their remedies.

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

Unit Outcomes:

The students will be able to

- **Explain** how sound is propagated in buildings (L2)
- **Analyze** acoustic properties of typically used materials in buildings (L4)
- **Recognize** sound level disruptors and their use in architectural acoustics (L2)
- **Identify** the use of ultrasonics in different fields (L3)

Unit-V: Crystallography and Characterization Techniques
8hrs

Crystallography- Space lattice, Basis, unit cell and lattice parameters – Bravais Lattice – Crystal systems – Packing fraction – Coordination number – Packing fraction of SC, BCC & FCC – Miller indices – Separation between successive (hkl) planes.

Characterization Techniques: X-Ray Diffraction**:** Bragg"s law – Bragg"s X-ray diffractometer – Crystal structure determination by Powder method – Electron microscopy: Scanning Electron Microscope – Transmission Electron Microscope.

Unit Outcomes:

The students will be able to

- **Classify** various crystal systems (L2)
- **Identify** different planes in the crystal structure (L3)
- **Analyze** the crystalline structure by Bragg"s X-ray diffractometer (L4)
- **Apply** powder method to measure the crystallinity of a solid (L4)
- **Analyze** the crystal structure using electron microscopes (L4)

Text books:

Engineering Physics by M. N. Avadhanulu, P.G.Kshirsagar & TVS Arun Murthy S.Chand Publications, 11th Edition 2019.
Engineering Physics" by D.K.Bhattacharya and Poonam Tandon, Oxford press (2018).
Applied Physics by P.K.Palanisamy ,SciTech publications (2018)

Reference Books:

Fundamentals of Physics – Halliday, Resnick and Walker, John Wiley &Sons, 11th Edition (2018).
Engineering Physics – K. Thyagarajan, McGraw Hill Publishers (2018).
Engineering Physics by M.R.Srinivasan, New Age international publishers (2014).
Engineering Physics by B.K. Pandey and S. Chaturvedi, Cengage Learning(2018)
Engineering Physics - Sanjay D. Jain, D. Sahasrambudhe and Girish, University Press(2016)
University Physics by H.D.Young and R.A. Freedman,Pearson(2017)

COURSE OUTCOMES	
CO1	**Study** the different realms of physics and their applications in both scientific and technological systems through physical optics. (L2)
CO2	**Identify** the wave properties of light and the interaction of energy with the matter (L3). **Asses** the electromagnetic wave propagation and its power in different media (L5).
CO3	**Understands** the response of dielectric and magnetic materials to the applied electric and magnetic fields. (L3) **Elucidates** the importance of nano materials along with their engineering applications. (L5)
CO4	**Explain** the basic concepts of acoustics and ultrasonics. (L2) **Apply** the concept of NDT to material testing. (L3)
CO5	**Study** the important properties of crystals like the presence of long-range order, periodicity and structure determination using X-ray diffraction technique (L5) and **Analyze** the crystal structure using electron microscopes (L4)

Mapping between Course Outcomes and Programme Outcomes

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

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

I- Year B.Tech. II-Sem	L	T	P	C
20A15501	2	0	0	2

Communicative English 1
Common to Civil, Mechanical

Introduction

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

Course Objectives

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

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

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

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

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

Unit 1

Lesson: On the Conduct of Life: William Hazlitt

Listening: Identifying the topic, the context and specific pieces of information by listening to short audio texts and answering a series of questions. **Speaking:** Asking and answering general questions on familiar topics such as home, family, work, studies and interests; introducing oneself and others. **Reading:** Skimming to get the main idea of a text; scanning to look for specific pieces of information. **Reading for Writing :**Beginnings and endings of paragraphs - introducing the topic, summarizing the main idea and/or providing a transition to the next paragraph. **Grammar and Vocabulary:** Content words and function words; word forms: verbs, nouns, adjectives and adverbs; nouns: countable and uncountable; singular and plural; basic sentence structures; simple question form - wh-questions; word order in sentences.

Learning Outcomes

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

understand social or transactional dialogues spoken by native speakers of English and identify the context, topic, and pieces of specific information

ask and answer general questions on familiar topics and introduce oneself/others

employ suitable strategies for skimming and scanning to get the general idea of a text and locate specific information

recognize paragraph structure and be able to match beginnings/endings/headings with paragraphs

form sentences using proper grammatical structures and correct word forms

Unit 2

Lesson: The Brook: Alfred Tennyson

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

Learning Outcomes

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

comprehend short talks on general topics

participate in informal discussions and speak clearly on a specific topic using suitable discourse markers

understand the use of cohesive devices for better reading comprehension

write well structured paragraphs on specific topics

identify basic errors of grammar/ usage and make necessary corrections in short texts

Unit 3

Lesson: The Death Trap: Saki

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

Learning Outcomes

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

comprehend short talks and summarize the content with clarity and precision

participate in informal discussions and report what is discussed

infer meanings of unfamiliar words using contextual clues

write summaries based on global comprehension of reading/listening texts
use correct tense forms, appropriate structures and a range of reporting verbs in speech and writing

Unit4

Lesson: Innovation: Muhammad Yunus

Listening: Making predictions while listening to conversations/ transactional dialogues without video; listening with video. **Speaking:** Role plays for practice of conversational English in academic contexts (formal and informal) - asking for and giving information/directions. **Reading:** Studying the use of graphic elements in texts to convey information, reveal trends/patterns/relationships, communicate processes or display complicated data. **Writing:**

Information transfer; describe, compare, contrast, identify significance/trends based on information provided in figures/charts/graphs/tables. **Grammar and Vocabulary:** Quantifying expressions - adjectives and adverbs; comparing and contrasting; degrees of comparison; use of antonyms

Learning Outcomes

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

Unit 5

Lesson: Politics and the English Language: George Orwell

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

Learning Outcomes

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

Prescribed Text:

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

Reference Books

Bailey, Stephen. *Academic writing: A handbook for international students*. Routledge, 2014.

Chase, Becky Tarver. *Pathways: Listening, Speaking and Critical Thinking.* Heinley ELT; 2nd Edition, 2018.

Skillful Level 2 Reading & Writing Student's Book Pack (B1) Macmillan Educational.

Hewings, Martin. *Cambridge Academic English (B2)*. CUP, 2012.

Oxford Learners Dictionary, 12th Edition, 2011

Course Outcomes

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

Understand the context, topic, and pieces of specific information from social or transactional dialogues spoken by native speakers of English

Apply grammatical structures to formulate sentences and correct word forms

Analyze discourse markers to speak clearly on a specific topic in informal discussions

Evaluate reading/listening texts and to write summaries based on global comprehension of these texts.

Create a coherent paragraph interpreting a figure/graph/chart/table

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

I- Year B.Tech. II-Sem **L T P C 3003**

20A12401

Basic Electrical & Electronics Engineering

Part A: Basic Electrical Engineering
((Mechanical, CSE & Chemical)

I B.Tech – II Sem L T P 3 0 03

Course Objectives:
1. To introduce basics of electric circuits.
2. To teach DC and AC electrical circuit analysis.
3. To explain working principles of transformers and electrical machines.
4. To impart knowledge on Power system generation, transmission and distribution

Unit 1 DC & AC Circuits:
Electrical circuit elements (R - L and C) - Kirchhoff laws - Series and parallel connection of resistances with DC excitation. Superposition Theorem - Representation of sinusoidal waveforms - peak and rms values - phasor representation - real power - reactive power - apparent power - power factor - Analysis of single-phase ac circuits consisting of RL - RC - RLC series circuits, Resonance.
Learning Outcomes: Students should be able to
● recall Kirchoff laws
● analyze simple electric circuits with DC excitation
● apply network theorems to simple circuits
● analyze single phase AC circuits consisting of series RL - RC - RLC combinations

Unit 2 DC & AC Machines:
Principle and operation of DC Generator - EMF equations - OCC characteristics of DC generator – principle and operation of DC Motor – Torque equation – Analyze Performance Characteristics of DC Motor - Speed control of DC Motor – Principle and operation of Single Phase Transformer - OC and SC tests on transformer - Principle and operation of 3-phase AC machines [Elementary treatment only]
Learning Outcomes: Students should be able to
● explain principle and operation of DC Generator & Motor.
● perform speed control of DC Motor
● explain operation of transformer and induction motor.
● explain construction & working of induction motor - DC motor
Unit 3 Basics of Power Systems:

1. 2. 3. 4.

Layout & operation of Hydro, Thermal, Nuclear Stations –Principle of operation of solar PV cell, characteristics of PV cell – Basic concept of wind power generation- Typical AC power supply scheme – Definition of short, medium and long transmission lines – Concepts of distribution system.

Learning Outcomes: Students should be able to

● understand working operation of various generating stations
● analyze the I-V characteristics solar PV cell

Text Books:

1. D. P. Kothari and I. J. Nagrath - “Basic Electrical Engineering” - Tata McGraw Hill - 2010.
2. V.K. Mehta & Rohit Mehta, “Principles of Power System” – S.Chand – 2018.

References:

1. L. S. Bobrow - “Fundamentals of Electrical Engineering” - Oxford University Press - 2011.
2. E. Hughes - “Electrical and Electronics Technology” - Pearson - 2010.
3. C.L. Wadhwa – “Generation Distribution and Utilization of Electrical Energy”, 3rd Edition, New Age International Publications.

Course Outcomes: The students should be able to

● apply concepts of KVL/KCL in solving DC circuits
● understand and choose correct rating of a transformer for a specific application
● illustrate working principles of DC Motor
● identify type of electrical machine based on their operation
● understand the basics of power generation, transmission and distribution

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

I –Year B.Tech.II -Semester

L	T	P	C
3	0	0	3

20A12401

BASIC ELECTRICAL & ELECTRONICS ENGINEERING

ELECTRONICS ENGINEERING
PART- B

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

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

UNIT I

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

UNIT II

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

UNIT III

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

Text Books:

Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education

Ramakant A.Gayakwad, Op-Amps and Linear Integrated Circuits, Eastern Economy Edition

3.M.Morris Mano and Michael D.Ciletti, Digital Design, Pearson Education,4th Edition

References:

R. Muthusubramanian, S. Salivahanan, “Basic Electrical and Electronics Engineering”, Tata McGraw-Hill Education.

Bell, D. A., Electronic Devices and Circuits, Oxford University Press

3.R.J. Tocci: Digital Systems; PHI, 6e, 2001.

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

I- Year B.Tech. II-Sem

L	T	P	C
1	0	2	2

20A10301

Engineering Drawing
(Common to CE, MECH, CHEM)

Course Objectives:

- Bring awareness that Engineering Drawing is the Language of Engineers.
- Familiarize how industry communicates technical information.
- Teach the practices for accuracy and clarity in presenting the technical information.
- Develop the engineering imagination essential for successful design.

Unit:I

Introduction to Engineering Drawing: Principles of Engineering Drawing and its significance-Conventions in drawing-lettering - BIS conventions. a)Conic sections including the rectangular hyperbola- general method only,
Cycloid, epicycloids and hypocycloid c) Involutes

Learning Outcomes:

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

- Lettering and dimensioning by freehand (L1)
- Create geometric constructions; drawing parallel and perpendicular lines, and to construct circles, arcs, tangencies, and irregular curves (L6)
- Create Conic sections and cycloidal curves.(L6)

Unit: II

Projection of points, lines and planes: Projection of points in any quadrant, lines inclined to one or both planes, finding true lengths, angle made by line. Projections of regular plane surfaces.

Learning Outcomes:

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

- Understand the Projection of the objectives in four quadrants (L2)
- Project the points, lines and planes (L6)

Unit: III

Projections of solids: Projections of regular solids inclined to one or both planes by rotational or auxiliary views method.

Learning Outcomes:

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

1.Project the solids in both planes. (L6)

2. To draw the solids by auxiliary method. (L6)

Unit: IV

Sections of solids: Section planes and sectional view of right regular solids- prism, cylinder, pyramid and cone. True shapes of the sections.

Learning Outcomes:

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

1.Project the sectional view of regular solids.(L6)

2. Understand how to draw the true shapes of the sections.(L2)

Unit:V

Development of surfaces: Development of surfaces of right regular solids-prism, cylinder, pyramid, cone and their sectional parts.

Learning Outcomes:

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

Draw the development of surfaces of the solids.(L6)

Understand to develop the sectional parts of the solids.(L2)

Text Books:

K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.

N.D.Bhatt, Engineering Drawing, 53/e, Charotar Publishers, 2016.

Reference Books:

Dr K.Prahlada Rao, Dr. S. Krishnaiah, Prof.A.V.S. Prasad, Engineering Graphics, Amaravati publications.

Dhanajay A Jolhe, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2009

Venugopal, Engineering Drawing and Graphics, 3/e, New Age Publishers, 2000

Shah and Rana, Engineering Drawing, 2/e, Pearson Education, 2009

K.C.John, Engineering Graphics, 2/e, PHI, 2013

Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

draw various curves applied in engineering. (L2)

show projections of solids and sections graphically. (L2)

draw the development of surfaces of solids. (L3)

Additional Sources

Youtube: http-sewor,Carleton.cag,kardos/88403/drawings.html conic sections-online, red woods.edu

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

I- Year B.Tech. II-Sem

L	T	P	C
0	0	2	1

20A10302

Engineering Graphics Lab
(Common to CE, MECH, CHEM)

Course Objectives:

Instruct the utility of drafting & modelling packages in orthographic and isometric drawings.
Instruct graphical representation of machine components.

Computer Aided Drafting:

Introduction to Geometric Modeling: Basic drawing and editing commands: line, circle, rectangle, erase, view, undo, redo, snap, object editing, moving, copying, rotating, scaling, mirroring, layers, templates, polylines, trimming, extending, stretching, fillets, arrays, dimensions.
Dimensioning principles and conventional representations.

Orthographic Projections: Systems of projections, conventions and application to orthographic projections - simple objects.

Isometric Projections: Principles of isometric projection- Isometric scale; Isometric views: lines, planes, simple solids.

Text Books:

K. Venugopal, V.Prabhu Raja, Engineering Drawing + Auto Cad, New Age International Publishers.
Kulkarni D.M, AP Rastogi and AK Sarkar, Engineering Graphics with Auto Cad, PHI Learning, Eastern Economy editions.

Reference Books:

T. Jayapoovan, Engineering Graphics using Auto Cad, Vikas Publishing House
K.L.Narayana & P.Kannaiah, Engineering Drawing, 3/e, Scitech Publishers, Chennai, 2012.
Linkan Sagar, BPB Publications, Auto Cad 2018 Training Guide.
K.C.John, Engineering Graphics, 2/e, PHI, 2013
Basant Agarwal & C.M.Agarwal, Engineering Drawing, Tata McGraw-Hill, Copy Right, 2008.

Course Outcomes:

After completing the course, the student will be able to

Use computers as a drafting tool. (L2)
Draw isometric and orthographic drawings using CAD packages. (L3)

Additional Sources: 1. Youtube: http-sewor,Carleton.cag, kardos/88403/drawings.html conic sections-online, red woods.edu.

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

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

COMMUNICATIVE ENGLISH LABORATORY-1
(Common to CE, MECH,)

20A15502

Course Objectives

students will be exposed to a variety of self instructional, learner friendly modes of language learning

students will cultivate the habit of reading passages from the computer monitor. Thus providing them with the required facility to face computer based competitive exams like GRE, TOEFL, and GMAT etc.

students will learn better pronunciation through stress, intonation and rhythm

students will be trained to use language effectively to face interviews, group discussions, public speaking

students will be initiated into greater use of the computer in resume preparation, report writing, format making etc

Course Outcomes

CO1: Remember and understand the different aspects of the English language proficiency with emphasis on LSRW skills

CO2: Apply communication skills through various language learning activities

CO3: Analyze the English speech sounds, stress, rhythm, intonation and syllable division for better listening and speaking comprehension.

CO4: Evaluate and exhibit acceptable etiquette essential in social and professional settings

CO5: Create awareness on mother tongue influence and neutralize it in order to improve fluency in spoken English.

Unit 1

Phonetics for listening comprehension of various accents
Reading comprehension
Describing objects/places/persons

Learning Outcomes

At the end of the module, the learners will be able to
understand different accents spoken by native speakers of English

employ suitable strategies for skimming and scanning on monitor to get the general idea of a text and locate specific information

learn different professional registers and specific vocabulary to describe different persons, places and objects

Unit 2

JAM

Small talks on general topics

Debates

Learning Outcomes

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

produce a structured talk extemporarily

comprehend and produce short talks on general topics

participate in debates and speak clearly on a specific topic using suitable discourse markers

Unit 3

Situational dialogues – Greeting and Introduction

Summarizing and Note making

Vocabulary Building

Learning Outcomes

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

Learn different ways of greeting and introducing oneself/others

summarize the content with clarity and precision and take notes while listening to a talk/lecture and make use of them to answer questions

replenish vocabulary with one word substitutes, homonyms, homophones, homographs to reduce errors in speech and writing

Unit4

Asking for Information and Giving Directions

Information Transfer

Non-verbal Communication – Dumb Charade

Learning Outcomes

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

Learn different ways of asking information and giving directions

Able to transfer information effectively

understand non-verbal features of communication

Unit 5

Oral Presentations
Précis Writing and Paraphrasing
Reading Comprehension and spotting errors

Learning Outcomes

At the end of the module, the learners will be able to
make formal oral presentations using effective strategies
learn different techniques of précis writing and paraphrasing strategies
comprehend while reading different texts and edit short texts by correcting common errors

Suggested Software

Young India Films
Walden Infotech
Orell

Reference Books

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

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

I- Year B.Tech. II-Sem (20A15204)

L	T	P	C
0	0	3	1.5

(Common to CE, MECH, CHEM)

Subject Code	Title of the Lab	L	T	P	C
20A15204	**ENGINEERING PHYSICS LABORATORY**	0	0	3	1.5

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

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

Mapping between Course Outcomes and Programme Outcomes

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

LIST OF EXPERIMENTS

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

Laser: Determination of wavelength using diffraction grating.
Laser: Determination of Particle size.
Determination of spring constant of springs using Coupled Oscillator
Determination of ultrasonic velocity in liquid (Acoustic grating)
Determination of dielectric constant and Curie temperature of a ferroelectric material.
B-H curve
Stewart-Gee's Method
Rigidity modulus of material of a wire-dynamic method (Torsional pendulum)
Determination of numerical aperture of an optical fiber.
Determination of thickness of thin object by wedge method.
Determination of radius of curvature of lens by Newton"s rings.
Determination of wavelengths of various colours of mercury spectrum using diffraction grating in normal incidence method.
Determination of dispersive power of the prism
Sonometer: Verification of the three laws of stretched strings
Meldes experiment: Determination of the frequency of tuning fork

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

Data Books Required: Nil

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

I- Year B.Tech. II-Sem	L	T	P	C
	0	0	1.5	0.75

BASIC ELECTRICAL ENGINEERING LAB

20A12402

(PART-A - ½ LAB)

Common to Mechanical, CSE & Chemical
Part A: Electrical Engineering Lab

I B. Tech – II Sem. L T P
0 0 3

Course Objectives:
1. To verify Kirchoff’s laws and Superposition theorem
2. To learn performance characteristics of DC Machines
3. To perform various tests on 1- Phase transformer
4. To study the I – V characteristics of solar PV cell

Note: From the following list experiments minimum six experiments are required to be conducted:

List of experiments: -
1. Verification of Kirchhoff laws
2. Verification of Superposition Theorem
3. Magnetization characteristics of a DC Shunt Generator
4. Speed control of DC Shunt Motor
5. OC & SC test of 1 – Phase Transformer
6. Load test on 1-Phase Transformer
7. I – V characteristics of solar PV cell
8. Brake test on DC Shunt Motor

Course Outcomes: The students should be able to
1. Understand Kirchoff’s laws & Superposition theorem
2. Analyze the various characteristics on DC machines by conducting various tests
3. Analyze I – V characteristics of PV cell
4. Apply the knowledge to perform various tests on 1-phase transformer

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

I- Year B.Tech. II-Sem

L	T	P	C
0	0	1.5	0.75

20A12402

BASIC ELECTRONICS ENGINEERING LAB

(PART-B - ½ LAB)

(Common to ME & CHEM)

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

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

LIST OF EXPERIMENTS:

1. PN Junction diode characteristics A) Forward bias B) Reverse bias.

   Zener diode characteristics and Zener as voltage Regulator

   Full Wave Rectifier with & without filter

   Wave Shaping Circuits (Clippers & Clampers)

   Input & Output characteristics of Transistor in CB / CE configuration

   Frequency response of CE amplifier.

Inverting and Non-inverting Amplifiers using Op Amps

Verification of Truth Table of AND, OR, NOT, NAND, NOR, Ex-OR, Ex-NOR gates using ICs

Verification of Truth Tables of RS, JK, T & D flip flops using respective ICs

LAB REQUIREMENTS:

Cathode Ray Oscilloscopes (30MHz)

Signal Generator /Function Generators (3 MHz)

Dual Regulated Power Supplies (0 – 30V)

IC Trainer Kit

Bread Boards

Electronic Components

JNTUA COLLEGE OF ENGINEERING (Autonomous) :: ANANTAPURAMU (Common to All Branches of Engineering)

20A19101 UNIVERSAL HUMAN VALUES
Common to CIVI, Mech, Chemical

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

1. ***Introduction:***

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

In the Induction Program, students would get an initial exposure to human values through Universal HumanValues–I.This exposure is to be augmented by this compulsory full semester foundation course.

2.Learning Objectives:

Exposure to the value of life, society and harmony

Leading towards holistic perspective based on self-exploration about themselves (human being), family, and society and nature/existence.

Bringing transition from the present state to Universal Human Order

Instill commitment and courage to act.

Know about appropriate technologies and management patterns

COURSE TOPICS:

Unit 1: Course Introduction - Need, Basic Guidelines, Content and Process for Value Education

Universal Human Values-I - Self-Exploration - content and process; „Natural Acceptance‟ and Experiential Validation - self-exploration - Continuous Happiness and Prosperity - Human Aspirations - current scenario - Method to fulfill the above human aspirations: understanding and living in harmony at various levels.

Unit 2: Understanding Harmony in the Human Being - Harmony in Myself!

human being as a co-existence of the sentient „I" and the material„Body" - the needs - happiness and physical facility -the Body as an instrument of „I" - the characteristics and activities of „I" and harmony in „I" - the harmony of I with the Body

Unit 3: Understanding Harmony in the Family and Society- Harmony in Human-Human Relationship

Values in human relationship; meaning of Justice; Trust and Respect; Difference between intention and competence; the other salient values in relationship - the harmony in the society: Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals - Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Unit 4: Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

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

Unit 5: Implications of the above Holistic Understanding of Harmony on Professional Ethics

Humanistic Education - Competence in professional ethics: professional competence - people friendly and eco-friendly production systems - appropriate technologies and management patterns for above production systems. Individuals as socially and ecologically responsible engineers, technologists and managers

Prescribed Text Book

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

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

ReferenceBooks

.**JeevanVidya: EkParichaya, ANagaraj, JeevanVidyaPrakashan, Amarkantak, 1999**
HumanValues,A.N.Tripathi,NewAgeIntl.Publishers,NewDelhi,2004.

The Story of Stuff (Book).

Economy of Permanence - J C Kumarappa 8.

Bharat Mein Angreji Raj - PanditSunderlal 9.

Rediscovering India - byDharampal

Hind Swaraj or Indian Home Rule - by Mohandas K.Gandhi

India Wins Freedom - Maulana Abdul Kalam Azad 12.

Vivekananda - Romain Rolland(English)

This is OUTCOME OF THECOURSE:

By the end of the course,

CO1: Define terms like Natural Acceptance, Happiness and Prosperity

CO2: Understand awareness of oneself, and ones surroundings (family, society, nature)

CO3: Apply what they have learnt to their own self in different day-to-day settings in real life

CO4: Relate human values with human relationship and human society.

CO5: Justify the need for universal human values and harmonious existence

CO6: Develop as socially and ecologically responsible engineers

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING II Year B.Tech.M.E. I Semester

Course Code	Complex variables and Transforms Techniques		L	T	P	C
20A35102	**B.Tech II Year** (Common to ECE, EEE & MECH)		3	0	0	3
Pre-requisite	Functions,Differentiationsand Integration	**Semester**	III			

Course Objectives:

This course aims at providing the student to acquire the knowledge on the calculus of functions of complex variables. The student develops the idea of using continuous/discrete transforms.

Course Outcomes (CO): Student will be able to

- understand the analyticity of complex functions and conformal mappings.
- apply Cauchy's integral formula and Cauchy's integral theorem to evaluate improper integrals along contours.
- understand the usage of Laplace Transforms, Fourier Transforms and Z transforms.
- evaluate the Fourier series expansion of periodic functions.
- Understand the use of Fourier transforms and apply Z transforms to solve difference equations.

UNIT - I	**Complex Variable – Differentiation**:	8 Hrs

Introduction to functions of complex variable-concept of Limit & continuity-Differentiation, Cauchy-Riemann equations, analytic functions (exponential, trigonometric, logarithm), harmonic functions, finding harmonic conjugate- construction of analytic function by Milne Thomson method-Conformal mappings- standard and special transformations (sin z, e^z, cos z, z^2) Mobius transformations (bilinear) and their properties.

UNIT - II	**Complex Variable – Integration**:	9 Hrs

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

UNIT - III	**Laplace Transforms**	9 Hrs

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

UNIT - IV	**Fourier series**	8 Hrs

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

UNIT - V	**Fourier transforms & Z Transforms:**	9 Hrs

Fourier integral theorem (without proof) – Fourier sine and cosine integrals-complex form of Fourier integral. Fourier transform – Fourier sine and cosine transforms – Properties – Inverse transforms – convolution theorem .

Z-transform – Inverse z-transform – Properties – Damping rule – Shifting rule – Initial and final value theorems. Convolution theorem – Solution of difference equations by z-transforms.

Textbooks:

Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

Reference Books:

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

Online Learning Resources:

nptel.ac.in/courses/111107056
onlinelibrary.wiley.com
https://onlinecourses.nptel.ac.in/noc18ma12.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	**Fluid Mechanics and Hydraulic Machines**		**L**	**T**	**P**	**C**
20A30108			**3**	**0**	**0**	**3**
Pre-requisite	**Physics, Chemistry**	**Semester**	**III**			

Course Objectives:

- To impart ability to solve engineering problems in fluid mechanics
- To explain basics of statics, kinematics and dynamics of fluids and various measuring techniques of hydrostatic forces on objects.
- To enable the students measure quantities of fluid flowing in pipes, tanks and channels
- To Introduce concepts of uniform and non-uniform flows through open channel.
- To impart knowledge on design of turbines and pumps.

Course Outcomes (CO):

- Familiarize basic terms used in fluid mechanics
- Understand the principles of fluid statics, kinematics and dynamics
- Understand flow characteristics and classify the flows and estimate various losses in flow through channels
- Analyze characteristics for uniform and non-uniform flows in open channels.
- Design different types of turbines, centrifugal and multistage pumps.

UNIT - I Introduction to Fluid Statics

Distinction between a fluid and a solid - characteristics of fluids - Fluid Pressure: Pressure at a point, Pascal's law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer. pressure gauges, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

UNIT - II Fluid kinematics and Dynamics

Classification of fluid flow - Stream line, path line, streak line and stream tube; stream function, velocity potential function. One, two and three - dimensional continuity equations in Cartesian coordinates.

Fluid Dynamics: Surface and body forces; Equations of motion - Euler's equation; Bernoulli's equation – derivation; Energy Principle; Practical applications of Bernoulli's equation: Venturimeter, orifice meter and Pitot tube; Momentum principle; Forces exerted by fluid flow on pipe bend; Vortex Flow – Free and Forced; Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number

UNIT - III Analysis Of Pipe Flow

Energy losses in pipelines; Darcy – Weisbach equation; Minor losses in pipelines; Hydraulic Grade Line and Total Energy Line; Concept of equivalent length – Pipes in Parallel and Series. Laminar Flow- Laminar flow through: circular pipes, annulus and parallel plates. Stoke's law, Measurement of viscosity. Reynolds experiment, Transition from laminar to turbulent flow. Resistance to flow of fluid in smooth and rough pipes-Moody's diagram – Introduction to boundary layer theory.

UNIT - IV Flow in Open Channels

Open Channel Flow-Comparison between open channel flow and pipe flow, geometrical parameters of a channel, classification of open channels, classification of open channel flow, Velocity Distribution of channel section. Uniform Flow-Continuity Equation, Energy Equation and Momentum Equation, Characteristics of uniform flow, Chezy's formula, Manning's formula. Computation of Uniform flow.Specific energy, critical flow, discharge curve, Specific force, Specific depth, and Critical depth. Measurement of Discharge and Velocity – Broad Crested Weir. Gradually Varied FlowDynamic Equation of Gradually Varied Flow. Hydraulic Jump and classification - Elements and characteristics- Energy dissipation.

UNIT - V	Hydraulic Machines
Impact of Jets- Hydrodynamic force of jets on stationary and moving flat, inclined and curved vanes - velocity triangles at inlet and outlet - Work done and efficiency - Hydraulic Turbines: Classification of turbines; pelton wheel and its design. Francis turbine and its design - efficiency - Draft tube: theory characteristic curves of hydraulic turbines - Cavitation - Working principles of a centrifugal pump, work done by impeller; heads, losses and efficiencies; minimum starting speed; Priming; specific speed; limitation of suction lift, net positive suction head (NPSH); Performance and characteristic curves; Cavitation effects; Multistage centrifugal pumps; troubles and remedies – Introduction to Reciprocating Pump.	

Textbooks:

P. M. Modi and S. M. Seth, "Hydraulics and Fluid Mechanics", Standard Book House
K. Subrahmanya, "Theory and Applications of Fluid Mechanics", Tata McGraw Hill

Reference Books:

R. K. Bansal, A text of "Fluid Mechanics and Hydraulic Machines", Laxmi Publications (P) Ltd., New Delhi.
K. Subramanya, Open channel Flow, Tata McGraw Hill.
N. Narayana Pillai, Principles of "Fluid Mechanics and Fluid Machines", Universities Press Pvt Ltd, Hyderabad. 3rd Edition 2009.
C. S. P. Ojha, R. Berndtsson and P. N. Chadramouli, "Fluid Mechanics and Machinery", Oxford University Press, 2010.
Banga& Sharma, "Hydraulic Machines", Khanna Publishers.

Online Learning Resources:

https://www.coursera.org/courses?query=fluid%20mechanics
https://www.udemy.com/topic/fluid-mechanics/
https://onlinecourses.nptel.ac.in/noc21_ce31/preview
https://ocw.mit.edu/courses/aeronautics-and-astronautics/16-01-unified-engineering-i-ii-iii-iv-fall-2005-spring-2006/fluid-mechanics/
http://lms.msitonline.org/mod/folder/view.php?id=138

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	**Manufacturing Processes**		**L**	**T**	**P**	**C**
20A30301			**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To introduce the students to working principle of different metal casting processes and gating system.
- To impart knowledge on plastic deformation, cold and hot working process, working of a rolling mill and types, extrusion processes.
- To teach principles of forging, tools and dies, working of forging processes.
- To develop fundamental understanding on classification of the welding processes, working of different types of welding processes and welding defects.
- To impart knowledge on manufacturing methods of plastics, ceramics and powder metallurgy.
- To introduce the basic concepts of Unconventional Machining Processes.

Course Outcomes (CO):

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

- Demonstrate different metal casting processes and gating systems. (L2)
- Classify working of various welding processes. (L2)
- Evaluate the forces and power requirements in rolling process. (L5)
- Apply the principles of various forging operations. (L3)
- Outline the manufacturing methods of plastics, ceramics and powder metallurgy. (L1)
- Identify different unconventional processes and their applications. (L3)

UNIT - I	**Casting Processes**	**8 Hrs**

Introduction: Importance and selection of manufacturing processes.

Introduction to casting process, process steps; pattern and design of gating system; Solidification of casting: Concept, solidification of pure metal and alloy; Special casting processes: Shell casting, investment casting, die casting, centrifugal casting, casting defects and remedies.

UNIT - II	**Metal Forming & Forging**	**8 Hrs**

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

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

UNIT - III	**Metal Joining Processes**	**8 Hrs**

Classification of welding processes, types of welds and welded joints and V-I characteristics, arc welding, weld bead geometry, submerged arc welding, gas tungsten arc welding, gas metal arc welding. applications, advantages and disadvantages of the above processes, Plasma Arc welding, Laser Beam Welding, Electron Beam Welding and Friction Stir Welding. Heat affected zones in welding; Welding defects: causes and remedies. soldering and Brazing: Types and their applications.

UNIT - IV	**Plastic Processing, Ceramics and Powder Metallurgy**	**8 Hrs**

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

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

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

UNIT - V	Additive Manufacturing Processes	10 Hrs
Introduction, Fused-deposition modeling, Stereolithography Multijet/Polyjet Modeling, Selective Laser Sintering, Electron-Beam Melting, Three-Dimensional Printing, Laminated-object Manufacturing, Laser-Engineered Net Shaping-Solid-ground Curing.		
Textbooks:		
Rao P.N., Manufacturing Technology – Volume I, 5/e, McGraw-Hill Education, 2018. Serope Kalpakjian and Steven R. Schmid , Manufacturing Engineering and Technology, 7/e, Pearson, 2018.		
Reference Books:		
Introduction to Physical Metallurgy by Sidney H.Avner Millek P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes and Systems, 4/e, John Wiley and Sons Inc, 2010. Sharma P.C., A Text book of Production Technology, 8/e, S Chand Publishing, 2014.		
Online Learning Resources:		
https://www.digimat.in/nptel/courses/video/112107145/L01.html https://www.digimat.in/nptel/courses/video/112105126/L01.html		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	Thermodynamics		L	T	P	C
20A30302			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To introduce the concepts of heat, work, energy and governing rules for conversion of one form to other.
- To explain relationships between properties of matter and basic laws of thermodynamics.
- To teach the concept of entropy for identifying the disorder and feasibility of a thermodynamic process.
- To introduce the concept of available energy for maximum work conversion.
- To impart knowledge on steam properties.
- To provide fundamental concepts of air standard cycles used in IC engines and gas turbines.

Course Outcomes (CO):

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

- Understand the importance of thermodynamic properties related to conversion of heat energy into work. (L1)
- Apply the laws of thermodynamics to boilers, heat pumps, refrigerators, heat engines, compressors and nozzles. (L3)
- Utilize steam properties to design steam based components. (L4)
- Analyze thermodynamic relations and air standard cycles. (L5)

UNIT - I	**First law of Thermodynamics**	**10 Hrs**

Introduction: Basic Concepts: Macroscopic and microscopic viewpoints, definitions of thermodynamic terms, quasi – static process, point and path function, forms of energy, ideal gas and real gas, Zeroth law of thermodynamics and Temperature measurement.
Joule's experiment - first law of thermodynamics, corollaries-perpetual motion machines of first kind, first law applied to non-flow and flow process- limitations of first law of thermodynamics**.**

UNIT - II	**Second Law of Thermodynamics**	**8 Hrs**

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

UNIT - III	**Entropy, Availability and Irreversibility**	**8 Hrs**

Clausius inequality - Concept of Entropy- entropy equation for different processes and systems.
Definition of exergy and anergy, expressions for availability and irreversibility. Availability in steady flow, non-flow processes and irreversibility.
Maxwell relations, TdS equations difference in heat capacities, ratio of heat capacities.

UNIT - IV	**Properties of Steam and use of Steam Tables**	**8 Hrs**

Pure Substances, P-V-T surfaces, T-s and h-s diagram, Mollier chart, dryness fraction, property tables, analysis of steam undergoing various thermodynamic processes using Mollier chart– steam calorimetry. Energy equation, Joule Thompson coefficient Clausius - Clapeyron equation.

UNIT - V	**Air Standard Cycles**	**8 Hrs**

Otto, Diesel and dual cycles, P-V and T -S diagrams - description and efficiencies, mean effective pressures. Brayton Cycle - Comparison of Otto, Diesel and dual cycles, Comparison of Brayton and Otto Cycles.

Textbooks:
P.K.Nag, Engineering Thermodynamics, 5/e, Tata McGraw Hill, 2013. Yunus A. Cengel, Michaela A. Boles, Thermodynamics, 7/e, Tata McGraw Hill, 2011.
Reference Books:
J.B.Jones and G.A.Hawkins, Introduction to Thermodynamics, 2/e, John Wiley & Sons, 2012. Moran, Michael J. and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, 3/e, Wiley, 2015 R.K. Rajput, S.Chand& Co., Thermal Engineering, 6/e, Laxmi publications, 2010
Online Learning Resources:
https://nptel.ac.in/courses/112/105/112105266/ https://nptel.ac.in/courses/112/104/112104113/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	**Mechanics of Materials**		**L**	**T**	**P**	**C**
20A30303			**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

Understand the basics of stresses and strains
Draw the shear force and bending moment drawings of various beams.
Understand the Behaviour of members and Torsional forces
Understand the Behaviour of cylinders
Understand the stresses developing in curved beams.

Course Outcomes (CO):

Evaluate stresses and strains
To draw the SF and BM diagrams for various beams under different loading conditions
Determine the resistance and deformation in machine members subjected to torsional loads and springs.
Analyze and design thin, thick cylinders.
Analysis of stresses in curved bars.

UNIT - I	Analysis of stress and strain

Types of external loads - self weight - internal stresses - normal and shear stresses - strain - Hooke's law - Poisson's ratio - relationship between elastic constants - stress strain diagrams working stress - elongation of bars of constant and varying sections - Stress on inclined planes for axial and biaxial stress fields - principal stresses - Mohr's circle of stress - principal strains - strain rosette – principal stress/strain problem as an eigenvalue problem.

UNIT - II	Bending moment and shear force

Different types of beams - shear force and bending moment diagrams for simply supported, overhanging and cantilever beams - relationship connecting intensity of loading, shearing force and bending moment - shear force and bending moment diagrams for statically determinate plane frames.

UNIT - III	Torsion and Springs

Torsion formulation stresses and deformation in circular and hollows shafts – Stepped shafts – Deflection in shafts fixed at the both ends – Stresses in helical springs – Deflection of helical springs, carriage springs.

UNIT - IV	Thin Cylinders, Spheres and Thick Cylinders

Stresses in thin cylindrical shell due to internal pressure circumferential and longitudinal stresses and deformation in thin cylinders – spherical shells subjected to internal pressure –Deformation in spherical shells – Lame"s theory – Application of theories of failure.

UNIT - V	Bending of curved bars & Unsymmetrical Bending

Stresses in bars of small initial curvature, Winkler-Bach theory, Stresses in bars of large initial curvature, Deflection of Crane hooks, Chain links, circular rings, stresses in circular rings. Introduction to unsymmetrical bending, Stresses and deflection in unsymmetrical bending, Shear center for angle, Channel and I-sections.

Textbooks:

Mechanics of Material – J. M. Gere and S. P. Timoshenko – CBS publisher
Popov, E.P., Mechanics of Materials, Prentice Hall India, New Delhi, 2002.

Advanced Mechanics of Materials–A. P. Boresi and O. M. Sidebottom–John Wiley & Sons
Strength of Materials – R. K. Rajput – S. Chand & Company

Beer, F.P.,Johnston, E.R. and DeWolf, J.T.,Mechanics of Materials, 3rd ed., Tata McGraw-Hill Strength of Material – Dr. Sadhu Singh – Khanna Publishers Strength of Material, Vol. I and II – S. P. Timoshenko – EWP Press
Online Learning Resources:
https://nptel.ac.in/courses/112/107/112107146/ https://ocw.mit.edu/courses/materials-science-and-engineering/3-11-mechanics-of-materials-fall-1999/ https://www.coursera.org/courses?query=mechanics%20of%20materials https://www.udemy.com/course/strengthofmaterials/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES LAB		L	T	P	C
20A30109			0	0	3	1.5
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

By performing this laboratory, the student will be able to know the fluid flow measurements by considering different types flow measurement devices and working principles of various pumps and motors.

Course Outcomes (CO):

By performing the various tests in this laboratory the student will be able to know the principles of discharge measuring devices and head loss due to sudden contraction and expansion in pipes and working principles of various pumps and motors.

List of Experiments:

Verification of Bernoulli's equation.
Calibration of Venturi meter.
Calibration of Orifice meter
Determination of Coefficient of discharge for a small orifice by constant head method.
Determination of Coefficient of discharge for a small orifice by variable head method.
Determination of Coefficient of discharge for an external mouth piece by Constant head method.
Determination of Coefficient of discharge for an external mouth piece by variable head method.
Calibration of contracted Rectangular Notch.
Calibration of contracted Triangular Notch. Determination of friction factor
Determination of loss of head in a sudden contraction.
Determination of loss of head in a sudden Expansion.
Performance test on Impulse turbines
Performance test on reaction turbines (Francis and Kaplan Turbines)
Impact of jet
Performance test on centrifugal pumps, determination of operating point and efficiency

References:

Fluid Mechanics & Hydraulic Machines A Lab Manual by Ts Desmukh (Author), Laxmi Publications (P) Ltd
Fluid Mechanics & Machinery Laboratory Manual by N Kumara Swamy (Author), Charotar Books Distributors
Lab. Manual of Fluid Mechanics & Machines by Gupta, Chandra (Author), cbspd (Publisher)

Online Learning Resources/Virtual Labs:

1. http://eerc03-iiith.vlabs.ac.in/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	Manufacturing Processes Lab		L	T	P	C
20A30304			0	0	3	1.5
Pre-requisite	NIL	Semester	III			

Course Objectives:

- Acquire practical knowledge on Metal Casting, Welding, Press Working and unconventional machining Processes

Course Outcomes (CO):

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

- Fabricate different types of components using various manufacturing techniques. (L6)
- Adapt unconventional manufacturing methods. (L6)

List of Experiments:

1. **METAL CASTING**
   a) Gating Design and pouring time and solidification time calculations.
   b) Sand Properties Testing – Exercise for Strength and Permeability.
   C) Molding, Melting and Casting for ferrous/ non ferrous materials.
2. **WELDING**
   a) TIG Welding.
   b) MIG Welding.
   c) Friction stir welding.
   d) Any other Special Welding Processes.
3. **MECHANICAL PRESS WORKING**
   a) Press Tool: Blanking and Piercing operation with Simple, Compound and Combination dies.
   b) Closed die forging, Deep Drawing and Extrusion operations.
4. **UN CONVENTIONAL MANUFACTUNRING PROCESSES**
   a) Electro Discharge Machining (EDM) / Wire cut EDM
   b) Plasma arc cutting / Abrasive jet machining (AJM)
   c) Additive manufacturing with reverse engineering

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	Mechanics of Materials Lab		L	T	P	C
20A30305			0	0	3	1.5
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

By performing this laboratory, the student will be able to know the structural behavior of various materials

Course Outcomes (CO):

By performing the various tests in this laboratory the student will be able to know the structural behavior of various structural elements when subjected to external loads

List of Experiments:

Tension test.
Bending test on (Steel/Wood) Cantilever beam.
Bending test on simply supported beam.
Torsion test.
Vickers Hardness Test
Rockwell Hardness Test
Brinell Hardness Test
Compression test on Open coiled springs
Tension test on Closely coiled springs
Compression test on wood/ concrete
Izod Impact test on metals
Charpy Impact test on metals
Shear test on metals
Direct Shear Test on Timber Specimen
Use of electrical resistance strain gauges.
Continuous beam – deflection test.

Note : Any 12 of the above equipments

References:

1. **Strength of Materials Lab Manual by** Anand Jayakumar A , **Notion** Press

Online Learning Resources/Virtual Labs:

http://sm-nitk.vlabs.ac.in/#

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	Skill oriented course-I		L	T	P	C
20A30306	Essentials for NX Designers		1	0	2	2
Pre-requisite	**NIL**	**Semester**	**III**			

Course objectives:

After successfully completing this course, you should be able to:

Open and examine NX models.
Create and edit parametric solid models.
Create and modify basic assembly structures.
Create and modify simple drawings.

Course Outcomes:

Open and examine NX models.
Create and edit basic assembly structures.
Create and edit drawings.
Use synchronous modeling.
Create component patterns.
Define revision identifier.

List of Course Contents

Opening and Working with Parts
Getting to know the NX Interface
Impact of Coordinate Systems on Parts
Creating Parts with Sketches
Sweeping geometry to create part features
Creating and editing geometric relationships with formulas
Creating datum geometry to support design intent
Examining the structure of a model
Editing and manipulating sketches
Trimming a solid body
Creating swept features with offset and draft
Creating and editing holes
Creating and manipulating shell features
Copying and mirroring part segments
Blending and chamfering edges
Modifying geometry of imported parts
Creating simple drawings

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

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

Course Code	Mandatory Noncredit course-II		L	T	P	C
20A10803	**ENVIRONMENTAL SCIENCE** (Common to CE, MECH, CHEM)		**3**	**0**	**0**	**0**
Pre-requisite	**NIL**	**Semester**	**III Sem**			

Course Objectives:

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

Course Outcomes (CO):

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

Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
Understand flow and bio-geo- chemical cycles and ecological pyramids.
Understand various causes of pollution and solid waste management and related preventive measures.
About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
Casus of population explosion, value education and welfare programmes.

UNIT - I **8 Hrs**

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

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

UNIT - II **12 Hrs**

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

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

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - III		8 Hrs

Environmental Pollution: Definition, Cause, effects and control measures of :

Air Pollution.
Water pollution
Soil pollution
Marine pollution
Noise pollution
Thermal pollution
Nuclear hazards

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

UNIT - IV		10 Hrs

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

UNIT - V		8 Hrs

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

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

Textbooks:

Text book of Environmental Studies for Undergraduate Courses Erach Bharucha for University Grants Commission, Universities Press.
Palaniswamy, “Environmental Studies”, Pearson education
S.Azeem Unnisa, “Environmental Studies” Academic Publishing Company
K.Raghavan Nambiar, “Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus”, Scitech Publications (India), Pvt. Ltd.

Reference Books:

Deeksha Dave and E.Sai Baba Reddy, “Textbook of Environmental Science”, Cengage Publications.
M.Anji Reddy, “Text book of Environmental Sciences and Technology”, BS Publication.
J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
J. Glynn Henry and Gary W. Heinke, “Environmental Sciences and Engineering”, Prentice hall of India Private limited
G.R.Chatwal, “A Text Book of Environmental Studies” Himalaya Publishing House
Gilbert M. Masters and Wendell P. Ela, “Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**Numerical Methods & Probability Theory-** (Common to EEE, MECH) **B.Tech II Year**		**L**	**T**	**P**	**C**
20A45101			**3**	**0**	**0**	**3**
Pre-requisite	Basic Equations and Basic Probability	**Semester**	**IV**			

Course Objectives:

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.The theory of Probability and random variables.

Course Outcomes (CO): Student will be able to

- apply numerical methods to solve algebraic and transcendental equations
- derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- apply Probability theory to find the chances of happening of events.
- understand various probability distributions and calculate their statistical constants.

UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs

Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT - II	**Interpolation**	8 Hrs

Finite differences -Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula.

UNIT - III	**Numerical Integration & Solution of Initial valueproblems to Ordinary differential equations**	9 Hrs

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

UNIT - IV	**Probability theory:**	9 Hrs
Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.		
UNIT - V	**Random variables & Distributions:**	9 Hrs
Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution		
Textbooks:		
Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India.		
Reference Books:		
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. Advanced Engineering Mathematics, by Alan Jeffrey,		
Elsevier. Online Learning Resources:		
https://onlinecourses.nptel.ac.in/noc17_ma14/preview nptel.ac.in/courses/117101056/17 http://nptel.ac.in/courses/111105090		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Applied Thermodynamics		L	T	P	C
20A40301			3	0	0	3
Pre-requisite	NIL	Semester	IV			

Course Objectives:

- To introduce students to the Working Principles of IC engines.
- To teach combustion process in SI and CI engines.
- To impart knowledge on different types of compressors.
- To familiarize concepts of thermodynamic cycles used in steam power plants and gas turbines
- To impart knowledge on the working of nozzles, turbines, refrigeration and air conditioning.

Course Outcomes (CO):

After completing this course, the students can

- Understand the working of IC engines with combustion process. (L1)
- Select compressors for different applications. (L2)
- Use T-s diagram in vapour power and gas power cycles. (L3)
- Evaluate the relative performance of different steam turbines (L6)
- Select appropriate refrigerant for different applications. (L6)

UNIT - I	IC Engines	10 Hrs

Working and classification of IC engines, comparison of two stroke and four stroke engines, comparison of SI and CI Engines.
Testing and Performance of IC Engines: Methods of testing IC Engines, performance analysis of IC Engines.
Combustion in IC Engines: SI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting ignition lag, Flame propagation and knocking. CI engine: stages of combustion, normal combustion, abnormal combustion, variables effecting delay period and knocking.

UNIT - II	Air compressors	8 Hrs

Reciprocating Compressor: Single stage reciprocating compressors, work required, effect of clearance in compressors, volumetric efficiency, multi stage compressor, effect of inter cooling in multi stage compressors, compressor performance.
Rotary Compressor: Working principle of a rolling piston type compressor (fixed vane type), multi vane type compressors, characteristics of rotary vane type compressor, working principle of centrifugal and axial flow compressors.

UNIT - III	Vapour & Gas Power Cycles	8 Hrs

Vapour power cycle, simple Rankine cycle, mean temp of heat addition, thermodynamic variables effecting efficiency, Rankine cycle – reheating and regeneration.
Simple gas turbine plant, Brayton cycle, closed cycle and open cycle for gas turbines, condition for optimum pressure ratio, actual cycle. Methods to improve performance: regeneration, intercooling and reheating.

UNIT - IV	Nozzles & Steam Turbines	8 Hrs

Type of nozzles - gas and steam nozzles. Compressible flow through nozzle- condition for maximum discharge - Nozzle efficiency - Super saturation.
Steam Turbines - impulse turbine and reaction turbine – compounding of impulse turbines - velocity diagrams in impulse and reaction turbines, blade efficiency, degree of reaction.

UNIT - V	Refrigeration & Air-Conditioning	8 Hrs

Refrigeration: Bell-Coleman cycle - vapour compression cycle, sub cooling and super heating-vapour absorption cycle, properties of common refrigerants.
Principles of Psychrometry and Air Conditioning: Psychometric properties, psychometric processes, summer and winter air conditioning systems.

Textbooks:

1. Thermal Engineering, Mahesh V Rathore, Tata McGraw Hill 2017
2. M.L.Mathur and F.S.Mehta, Thermal Engineering, Jain brothers,2014

Reference Books:
Ganesan V, Internal Combustion Engines, Tata McGraw Hill, 2017. Yahya, S. M., Turbines, Compressors and Fans, 4/e, Tata McGraw Hill, 2010. Nag P.K, Engineering Thermodynamics, 4/e, Tata McGraw-Hill, 2008. Onkar Singh, Thermal Turbomachines, 3/e, Wiley India, 2014. Refrigeration and Air Conditioning, C.P.Arora
Online Learning Resources: https://nptel.ac.in/courses/112/103/112103307/ https://nptel.ac.in/courses/112/103/112103275/

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JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	KINEMATICS OF MACHINERY		L	T	P	C
20A40302			3	0	0	3
Pre-requisite	NIL	Semester	IV			

Course Objectives:

The Objectives of this course are to:

- To provide a foundation for the study of Dynamics of Machinery and machine design.
- Comprehend the fundamentals of kinematics and to understand the concept of machines, mechanisms and related terminologies.
- Analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To develop skills for designing and analyzing linkages and mechanisms.
- Formulate the concept of synthesis and analysis of different mechanisms.
- To understand the Principles and working of various straight line motion mechanisms.
- To analyze Steering gear mechanisms and working of Hooke's joint.
- To understand the theory of gears, gear trains and cams.

Course Outcomes (CO):

- Build up critical thinking and problem-solving capacity of various mechanical engineering problems related to kinematics of machines (L4)
- Understand the basic principles of mechanisms in mechanical engineering (L1)
- Assess various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of power elements (Gears, gear trains, Cams) and design related problems effectively (L6)
- Examine the velocity and acceleration diagram for a given mechanism (L3)
- Utilize analytical, mathematical and graphical aspects of kinematics of Machines for effective design (L3)
- Construct the cam profile for a given motion (L3)
- Analyze various gear trains (L4)

UNIT - I	MECHANISMS AND MACHINES	16 Hrs

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

Steering & Straight-Line Motion Mechanisms :

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

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

UNIT - II	KINEMATICS	10Hrs

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

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

UNIT - III	Kinematic Synthesis	10 Hrs

Kinematic Synthesis: Dimensional synthesis, function generation, path generation and motion generation, Synthesis of Four Bar linkage for specified Instantaneous conditions, Hirsch horn's method of components.

UNIT - IV	Gears & GEAR TRAINS	10 Hrs

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

GEAR TRAINS:

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

UNIT - V	CAMS & Followers	8 Hrs

CAMS: Definitions of cam and follower – uses – Types of followers and cams – Terminology. Types of follower motion - Uniform velocity, Simple harmonic motion, Cycloidal, uniform acceleration and retardation, Maximum velocity and maximum acceleration during outward and return strokes. Drawing of cam profiles.

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

Textbooks:

Theory of Machines and Mechanisms-S.S.Rattan, Tata McGraw Hill Publishers.
Theory of Machines R.S Khurmi& J.K Gupta, S Chand Publishers.

Reference Books:

Theory of Machines by Thomas Bevan/ CBS
Theory of Machines / R.K Bansal
Theory of Machines Sadhu Singh PearsonsEdn
Mechanism and Machine Theory / JS Rao and RV Dukkipati / New Age
The theory of Machines /Shiegley/ Oxford.
Theory of machines – PL. Balaney/khanna publishers
Mechanics Synthesis by RL Naathan

Online Learning Resources:

https://www.digimat.in/nptel/courses/video/112104121/L01.html
https://nptel.ac.in/courses/112/105/112105268/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Manufacturing Technology		L	T	P	C
20A40303			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

To introduce the parameters in the metal cutting operation.
To relate tool wear and tool life and the variables that control them.
To calculate machining times for different machining processes.
To impart knowledge on various metal cutting processes. (Lathe, drilling, boring shaping, slotting, milling and grinding).
To teach the principles of jigs and fixtures and types of clamping and work holding devices.

Course Outcomes (CO):

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

Choose cutting processes and variables. (L3)
Relate tool wear and tool life. (L1)
Calculate the machining parameters for different machining processes. (L5)
Identify methods to generate different types of surfaces. (L3)
Explain work-holding requirements. (L2)
Design jigs and fixtures. (L6)

UNIT - I	**Material Removal Processes & Lathe**	**8 Hrs**

Metal Cutting: Single and multi-point cutting tools, orthogonal and oblique cutting, Merchant circle Diagram, chip formation, tool wear and tool life, surface finish, machinability, cutting tools and materials, cutting fluids.
Lathe and Lathe Operations: Principles of working, specifications, types of lathes, operations, work and tool holders. Taper turning, thread turning attachments for lathes. Machining time calculations. Principles of working: Turret and capstan lathes.

UNIT - II	**Drilling Machines, Boring, Reaming and Taping**	12 Hrs

Drilling Machines: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of twist drill, Machining time calculations
Boring Machines- Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of boring tools, Machining time calculations
Reaming and Reamers: Principles of working, specifications, types, and operations performed – tool holding devices - nomenclature of reamers. Machining time calculations
Taping and Taps: Principles of working, specifications, types, and operations performed - tool holding devices - nomenclature of taps

UNIT - III	**Milling, Shaping and Abrasive Machining**	8 Hrs

Milling operations and Milling machines - Principles of working, specifications, classifications of milling machines, machining operations, types and geometry of milling cutters, methods of indexing, and accessories to milling machines, machining time calculations.
Shaping, Slotting and planing machines - Principles of working - principal parts, specification, classification, operations performed, machining time calculations
Abrasive Machining: Grinding and grinding machines: Grinding process, types of grinding machines, grinding process parameters, honing, lapping, other finishing processes.

UNIT - IV	**Unconventional Machining Processes**	**10 Hrs**

principle and Processes parameters of Electrical discharge machining (EDM), electro-chemical machining (ECM), Laser beam machining (LBM), plasma arc machining (PAM), electron beam machining, Abrasive jet machining (AJM), water jet machining (WJM), and ultrasonic machining(UM)

UNIT - V	Jigs and Fixtures	8 Hrs
Principles of design of Jigs and fixtures and uses, 3-2-1 principle of location and clamping, classification of Jigs & Fixtures, types of clamping and work holding devices, typical examples of jigs and fixtures.		

Textbooks:

P.N. Rao, Manufacturing Technology: Metal Cutting and Machine Tools, (Volume 2), 3/e, Tata McGraw-Hill Education, 2013
R.K. Jain and S.C. Gupta, Production Technology, 17/e, Khanna Publishers, 2012
Kalpakzian S and Schmid SR, Manufacturing Engineering and Technology, 7/e, Pearson, 2018.

Reference Books:

Milton C.Shaw , Metal Cutting Principles, 2/e, Oxford, 2012
Hindustan Machine Tools, Production Technology, TMH, 2001
V.K.Jain, Advanced Machining Process,12/e, Allied Publications, 2010
AB. Chattopadhyay, Machining and Machine Tools, 2/e, Wiley, 2017
Halmi A Yousuf & Hassan, , Machine Technology: Machine Tools and Operations, CRC Press Taylor and Francis Group, 2008

Online Learning Resources:

https://www.digimat.in/nptel/courses/video/112107239/L01.html
https://nptel.ac.in/courses/112/104/112104304/

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU
B.Tech (R-20 Mechanical Engineering)
Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101a	MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS	3	0	0	3

Pre-requisite **Semester -IV**

Course Objectives:

The objectives of this course are:

1.	To inculcate the basic knowledge of micro economics and financial accounting
2.	To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
3.	To know the various types of Market Structures & pricing methods and its strategies
4.	To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
5.	To provide fundamental skills on Accounting and to explain the process of preparing Financial statements

UNIT – I

Managerial Economics

Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand – DemandElasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

State the Nature of Managerial Economics and its importance

- Understand the concept of demand andits determinants
- Analyze the Elasticity and degree of elasticity
- EvaluateDemand forecasting methods
- Design the process of demand estimation for different types of demand

UNIT - II

Production and Cost Analysis

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination–Shortrun and longrun Production Function- Isoquants andIsocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break-Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III
Business Organizations and Markets
Introduction – Nature, meaning, significance, functions and advantages.Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises.Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition – Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies.

UNIT - IV
Capital Budgeting
Introduction – Nature, meaning, significance, functions and advantages. Typesof Working Capital,Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals,Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)

UNIT - V
Financial Accounting and Analysis
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis* -** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.

Textbooks:

1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013.
2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019

Reference Books:

1. Ahuja Hl Managerial economics Schand,3/e,2013
2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013.
3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi.
4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

B.Tech (R-20 Mechanical Engineering)

Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101b	ENTREPRENEURSHIP& INCUBATION	3	0	0	3

COURSE OBJECTIVES: The objective of this course is	
1	To make the student understand about Entrepreneurship
2	To enable the student in knowing various sources of generating new ideas in setting up ofnew enterprise
3	To facilitate the student in knowing various sources of finance in starting up of a business
4	To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
5	To encourage the student in creating and designing business plans

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	Define the Concepts related to the Entrepreneurship and Incubators
CO2	Understand the concept of Entrepreneurship and challenges in the world of competition.
CO3	Apply the Knowledge in generating ideas for New Ventures.
CO4	Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
CO5	Evaluate the role of central government and state government in promoting Entrepreneurship.
CO6	Create and design business plan structure through incubations.

UNIT-I: Entrepreneurship

Introduction-Nature, meaning, significance, functions and advantages. concept, characteristics-knowledge and skills requirement - process - Factors supporting entrepreneurship - Differences between Entrepreneur and Intrapreneur - entrepreneurial mindset and personality - Recent trends.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Understand theconcept of Entrepreneur and Entrepreneurship in India

- Analyzerecent trends in Entrepreneurship across the globe
- Develop a creative mind set and personality in starting a business.

UNIT-II: Women Entrepreneurship

Introduction – Nature, meaning, significance, functions and advantages. Growth of women entrepreneurship in India. - Issues & Challenges - Entrepreneurial motivations.Entrepreneurship Development and Government. Role, of Central and State Government - incentives, subsidies and grants – Export-oriented Units - Fiscal and Tax concessions.

LEARNING OUTCOMES

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

- Understand the role of government in promoting women entrepreneurship
- Analyze the role of export-oriented units
- Evaluate the tax concessions available for Women entrepreneurs

UNIT-III:Product Development

Introduction – Nature, meaning, significance, functions and advantages. Startup Initiatives - Generating business/ Service idea – Sources and methods –Identifying opportunities - Feasibility study - Market feasibility, technical/operational feasibility, Financial feasibility. Developing business plan, Preparing project report, Presenting business plan to investors.

LEARNING OUTCOMES

At the end if the Unit, the learners will be able to

- Analyze the sources of new methods in generating business idea
- Evaluate market feasibility, financial feasibility and technical feasibility
- Design and draw business plansinproject preparation and prepare project reports

UNIT-IV:Startups

Introduction – Nature, meaning, significance, functions and advantages. Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence theType/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure -Value proposition

LEARNING OUTCOMES

At the end of the Unit, the learners will be able to:

- Understand the importance of business incubation
- Apply brilliant ideas in the process of business incubation
- Analyze the process of business incubation/incubators.
- Design their own business incubation/incubators as viable-business unit.

UNIT-V: Finance

Introduction – Nature, meaning, significance, functions and advantages. Sources - Long term and Short term - Institutional Finance – Commercial Banks, SFC's and NBFC's in India, Role in small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey-Institutions supporting entrepreneurship development.

LEARNING OUTCOMES

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

- Understand the various sources of finance in Starting the new venture
- Analyze the role of banks and other financial institutions in promoting entrepreneurship in India
- Evaluatethe need and importance of MSMEs in the growth of country

TEXT BOOKS

1. D F Kuratko and T V Rao, **Entrepreneurship** - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit :login.cengage.com)

2 .Nandan H, Fundamentals of Entrepreneurship, PHI, 2013

REFERENCES

1.Vasant Desai,Small Scale Industries and Entrepreneurship, Himalaya Publishing 2012.

2. Rajeev Roy Entrepreneurship, 2nd Edition, Oxford, 2012.

3.B.JanakiramandM.Rizwana|| Entrepreneurship Development: Text & Cases, Excel Books, 2011.

4.Stuart Read, Effectual Entrepreneurship, Routledge, 2013.

E-RESOURCES

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd
4. http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
COLLEGE OF ENGINEERING (Autonomous), ANANTHAPURAMU

B.Tech (R-20 Mechanical Engineering)

Common to Civil, Mech, CHEM

Course Code		L	T	P	C
20A49101c	**BUSINESS ETHICS AND CORPORATE GOVERNANCE**	3	0	0	3

Pre-requisite **Semester -IV**

Course Objectives:

The objectives of this course are:

1.	To make the student understand the principles of business ethics
2.	To enable them in knowing the ethics in management
3.	To facilitate the student's role in corporate culture
4.	To impart knowledge about the fair-trade practices
5.	To encourage the student in creating knowing about the corporate governance

UNIT – I

ETHICS

Introduction – Meaning – Nature, Scope, significance, Loyalty, and ethical behavior - Value systems - Business Ethics,Types, Characteristics, Factors, Contradictions and Ethical Practices inManagement- Corporate Social Responsibility – Issues of Management – Crisis Management.

UNIT - II
ETHICS IN MANAGEMENT
Introduction Ethics in production, finance, Human Resource Management and, Marketing Management - Technology Ethics and Professional ethics - The Ethical Value System – Universalism, Utilitarianism, Distributive Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

UNIT - III
CORPORATE CULTURE
Introduction, Meaning,definition,Nature, Scope, Functions,andsignificance–
Cross cultural issues in Ethics - - Emotional Honesty – Virtue of humility – Promote happiness – karma yoga – proactive – flexibility and purity of mind. The Ethical Value System – Universalism, Utilitarianism, Distributive
Justice, Social Contracts, Individual Freedom of Choice, Professional Codes; Culture and Ethics – Ethical Values in different Cultures, Culture and Individual Ethics.

UNIT - IV
LEGAL FRAME WORK
Law and Ethics, Agencies enforcing Ethical Business Behavior, Legal Impact– Environmental Protection, Fair Trade Practices,legal Compliances, Safeguarding Health and wellbeing of Customers.

UNIT - V
CORPORATE GOVERNANCE
Introduction, meaning – scope Nature - Issues, need, corporate governance code, transparency & disclosure, role of auditors, board of directors and shareholders. Global issues, accounting and regulatory frame work, corporate scams, committees in India and abroad, corporate social responsibility. of BoDs composition, Cadbury Committee - various committees - reports - Benefits and Limitations.

Textbooks:

1. Murthy CSV: Business Ethics and Corporate Governance, HPH
2. Bholananth Dutta, S.K. Podder – Corporation Governance, VBH.

Reference Books:

1.Dr. K. Nirmala, KarunakaraReddy: Business Ethics and Corporate Governance, HPH
2. H.R.Machiraju: Corporate Governance
3. K. Venkataramana, Corporate Governance, SHBP.
4. N.M.Khandelwal : Indian Ethos and Values for Managers

2020-2021

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

JNTUACEA **R-20**

2020-2021

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

<table>
<tr><th>Course Code</th><th colspan="2" rowspan="2">Applied Thermodynamics Lab</th><th>L</th><th>T</th><th>P</th><th>C</th></tr>
<tr><td>20A40304</td><td>0</td><td>0</td><td>3</td><td>1.5</td></tr>
<tr><td>Pre-requisite</td><td>NIL</td><td>Semester</td><td colspan="4">IV</td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">• Understand the functioning and performance of I.C. Engines
• To find heat losses in various engines</td></tr>
<tr><td colspan="7">Course Outcomes (CO):</td></tr>
<tr><td colspan="7">Upon the successful completion of course, students will be able to
• Explain different working cycles of engine
• Describe various types of combustion chambers in IC engines
• Illustrate the working of refrigeration and air conditioning systems
• Evaluate heat balance sheet of IC engine.
•</td></tr>
<tr><td colspan="7">LIST OF EXPERIMENTS</td></tr>
<tr><td colspan="7">Demonstration of diesel and petrol engines by cut models
1. Valve timing diagram of 4-stroke diesel engine
2. Port timing diagram of 2-stroke petrol engine
3. Performance of 2-stroke single cylinder petrol engine
4. Morse test on multi cylinder petrol engine
5. Performance of 4-stroke single cylinder diesel engine
6. Assembly and disassembly of diesel and petrol engines
7. Exhaust gas analysis
8. Performance of two stage reciprocating air compressor
9. Determination of nozzle characteristics
10. Performance of Refrigeration system
11. Performance of Air conditioning system
12. Performance of heat pump</td></tr>
</table>

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	**Manufacturing Technology Lab**		**L**	**T**	**P**	**C**
20A40305			**0**	**0**	**3**	**1.5**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- Familiarize the construction and working of various machine tools.
- Teach selection of parameters for different machining processes.

Course Outcomes (CO):

After completion of this course the student may be able to

- Implement the concept of machining with various machine tools.(L5)
- Get hands on experience on various machine tools and machining operations. (L5)

List of Experiments:

1. Demonstration of operations on general purpose machines: Lathe, drilling, milling, shaper, slotting, cylindrical and surface grinding machines.
2. Step turning and knurling on lathe machine
3. Taper turning and knurling on lathe machine
4. Thread cutting (left hand or right hand) on lathe machine.
5. Drilling and Boring operations.
6. Reaming and tapping operations.
7. Milling (Gear cutting) by using simple and Compound indexing.
8. key way/Groove cutting on milling machine
9. Shaping and planning operations
10. Slotting operations
11. Cylindrical and surface grinding operations
12. Grinding of single point cutting tool

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU
DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Computer Aided Machine Drawing		L	T	P	C
20A40306			0	0	3	1.5
Pre-requisite	NIL	Semester	IV			

Course Objectives:

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings.
- Familiarize with limits, fits and tolerances in mating components

Course Outcomes (CO):

After completion of this lab student will be able to

- Demonstrate the conventional representations of materials and machine components.
- Model riveted, welded and key joints using CAD system.
- Create solid models and sectional views of machine components.
- Generate solid models of machine parts and assemble them.
- Translate 3D assemblies into 2D drawings.
- Create manufacturing drawing with dimensional and geometric tolerances.

The following contents are to be done by any 2D software package

Conventional representation of materials and components:
Detachable joints: Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint with washer and locknut, stud joint, screw joint and foundation bolts.
Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
Welded joints: Lap joint and T joint with fillet, butt joint with conventions.
Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
Couplings: rigid – Muff, flange; flexible – bushed pin-type flange coupling, universal coupling, Oldhams' coupling.

The following contents to be done by any 3D software package

Sectional views
Creating solid models of complex machine parts and create sectional views.
Assembly drawings: (Any four of the following using solid model software)
Lathe tool post, tool head of shaping machine, tail stock, machine vice, gate valve, carburettor, piston, connecting rod, eccentric, screw jack, plumber block, axle bearing, pipe vice, clamping device, Geneva cam, universal coupling,

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

Textbooks:

K.L.Narayana, P.Kannaiah and K.Venkat Reddy, Production Drawing, New Age International Publishers, 3/e, 2014
Software tools/packages- Auto CAD, Solid works or equivalent.

Reference Books:
Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
Online Learning Resources:
https://eeedocs.files.wordpress.com/2014/02/machinedrawing.pdf

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Skill oriented course-II		L	T	P	C
20A40307	Application Development with Python		1	0	2	2
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

1. To learn the basic concepts of software engineering and life cycle models
2. To explore the importance of Databases in application Development
3. Acquire programming skills in core Python
4. To understand the importance of Object-oriented Programming

Course Outcomes (CO):

Students should be able to

1. Identify the issues in software requirements specification and enable to write SRS documents for software development problems
2. Explore the use of Object oriented concepts to solve Real-life problems
3. Design database for any real-world problem
4. Solve mathematical problems using Python programming language

Module 1. Basic concepts in software engineering and software project management

Basic concepts: abstraction versus decomposition, the evolution of software engineering techniques, Software development life cycle
Software project management: project planning and project scheduling

Task:
Identifying the Requirements from Problem Statements

Module 2. Basic Concepts of Databases
Database systems applications, Purpose of Database Systems, view of Data, Database Languages, Relational Databases, Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table), Data Manipulation Language(DML) Statements
Task:
Implement Data Definition Language(DDL) Statements: (Create table, Alter table, Drop table)
Implement Data Manipulation Language(DML) Statements

Module 3. Python Programming:
Introduction to Python: Features of Python, Data types, Operators, Input and output, Control Statements, Looping statements
Python Data Structures: Lists, Dictionaries, Tuples.

Strings: Creating strings and basic operations on strings, string testing methods.

Functions: Defining a function- Calling a function- Types of functions-Function Arguments- Anonymous functions- Global and local variables

OOPS Concepts; Classes and objects- Attributes- Inheritance- Overloading- Overriding- Data hiding

Modules and Packages: Standard modules-Importing own module as well as external modules Understanding Packages Powerful Lamda function in python Programming using functions, modules and external packages

Working with Data in Python: Printing on screen- Reading data from keyboard- Opening and closing file- Reading and writing files- Functions-Loading Data with Pandas-Numpy

Tasks:
1. OPERATORS

Read a list of numbers and write a program to check whether a particular element is present or not using membership operators.

Read your name and age and write a program to display the year in which you will turn 100 years old.

Read radius and height of a cone and write a program to find the volume of a cone.

Write a program to compute distance between two points taking input from the user (Hint: use Pythagorean theorem)

2. CONTROL STRUCTURES

a. Read your email id and write a program to display the no of vowels, consonants, digits and white spaces in it using if…elif…else statement.

b. Write a program to create and display a dictionary by storing the antonyms of words. Find the antonym of a particular word given by the user from the dictionary using while loop.

c. Write a Program to find the sum of a Series 1/1! + 2/2! + 3/3! + 4/4! +…….+ n/n!. (Input :n = 5, Output : 2.70833)

d. In number theory, an abundant number or excessive number is a number for which the sum of its proper divisors is greater than the number itself. Write a program to find out, if the given number is abundant. (Input: 12, Sum of divisors of 12 = 1 + 2 + 3 + 4 + 6 = 16, sum of divisors 16 > original number 12)

LIST

Read a list of numbers and print the numbers divisible by x but not by y (Assume x = 4 and y = 5).

Read a list of numbers and print the sum of odd integers and even integers from the list.(Ex: [23, 10, 15, 14, 63], odd numbers sum = 101, even numbers sum = 24)

Read a list of numbers and print numbers present in odd index position. (Ex: [10, 25, 30, 47, 56, 84, 96], The numbers in odd index position: 25 47 84).

Read a list of numbers and remove the duplicate numbers from it. (Ex: Enter a list with duplicate elements: 10 20 40 10 50 30 20 10 80, The unique list is: [10, 20, 30, 40, 50, 80])

TUPLE

a. Given a list of tuples. Write a program to find tuples which have all elements divisible by K from a list of tuples. test_list = [(6, 24, 12), (60, 12, 6), (12, 18, 21)], K = 6, Output : [(6, 24, 12), (60, 12, 6)]

b. Given a list of tuples. Write a program to filter all uppercase characters tuples from given list of tuples. (Input: test_list = [("GFG", "IS", "BEST"), ("GFg", "AVERAGE"), ("GfG",), ("Gfg", "CS")], Output : [(„GFG‟, „IS‟, „BEST‟)]).

Given a tuple and a list as input, write a program to count the occurrences of all items of the list in the tuple. (Input : tuple = ('a', 'a', 'c', 'b', 'd'), list = ['a', 'b'], Output : 3)

5: SET

Write a program to generate and print a dictionary that contains a number (between 1 and n) in the form (x, x*x).

Write a program to perform union, intersection and difference using Set A and Set B.

Write a program to count number of vowels using sets in given string (Input : "Hello World", Output: No. of vowels : 3)

Write a program to form concatenated string by taking uncommon characters from two strings using set concept (Input : S1 = "aacdb", S2 = "gafd", Output : "cbgf").

6: DICTIONARY

Write a program to do the following operations:

Create a empty dictionary with dict() method

Add elements one at a time

Update existing key‟s value

iv. Access an element using a key and also get() method

Deleting a key value using del() method

Write a program to create a dictionary and apply the following methods:

pop() method

popitem() method
clear() method
c. Given a dictionary, write a program to find the sum of all items in the dictionary.
d. Write a program to merge two dictionaries using update() method.

7: STRINGS
a. Given a string, write a program to check if the string is symmetrical and palindrome or not. A string is said to be symmetrical if both the halves of the string are the same and a string is said to be a palindrome string if one half of the string is the reverse of the other half or if a string appears same when read forward or backward.
b. Write a program to read a string and count the number of vowel letters and print all letters except 'e' and 's'.
c. Write a program to read a line of text and remove the initial word from given text. (Hint: Use split() method, Input : India is my country. Output : is my country)
d. Write a program to read a string and count how many times each letter appears. (Histogram).

8: USER DEFINED FUNCTIONS
A generator is a function that produces a sequence of results instead of a single value. Write a generator function for Fibonacci numbers up to n.
Write a function merge_dict(dict1, dict2) to merge two Python dictionaries.
Write a fact() function to compute the factorial of a given positive number.
Given a list of n elements, write a linear_search() function to search a given element x in a list.

9: BUILT-IN FUNCTIONS
a. Write a program to demonstrate the working of built-in statistical functions mean(), mode(), median() by importing statistics library.
Write a program to demonstrate the working of built-in trignometric functions sin(), cos(), tan(), hypot(), degrees(), radians() by importing math module.
Write a program to demonstrate the working of built-in Logarithmic and Power functions exp(), log(), log2(), log10(), pow() by importing math module.
Write a program to demonstrate the working of built-in numeric functions ceil(), floor(), fabs(), factorial(), gcd() by importing math module.

CLASS AND OBJECTS
Write a program to create a BankAccount class. Your class should support the following methods for
Deposit
Withdraw
GetBalanace
PinChange
Create a SavingsAccount class that behaves just like a BankAccount, but also has an interest rate and method that increases the balance by the appropriate amount of interest (Hint:use Inheritance).
Write a program to create an employee class and store the employee name, id, age, and salary using the constructor. Display the employee details by invoking employee_info() method and also using dictionary (dict).
Access modifiers in Python are used to modify the default scope of variables. Write a program to demonstrate the 3 types of access modifiers: public, private and protected.

FILE HANDLING
a. . Write a program to read a filename from the user, open the file (say firstFile.txt) and then perform the following operations:
i. Count the sentences in the file.
Count the words in the file.
Count the characters in the file.
b. . Create a new file (Hello.txt) and copy the text to other file called target.txt. The target.txt file should store only lower case alphabets and display the number of lines copied.
c. Write a Python program to store N student"s records containing name, roll number and branch. Print

the given branch student"s details only.
References:
Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018. Ramez Elmasri, Shamkant, B. Navathe, “Database Systems”, Pearson Education, 6th Edition, 2013. 3.Reema Thareja, “Python Programming - Using Problem Solving Approach”, Oxford Press, 1st Edition, 2017. Larry Lutz, “Python for Beginners: Step-By-Step Guide to Learning Python Programming”, CreateSpace Independent Publishing Platform, First edition, 2018
Online Learning Resources/Virtual Labs:
http://vlabs.iitkgp.ernet.in/se/ http://vlabs.iitb.ac.in/vlabs-dev/labs/dblab/index.php https://python-iitk.vlabs.ac.in

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS):: ANANTHAPURAMU

DEPARTMENT OF MECHANICALENGINEERING

II Year B.Tech.M.E. II Semester

Course Code	Mandatory noncredit course-III		L	T	P	C
20A49102	Design Thinking for Innovation (Common to All branches of Engineering)		2	1	0	0
Pre-requisite	NIL	Semester	IV			

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.

Course Outcomes (CO):

Define the concepts related to design thinking.
Explain the fundamentals of Design Thinking and innovation
Apply the design thinking techniques for solving problems in various sectors.
Analyse to work in a multidisciplinary environment
Evaluate the value of creativity
Formulate specific problem statements of real time issues

UNIT - I **Introduction to Design Thinking** **10 Hrs**

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II **Design Thinking Process** **10 Hrs**

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III **Innovation** **8 Hrs**

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV **Product Design** **8 Hrs**

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.

Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT - V **Design Thinking in Business Processes** **10 Hrs**

Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes.

Activity: How to market our own product, About maintenance, Reliability and plan for startup.

Textbooks:

Change by design, Tim Brown, Harper Bollins (2009)
Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.

Reference Books:

Design Thinking in the Classroom by David Lee, Ulysses press Design the Future, by Shrrutin N Shetty, Norton Press Universal principles of design- William lidwell, kritinaholden, Jill butter. The era of open innovation – chesbrough.H
Online Learning Resources:
https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview

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

L	T	P	C
3	0	0	3

B. Tech (ME) III-I SEM (R20)

(20A50301) Theory -1 DESIGN OF MACHINE MEMBERS

CourseObjectives:

Provideanintroductiontodesignofmachineelements.
Familiarizewithfundamentalapproachestofailurepreventionforstaticandd ynamicloading.
Explaindesignprocedurestodifferenttypesofjoints.
Teachprinciplesofclutchesandbrakesanddesignprocedures.
Instructdifferenttypes ofbearingsanddesignprocedures.

CourseOutcomes:

Attheendofthecoursethestudentswillbeableto
Estimatesafetyfactorsof machinememberssubjectedtostaticanddynamicloads. (L5)
Designfastenerssubjectedtovarietyofloads. (L6)
Select of standard machine elements such as keys, shafts, couplings, springs and bearings. (L1)
Designclutchesbrakesandspurgears.(L6)

UNIT-I Introduction,DesignforStaticandDynamicloads

Mechanical Engineering Design: Designprocess, design considerations, codes and standards of designation of materials, selection of materials.

Design for Static Loads: Modes of failure, design of components subjected to axial, bending, torsional and impact loads. Theories of failure for static loads.

Design for Dynamic Loads: Endurance limit, fatigue strength under axial, bending and torsion, stress concentration, notch sensitivity. Types of fluctuating loads, fatigue design for infinite life. Soderberg,Goodman and modified Goodman criterion for fatigue failure. Fatigue design under combined stresses.

UNIT-II DesignofBoltedandWeldedJoints

Design of Bolted Joints: Threaded fasteners, preload of bolts, various stresses induced in the bolts. Torque requirement for bolt tightening, gasketed joints and eccentrically loaded bolted joints.

WeldedJoints: Strengthof lap andbutt welds, Joints subjectedtobendingandtorsion. Eccentrically loaded welded joints.

UNIT-III PowertransmissionshaftsandCouplings

Power TransmissionShafts: Design of shafts subjected to bending, torsion and axial loading. Shafts subjected to fluctuating loads using shock factors.

Couplings: Designofflangeandbushedpincouplings,universalcoupling.

UNIT-IV DesignofClutches, BrakesandSprings

Friction Clutches: Torque transmitting capacity of disc and centrifugal clutches. Uniform wear theory and uniform pressure theory.

Brakes: Different types of brakes. Concept of self-energizing and self-locking of brake. Band and block brakes, disc brakes.
Springs: Designofhelicalcompression,tension,torsionandleafsprings.

UNIT-V DesignofBearingsand Gears

Design of Sliding Contact Bearings: Lubrication modes, bearing modulus, McKee's equations, design of journal bearing, Bearing Failures.

Design of Rolling Contact Bearings: Static and dynamic load capacity, Stribeck's Equation, equivalent bearing load, load-life relationships, load factor, selection of bearings from manufacturer's catalogue.

DesignofGears: Spurgears,beamstrength,Lewisequation,designfor dynamicandwear loads.

Textbooks:

R.L.Norton,MachineDesignanIntegratedapproach,2/e,PearsonEducation, 2004.
V.B.Bhandari,DesignofMachineElements,3/e,TataMcGrawHill,2010.

Dr.N.C.Pandya&Dr.C.S.Shah,Machinedesign,17/e,CharotarPublishingH ouse Pvt. Ltd, 2009.

ReferenceBooks:

R.K.Jain,MachineDesign,KhannaPublications, 1978.
J.E.Shigley,MechanicalEngineeringDesign,2/e,TataMcGrawHill,1986.

M.F. SpottsandT.E. Shoup, DesignofMachineElements,3/e, Prentice Hall (Pearson Education), 2013.
K.Mahadevan&K.BalaveeraReddy,Designdatahandbook, CBSPublications,4/e,2018.

OnlineLearningResources:

https://www.yumpu.com/en/document/view/18818306/lesson-3-course-name-design-of- machine-elements-1-nptel
https://www.digimat.in/nptel/courses/video/112105124/L01.html
https://dokumen.tips/documents/nptel-design-of-machine-elements-1.html http://www.nitttrc.edu.in/nptel/courses/video/112105124/L25.html

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

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B. Tech (ME)-III-I Sem (R20)

(20A50302) Theory 2 METROLOGY AND MEASUREMENTS

Course Objectives:

Introducethebasicconceptsof metrologyandmeasurementmethods.
Demonstratetheimportanceof metrologyin manufacturing.
Explaintheconceptsoftransducersanditspracticalapplications.
Exposewithvariousmeasuringinstruments.
Familiarizecalibrationmethodsofvariousmeasuringinstruments.

Course Outcomes: At the end of the course the students will be able to
Listvariousmeasuringinstrumentsusedinmetrology.L1
Examinegeometryofscrewthreadsandgearprofiles.L3
Measureforce, torqueandpressure.L3
Calibratevariousmeasuringinstruments.L5

UNIT I Concept of measurement

Concept of Measurement: General concept-generalized measurement system, units and standards, measuring instruments, sensitivity, readability, range of accuracy, precision, static and dynamic response, repeatability, systematic and random errors, correction, calibration, terminology and limits fits and tolerances, hole basis and shaft basis system, interchangeability.

Limit Gauges And Gauge Design: Plug, Ring, Snap, Gap, Taper gauges. Taylor's principle. Design of Go and No Go gauges.

Linear and Angular Measurement: Linear measuring instruments: Vernierinstruments, micrometers, slip gauges, tool makers microscope. Comparators: Mechanical, pneumatic and electrical.

Angular measurements: Sine bar, bevel protractor and angle dekkor, rollers and spheres used to determine the tapers.

UNIT–II FlatnessandSurfaceRoughnessmeasurement.
Flatness Measurement: Measurement of flatness – straight edges – surface plates, optical flat and autocollimators, interferometers and their applications.

Surface Roughness Measurement: Terminology systems, differences between surface roughness and surface waviness- Numerical assessment of surface finish - CLA, R.M.S Value-Ra, Rzvalues, Methods of measurement of surface finish-profilograph, talysurf, BIS symbols for indication of surface roughness.

UNIT–III ScrewThreadandGearMeasurement

Screw thread measurements: Elements of threads, errors in screw threads, various methods for measuring external and internal screw threads, screw thread gauges.

Gear Measurement: Gear tooth terminology, measurement of gear elements-run out, lead, pitch backlash, profile, pressure angle, tooth thickness, diameter of gear, constant chord and base tangent method.

CoordinateMeasuringMachine(CMM)-Constructionandfeatures.

UNIT–IV MeasurementofDisplacementandStrain

Measurement of Displacement: Theory and construction of various transducers to measure displacement – Piezo-electric, inductive, capacitance, resistance, ionization and photoelectric transducers, calibration procedures.

Measurements ofStrain: Various types of electrical strain gauges, gaugefactor, methodof usage of resistance strain gauge for bending, compressive and tensile strains, usage for measuring torque,straingaugerosettes.

UNIT–V MeasurementofForce,Torqueand Pressure

MeasurementofForce: Direct method-analyticalbalance, platformbalance; elastic members –load cells, cantilever beams and proving rings.

Measurement of Torque: Torsion bar dynamometer, servo controlled dynamometer and absorption dynamometer.

Measurement ofPressure: Standards and calibration, basic methods of pressuremeasurement, dead weight gauges and manometers, High and low pressure measurement, Elastic transducers.

Textbooks:

Beckwith,Marangoni,Linehard,MechanicalMeasurements,6/e,PHI,2013.
R.K.Jain,EngineeringMetrology,20/e,KhannaPublishers,2013.

ReferenceBooks:

Mahajan,EngineeringMetrology,2/e,DhanpatRai,2013.
S.Bhaskar,BasicPrinciples-

MeasurmentsandControlSystems,AnuradhaPublications, 2014.
AnandKBewoor&VinayAKulkarni,Metrology&Measurement,15/e,McGrawHill, 2015.
D.S.Kumar,MechanicalMeasurements&Control,MetropolitanPublishers,5/e,2015.

OnlineLearningResources:

https://nitsri.ac.in/Department/Mechanical%20Engineering/MEC_405_Book_2,_for_Unit_2B.pdf
https://www.digimat.in/nptel/courses/video/112104250/L47.html
https://www.digimat.in/nptel/courses/video/112106138/L01.html
https://www.digimat.in/nptel/courses/video/112106179/L01.html
https://www.youtube.com/watch?v=tczyyM4Dykc
https://www.youtube.com/watch?v=_UsAiZmRC1M
https://www.youtube.com/watch?v=oCkaxMI19X8

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
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B.Tech (ME) – III-I Sem (R20)

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2	0	1	3

(20A50303) Theory -3 DYNAMICS OF MACHINERY

Course Objectives:

Analysisofforcesactinginmechanisms
Effectsofunbalanceforces
Modellingandanalyzingthevibrationbehaviorofspringmassdampersystem
Theprinciplesinmechanismsusedforgoverningofmachines.

Course Outcomes: Attheendofthecourse,thestudentwillbeable to

Determinetheforcesactingonvariouslinkageswhenamechanismissubjectedtoexternalforces.L5
IdentifyandcorrecttheunbalancesofrotatingbodyL1
AnalyzethevibratorymotionofSDOFsystems.L2
ReducethemagnitudeofvibrationandisolatevibrationofdynamicsystemsL3
DeterminedimensionsofGovernorsforspeedcontrol.L5

UNIT-I Friction and PowerScrews

Friction: Inclined plane, frictionof screws andnuts, pivot andcollar, uniformpressure, uniformwear. Friction circle and friction axis, lubricated surfaces, boundary friction, film lubrication.

Powerscrews:Formsofthreads, self-locking ofscrews,efficiencyof different screws,Square, trapezoidal, screw threads.

UNIT-II Precession,Turning Moment Diagram and FlyWheel

Precession: Gyroscopes, effect of precession motion on the stability of moving vehicles such as motor car, motorcycle,aeroplanes and ships. TurningMoment DiagramsandFlyWheels:Turningmoment diagrams for steamengine, IC Engine and multi cylinder engine. Crank effort - coefficient of Fluctuation of energy, coefficient of Fluctuation of speed – Fly wheels and their design, Fly wheels for Punching machines.

UNIT-III Governors

Watt, Porterand Proell governors. Spring loaded governors– Hartnell and Hartung governors withauxiliary springs. Sensitiveness, isochronism and hunting.Effort and power of a governor.

UNIT-IVBalancing

Balancing: Balancing of rotating masses - single and multiple – single and different planes.
Balancing ofReciprocatingMasses:PrimaryandSecondarybalancingofreciprocatingmasses .
Analytical and graphical methods.Unbalanced forces and couples – V-engine, multi cylinder inline and radial engines for primary and secondary balancing.

UNIT-V Vibration

Freeandforced vibration ofsingledegreeoffreedomsystem, Roleof damping, whirlingofshafts and critical speeds.Simple problems on free, forced and damped vibrations.Vibration Isolation & Transmissibility. Transverse vibrations of beams with concentrated and distributed loads. Dunkerly’s method, Raleigh’s method.Torsional vibrations - two and three rotor systems.

Textbooks:

S.S.Rattan,TheoryofMachines,MGHPublishers,3/e,2013.
R.L.Norton,KinematicsandDynamicsofMachinery,TataMcGrawHill,2017.

ReferenceBooks:

ThomasBevan,Theoryofmachines,Pearson,3/e,2012.
J.E.Shigley,Thetheoryofmachinesandmechanisms,McGrawhill,2/e,1995.
R.S.Khurmi,J.K.Guptha,TheoryofmachinesS.Chandpublications,2005.

OnlineLearningResources:

https://nptel.ac.in/courses/112104114
https://nptel.ac.in/courses/112101096
https://archive.org/details/NPTEL-MechEngr-Dynamics_of_Machines
https://www.youtube.com/watch?v=OlZXxPVpmBs
https://www.digimat.in/nptel/courses/video/112104114/L01.html

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

B.Tech (ME) – III-I SEM (R20)

(20A50304a) POWER PLANT ENGINEERING

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(PROFESSIONAL ELECTIVE-I)

Course objective

Familiarizethesourcesofenergy,powerplant economicsandenvironmentalaspects.
Outlinetheworkingcomponentsofdifferentpower plant.
Explain renewable energy sources; characteristics, working principle, classify types, layouts, and plant operations.
Imparttypesofnuclearpowerplants,andoutlineworkingprincipleandadvantagesand hazards.

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

Outlinesourcesof energy,powerplanteconomics,andenvironmentalaspectsL1
Explainpowerplanteconomicsandenvironmentalconsiderations L1
Describeworkingcomponentsofa steampowerplantL2
IllustratetheworkingmechanismofDieselandGasturbinepowerplantsL3
SummarizetypesofrenewableenergysourcesandtheirworkingprincipleL4
Demonstratetheworkingprincipleofnuclear power plantsL3

UNIT-I Introduction to the Sources of Energy

Introduction to the Sources of Energy - Resources and Development of Power in India. Layouts of Steam, Hydel, Diesel, MHD, Nuclear and Gas Turbine Power Plants - Combined Power Cycles - Comparison and Selection.

Power Plant Economics and Environmental Considerations: Capital Cost, Investment of Fixed Charges, Operating Costs, General Arrangement of Power Distribution, Load Curves, Load Duration Curve. Definitions of Connected Load, Maximum Demand, Demand Factor, Average Load, Load Factor, Diversity Factor - Tariff - Related Exercises. Effluents from Power Plants and Impact on Environment - Pollutants and Pollution Standards - Methods of Pollution Control. Inspection And Safety Regulations.

UNIT-II Steam PowerPlant

Modern High Pressureand Supercritical Boilers - Analysis of Power Plant CyclesModern Trends in Cycle Improvement - Waste Heat Recovery, Fluidized Bed Boilers., Fueland Handling Equipments, Types ofCoals, CoalHandling,

ChoiceofHandlingEquipment, CoalStorage, AshHandlingSystems.
Combustion Process- Properties of Coal - Overfeed and Under Feed Fuel Beds, Travelling Grate Stokers, Spreader Stokers, Retort Stokers, Pulverized Fuel Burning System And Its Components, Combustion Needs and Draught System, Cyclone Furnace, Design and Construction, Dust Collectors, Cooling Towers And Heat Rejection. Analysis of Pollution from Thermal Power Plants - Pollution Controls.CO2Recorders

UNIT-III Diesel and Gas Turbine PowerPlants

Diesel Power Plant: Diesel Power Plant: Introduction - IC Engines, Types, Construction- FuelStorage
Gas Turbine Plant: Introduction - Classification - Construction - Principles of Working Closed and Open Cycle Gas Turbines. Advantages And Disadvantages Combined Cycle Power Plants.

UNIT-IV HydroElectric Power Plants

HydroElectricPowerPlant: Waterpower-HydrologicalCycle/FlowMeasurement-Drainage Area Characteristics - Hydrographs - Storage and Pondage - Classification of Dams and Spill Ways. **HydroProjects&Plant:**Classification-PlantAuxiliaries-PlantOperationPumpedStoragePlants.

UNIT-V Non-Conventional Source of Energy

Power From Non-Conventional Sources: Utilization of Solar Collectors- Principle of its Working, Wind Energy - Types of Turbines - HAWT & VAWT- Tidal Energy. MHD power Generation.

NuclearPowerStation: NuclearFuel-NuclearFission,ChainReaction,BreedingandFertile Materials - Nuclear Reactor - Reactor Operation.
TypesOfReactors: PressurizedWaterReactor,BoilingWaterReactor,Sodium-GraphiteReactor,

Fast breeder Reactor, Homogeneous Reactor, Gas Cooled Reactor, Radiation Hazards and Shielding - Radioactive Waste Disposal.

Textbooks:

P.K.Nag,PowerPlantEngineering,3/e,TMH,2013.
Arora andS. Domkundwar, AcourseinPower Plant Engineering, DhanpatRai&Co(P) Ltd, 2014.

ReferenceBooks:

Rajput,ATextbookofPowerPlantEngineering,4/e,LaxmiPublications, 2012.
Ramalingam,PowerplantEngineering,SciTechPublishers,2013.
P.C.Sharma,PowerPlantEngineering,S.K.KatariaPublications,2012.

OnlineLearningResources:

https://www.iare.ac.in/sites/default/files/lecture_notes/PPE_LECTURE_NOTES.pd f

http://www.digimat.in/nptel/courses/video/112107291/L21.html
https://onlinecourses.nptel.ac.in/noc19_me63/preview
https://www.youtube.com/watch?v=iWWyI8CZhUw
https://www.youtube.com/watch?v=D0i1E_lE_TE

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
B.Tech (ME) – III-I Sem (R20)

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(20A50304b)TOOL DESIGN (PROFESSIONAL ELECTIVE-I)

Theobjectivesofthiscourseareto

- DescribethebasicconceptsofToolDesign.
- ClassifyFitsandTolerancesusedinToolDesign.
- DefinethefundamentalconceptsofDesigningofJigsandFixtures.
- Applybasicmathematicstodesignthepresstooldies.
- Understandthen nomenclatureofthemillingcutters.
- ExplaintheconceptualdesignofCNCmachinetools.

CourseOutcomes:

Attheendofthecoursestudentwillbeableto

- ComparetheFerrous andnonferrous toolmaterialsL1
- Classifythetypesofchipformationduringorthogonal cuttingL1
- DesignDrillJigsandFixturesL6
- Designas simplegripperforrobotL6
- UnderstandtheconceptofdesignofdieandpiercingoperationsL2
- Understandaboutthetoolholdingmethods,Automatictoolchangersandtoolp ositionsinCNC MachineL2

UNIT- INTRODUCTIONTOTOOLDESIGN

Introduction –Tool Engineering – Tool Classifications– Tool Design Objectives – Tool Design in manufacturing- Challenges and requirements- Standards in tool design-Tool drawings -Surface finish – Fits and Tolerances - Tooling Materials- Ferrous and Non ferrous Tooling Materials- Carbides, Ceramics and Diamond -Non metallic tool materials-Designing with relation to heat treatment.

UNIT-II DESIGNOFCUTTINGTOOLS

Mechanics of Metal cutting –Oblique and orthogonal cutting- Chip formation and shear angle -Single-point cutting tools – Milling cutters – Hole making cutting tools- Broaching Tools - Design of Form relieved and profile relieved cutters-Design of gear and thread milling cutters.

UNIT-III DESIGNOFJIGSANDFIXTURES

Introduction–FixedGages –GageTolerances –selectionof materialfor Gauges – IndicatingGages – Automatic gages – Principles of location – Locating methods and devices – Principles of clamping – Drill jigs – General considerations in the design of drill jigs – Drill bushings – Methods of construction –Types of Fixtures – Vice Fixtures – Milling Fixtures – Boring Fixtures – Broaching Fixtures.

UNIT-IV DESIGNOFPRESSTOOL DIES

Types of Dies –Method of Die operation–Clearance and cutting force calculations- Blanking and Piercing die design – Pilots – Strippers and pressure pads- Presswork materials – Centre of pressure - Strip layout – Short-run tooling for Piercing – Bending dies – Drawing dies-Design and drafting.

UNIT-V TOOLDESIGNFORCNCMACHINETOOLS

Introduction–Toolingrequirements for Numericalcontrolsystems – Fixturedesignfor CNCmachine tools- Sub plate and tombstone fixtures- Universal fixtures– Cutting tools– Tool holding methods– Automatic tool changers and tool positioners – Tool presetting– General explanation of the Brownand Sharp machine.

Textbooks:

CyrllDonaldson,GeorgeH.LeCain,V.C.Goold,“ToolDesign”,TataMcGrawHill Publishing Company Ltd., 2000.

E.G.Hoffman,”JigandFixtureDesign”, ThomsonAsia PvtLtd, Singapore,2004.

ReferenceBooks:

P.C.Sharma,ATextbookofProductionEngineering’s.ChandPublications,1999.

PrakashHiralalJoshi,“Toolingdata”,WheelerPublishing, 2000

VenkataramanK.,“DesignofJigs,FixturesandPress tools”, TMH,2005.

HaslehurstM.,“ManufacturingTechnology”, TheELBS,1978.

OnlineLearningResources:

https://www.iare.ac.in/sites/default/files/lecture_notes/TOOL%20DESIGN_Lecture_Notes.pdf

https://www.cet.edu.in/noticefiles/261_MMP%20Lecture%20Notes-ilovepdf- compressed.pdf

https://www.vssut.ac.in/lecture-notes.php?url=production-engineering

https://nptel.ac.in/courses/112/105/112105233/
https://www.youtube.com/watch?v=7MkX-sW97rI
https://nptel.ac.in/courses/112/105/112105126/#

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DEPARTMENT OF MECHANICAL ENGINEERING

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B.Tech (ME)-III-I Sem (R20)

(20A50304c) AUTOMATION AND ROBOTICS

(PROFESSIONAL ELECTIVE-I)

Course objective: -

Theobjectivesofthiscourseareto

Describethebasicconceptsofautomationinmanufacturingsystems.
Acquirethefundamentalconceptsofautomatedflowlinesand theiranalysis.
Classifyautomatedmaterialhandling,automatedstorageandretrievalsystems.
Illustrateadaptivecontrolsystemsandautomatedinspection methods.
Definethefundamentalconceptsofindustrialrobotics.
Applybasicmathematicstocalculatetherobotkinematicanddynamicmechanics

- Understandtherobotprogrammingmethodsandsoftwarepackages.

CourseOutcomes:

Attheendofthecoursestudentwillbeableto

Classifythetypesof hardwarecomponentsofautomationandcontrolsystem.L1
Designa simplematerialhandlingsystemforlow-costmanufacturingL5
DesignasimplegripperforrobotL5
ComparethetypesofactuatorsusedinrobotmanipulatorL2
UnderstandtherequirementsandfeaturesofrobotprogrammingL2
DemonstratethevariousapplicationsofrobotsinmanufacturingL2

UNIT- Introduction

Introduction: Automationinproductionsystem,need,types,PrinciplesandStrategiesof automation, levels of automation, basic elements of an automated system, hardware components for automationandprocess control, mechanicalfeeders, hoppers, orienteers ,high speedautomaticinsertion devices.
Material handling and Identification Technologies: Overview of automatic material handling systems, principles anddesignconsideration, material transport systems, storagesystems, overview of automatic identification methods.

UNIT-II Assembly Line Balancing and Automated Manufacturing System

Assembly Line Balancing: Assembly process and systems assembly line, line

balancing algorithms, ways ofimprovinglinebalance,flexibleassemblylines.
Automated flow lines& transfer mechanisms, fundamentals of transfer Lines, flow lines with or without buffer storage.

Automated Manufacturing Systems: Components, classification and overview of manufacturing systems, manufacturing cells, GT and cellular manufacturing, FMS and its planning and implementation.

UNIT-III Introductionto Robotics

Introduction: Briefhistoryofrobots,classificationofrobot,functionallinediagram,degreesof freedom. Elements of robot - types and its functions, factors tobeconsideredinthe designofgrippers.
Robot Actuators and Feedback Components: Actuators, Pneumatic, Hydraulic actuators, Electric &Steppermotors,comparison.Positionsensors-potentiometers,resolvers,encoders-velocitysensors, Tactile sensors, Proximity sensors.

UNIT-IV Kinematics and Dynamics of a Manipulator

Manipulator Kinematics:
Homogenoustransformationsasapplicabletotranslation, rotations-D-H notation, Forwardand inverse kinematics.
Manipulator Dynamics: Differentialtransformations, Jacobians, Lagrange-Euler andNewton- Euler formations.

UNIT-V RobotProgrammingandApplications

Robot Programming: Methods of programming - requirements and features of programming languages, software packages, problems with programming languages. Motion path control- slew motion,jointintegratedmotion,straightlinemotion;avoidanceof obstacles.
Robot Application in Manufacturing: MaterialTransfer -Materialhandling, loadingandunloading; Process - spotandcontinuousarcwelding&spraypainting; AssemblyandInspection.

Textbooks:

MikellP.Groover, Automation, ProductionSystems andComputer IntegratedManufacturing- Pearson Education.5/e, 2009.
MikellP.GrooverandMitchellWeiss,RogerN.Nagel,NicholasG.Odrey,Industrial Robotics — McGraw Hill, 1986.
ReferenceBooks:

S. R. Deb & Sankha Deb, Robotics Technology and Flexible

Automation, Tata McGraw-Hill Education, 2009.
R KMittal andI J Nagrath, Robotics andcontrol, IllustratedEdition, Tata McGrawHill India 2003.
SaeedB. Niku, IntroductiontoRobotics – Analysis, System, Applications, 2/e, JohnWiley& Sons, 2010.
RichardD. Klafter,ThomasRoboticEngineeringanintegratedapproach, PHIpublications 1988.

OnlineLearningResources:

https://www.digimat.in/nptel/courses/video/112104288/L01.html
https://www.edx.org/learn/robotics
https://www.youtube.com/watch?v=xrwz9IxpMJg
https://nptel.ac.in/courses/112101098
https://onlinecourses.nptel.ac.in/noc20_de11/preview

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

B-Tech (ME)-III-I Sem (R20)

(20A50306) METROLOGY AND MEASUREMENTS LAB

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CourseObjectives:

Toexperimentwithmeasuringequipment'susedforlinearandangularmeasurements.
Tofindcommontypesof errorsin measurement equipment.
Toexperimentwithdifferenttypesofsensors,transducersandstraingaugesequipment.
Tomakeuseofthermocouplesformeasurementoftemperature.

CourseOutcomes: Attheendofcoursethestudents willbeableto:

Applydifferentinstrumentstomeasurelength,width,depth,borediameters,internaland external tapers, tool angles, and surface roughness.L2
Measure effective diameter ofthreadprofile.L3
Conductdifferentmachinealignmenttests.L2
Measuretemperature,displacement,andpressure.L4

ListofExperiments:

SectionA:

Measurement ofboresbyinternalmicrometersanddialboreindicators.
Use of gear teeth Verniercallipers and checking the chordal addendum and chordal height of spur gear.
Alignmenttestonthelatheandmillingmachineusingdialindicators
StudyofToolmakersmicroscopeanditsapplication
AngleandtapermeasurementsbyBevelprotractor,Sinebar spiritleveletc.
ThreadmeasurementbyTwowire/Threewiremethod.
SurfaceroughnessmeasurementbyTalysurfinstrument.
Useofstraightedgeandsprit levelinfindingtheflatness ofsurfaceplate.

SectionB:

CalibrationofPressureGauges
Calibrationoftransducerorthermocouplefortemperaturemeasurement.
CalibrationofLVDTtransducerfordisplacement measurement.
Calibrationofcapacitivetransducerforangular measurement.
Calibrationofphotoandmagneticspeedpickupsfor themeasurementofspeed.
Study and use of a Seismic pickup for the measurement of vibration amplitude of an enginebed at various loads.

StudyandcalibrationofMcleodgaugeforlowpressure.

VirtualLab:

TouseVernierCallipersforthemeasurementofdimensions ofgivenobject.

To use Micrometer Screw Gauge for the measurement ofdimensions(Length,Thickness, Diameter) of given object.

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=156&cnt=4

TocalculateYoung'smodulusofelasticityofsteelwirebyVerniermethod

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=155&cnt=4

References:

Dr.R.Manikandan,MetrologyandMeasurementslaboratorymanual,Notion Press;1/e, 2020.

ArulR, MetrologyandMeasurementsLabManual,NotionPress;1/e,2020.

OnlineLearningResources/VirtualLabs:

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=16&cnt=4

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=156&cnt=4

https://amrita.olabs.edu.in/?sub=1&brch=5&sim=36&cnt=4

https://www.sciencedirect.com/science/article/pii/S2212827116003929

https://sjce.ac.in/wp-content/uploads/2018/04/Metrology-and-Measurement-Laboratory- Manual.pdf

https://www.youtube.com/watch?v=jfUNqg8iWmg&list=PL9Q_yrlFD9Opks9GDke48rETYcnBFBumj&index=5

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

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III Year B.Tech. M.E.I-Sem (R20)

(20A50307)DYNAMICS LAB

Course Objectives:	
	To supplement the principles learnt in kinematics and Dynamics of Machinery.
	To understand how certain measuring devices are used for dynamic testing.

Course Outcomes: At the end of the course the students will be able to	
	Ability to demonstrate the principles of kinematics and dynamics of machineryL1
	Determine the Mass moment of inertia, Range sensitivity.L2
	Drawing of Cam profile, determination of torsional ,undamped and damped natural frequencies.L3
	Determining of influence of coefficient and balancing of rotating ,reciprocating masses.L5
	Verify the laws of springs and forced vibration of cantilever beam.L6

LIST OF EXPERIMENTS

Kinematics of Four Bar, Slider Crank, Crank Rocker, Double crank, Double rocker, Oscillating cylinderMechanisms.

Determination of Mass moment of inertia of Fly wheel and Axlesystem.

Determination of range sensitivity, effort etc., for Watts, Porter, Proell and HartnellGovernors.

Cams – Cam profile drawing, Motion curves and study of jumpphenomenon.

Determination of torsional natural frequency of single and Double Rotorsystems. Undamped and Damped Natural frequencies.

Multi degree freedom suspension system – Determination of influencecoefficient.

Determination of torsional natural frequency of single and Double Rotor systems.-damped Natural frequencies.

Determination of torsional natural frequency of single and Double Rotor systems.- UnDamped Natural frequencies

Balancing of rotating masses.

Balancing of reciprocatingmasses.

Determination of natural Frequency and verification of Laws ofsprings

Forced Vibration of Cantilever beam – Mode shapes and naturalfrequencies.

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
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III YEAR B-TECH I SEM (R20)

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1	0	2	2

(20A50308)COMPUTER AIDED MODELING
(Skill Oriented Course-III)

CourseObjectives:

Totrainthestudents withCADpackages.
To importthe2Dand3Dmodelingskills tothestudents.
Toimportandexportdifferent IGES filesfromonesoftwaretoanother

CourseOutcomes: At the end of the course the students will be able to
Studentswillbeabletodesigndifferentpartsofmechanicalequipment's L2
StudentswillbeabletoapplytheirskillsinvariousdesigningandManufacturingIndustries.L
2

ListofExperiments:

Generationofthefollowingcurvesusing"C"/Pythonlanguage -2 experiments
CubicSplines
Beziercurves
B-Splines.
Generationofthefollowingsurfacesusing"C"/Pythonlanguage -2 experiments
Beziersurfaces
B-Splinesurfaces
TypicaltasksofModeling using any solidmodeling packages such as PRO/E,IDEAS,CATIA, etc.,
SolidBooleanalgebra-1Exercise
Wireframe&SurfaceModelling– 3 Exercises
3D–Draftingindetail– 1Exercise
ProductionDrawingwithGeometricDimensioningandTolerances–3 Exercises (PreferablyfortheassemblydrawingsdrawninComputerAidedMachineDrawinginprevious semester)
Introduction to MATLAB Tools

References:

JamesDMeadows"GeometricDimensioningandTolerancing-Applications,Analysis&Measurement ASME Y14.5-2018.

KLNarayana,PKannaiahandK.VenkatReddy, ProductionDrawing, NewAgepublishers, 2014.

IbrahimZeid,TataMcGrawhill, CAD/CAMTheoryandPractice, 2012.

OnlineLearningResources/Virtual Labs:

https://www.youtube.com/watch?v=er7xJFKv5k&list=PL5w7L_xR0pu2wLbJtOuK49WxJJVjiyKks&index=2

https://www.youtube.com/watch?v=Gy0MKabzDa8&list=PLrOFa8sDv6jccqLnN7UDa1YW4s_hR6YX0

https://www.youtube.com/watch?v=k3kFC9uTdUk&list=PLM5xm8DJKViImdv5ZXxQ2NyIdSlid_jCB

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

Year B.Tech. M.E. I Semester (R20)

CONSTITUTION OF INDIA

Common to Civil, Mech, Chem

Subject Code	Title of the Subject	L	T	P	C
20A59101	**INDIAN CONSTITUTION**	2	0	0	0

COURSE OBJECTIVES : The objective of this course is	
To	Enable the student to understand the importance of constitution
To	understand the structure of executive, legislature and judiciary
To	understand philosophy of fundamental rights and duties
To	understand the autonomous nature of constitutional bodies like Supreme Court and high court controller and auditor general of India and Election Commission of India.
To	understand the central-state relation in financial and administrative control

Syllabus

UNIT-IIntroduction to Indian Constitution

Constitution -Meaning of the term - Indian Constitution- Sources and constitutional history - Features– Citizenship – Preamble - Fundamental Rights and Duties - Directive Principles of State Policy.

LEARNING OUTCOMES:-After completion of this unit student will

Understand the concept of Indian constitution
Apply the knowledge on directive principle of state policy
Analyze the History and features of Indian constitution
Learn about Preamble, Fundamental Rights and Duties

UNIT-IIUnion Government and its Administration

Structure of the Indian Union- Federalism - Centre-State relationship – President's Role, power and position - PM and Council of ministers - Cabinet and Central Secretariat–LokSabha-RajyaSabha - The Supreme Court and High Court - Powers and Functions **LEARNING OUTCOMES:-**After completion of this unit student will

Understand the structure of Indian government
Differentiate between the state and central government
Explain the role of President and Prime Minister
Know the Structure of supreme court and High court

UNIT-IIIState Government and its Administration

Structure of the State Govt. -Governor - Role and Position -CM and Council of Ministers - State Secretariat-Organization Structure and Functions

LEARNING OUTCOMES:-After completion of this unit student will

Understand the structure of state government
Analyze the role of Governor and Chief Minister
Explain the role of State Secretariat
Differentiate between structure and functions of state secretariat

UNIT-IV Local Administration

District's Administration Head - Role and Importance - Municipalities - Mayor and role of Elected Representatives -CEO of Municipal Corporation PanchayatiRaj - Functions– PRI– ZillaParishath - Elected officials and their roles – CEO, ,ZillaParishath - Block level Organizational Hierarchy - (Different departments) - Village level - Role of Elected and Appointed officials - Importance of grass root democracy

LEARNING OUTCOMES:-After completion of this unit student will

Understand the local Administration
Compare and contrast district administration's role and importance
Analyze the role of Mayor and elected representatives of Municipalities
Learn about the role ofZillaParishath block level organization

UNIT-VElection Commission

Election Commission- Role of Chief Election Commissioner and Election Commissionerate - State Election Commission -Functions of Commissions for the welfare of SC/ST/OBC and Women

LEARNING OUTCOMES:-After completion of this unit student will

Know the role of Election Commission
Contrast and compare the role of Chief Election commissioner and Commissionerate
Analyze the role of state election commission
Evaluate various commissions vizSC/ST/OBC and women

TEXT BOOKS

Durga Das Basu, Introduction to the Constitution of India, Prentice – Hall of India Pvt. Ltd.. New Delhi

SubashKashyap, Indian Constitution, National Book Trust

REFERENCES:

J.A. Siwach, Dynamics of Indian Government & Politics,

H.M.Sreevai, Constitutional Law of India, 4th edition in 3 volumes (Universal Law Publication)

3. .J.C. Johari, Indian Government andPolitics, Hans India

M.V. Pylee, Indian Constitution Durga Das Basu, Human Rights in Constitutional Law, Prentice – Hall of India Pvt. Ltd.. New Delhi

E-RESOURCES:

1.nptel.ac.in/courses/109104074/8
2.nptel.ac.in/courses/109104045/
3.nptel.ac.in/courses/101104065/
4.www.hss.iitb.ac.in/en/lecture-details
5.www.iitb.ac.in/en/event/2nd-lecture-institute-lecture-series-indian-constitution

COURSE OUTCOMES: At the end of the course, students will be able to	
CO1	State the historical background of the constitution making and its importance for building a democratic India.
CO2	Understand the functioning of three wings of the governmentie., executive, legislative and judiciary.
CO3	Demonstrate the value of the fundamental rights and duties for becoming good citizen of India.
CO4	Analyze the decentralization of power between central, state and local self-government
CO5	Appraise the knowledge in strengthening of the constitutional institutions like CAG,Election Commission and UPSC for sustaining democracy.
CO6	Develop themselves as responsible citizens and pave way to build a democratic country.

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

B-Tech (ME)-III-II Sem (R20)

(20A60301) Theory -1 CAD/CAM

L	T	P	C
3	0	0	3

	Course Objectives:
To	impart the students to CAD/CAM and CIM and the basics of computer graphics.
To	impart knowledge on geometric modeling.
To	impart fundamental knowledge on NC and concepts of part programming.
To	introduce the philosophy of group technology, basics of Flexible Manufacturing Systems and computer aided quality control.
To	impart the concepts of Computer Aided Process Planning, Computer Integrated Process Planning and introduce the trends in manufacturing.

	Course Outcomes: At the end of the course the students will be able to
CO1	To implement the concepts of CAD/CAM and CIM in industry. L2
CO2	Use CAD software for solid modeling. L1
CO3	To implement suitable NC part programming concepts. L2
CO4	Implement appropriate suitable production systems and computer aided quality control. L2
CO5	Utilize suitable computer aided process planning and computer integrated production planning for a customized manufacturing system. L3

UNIT –I

Overview of CAD/CAM: Product cycle, CAD, CAM and CIM. CAD Tools,CAM Tools, Utilization in an Industrial Environment, Evaluation criteria. CAD data structure, Data base managementsystems.

Computer Graphics: Co-ordinate systems, Graphics package functions, 2D and 3D transformations, clipping, hidden line / surface removal color, shading.

UNIT –II

Geometric Modeling: Representation techniques, Parametric and non-parametric representation, various construction methods, wire frame modeling, synthetic curves and their representations, surface modeling, synthetics surfaces and their representations.Solid modeling, solid representation, fundamentals, introduction to boundary representations, constructive solid geometry representations

UNIT- III

Numerical Control: NC, NC Modes, NC Elements, NC Machine tools and their structure, Machining center, types and features. Controls in NC, CNC systems, DNC systems. Adaptive control machining systems, types of adaptive control.

CNC Part Programming: Fundamentals, NC word, NC Nodes, canned cycles, cutter radius compensation, length compensation, computed assisted part programming using APT: Geometry statements, motion statements, post process statements, auxiliary statements, macro statement program for simple components.

UNIT -IV

Group Technology & FMS: Part Family, Classification and Coding, advantages & limitations, Group technology machine cells, benefits. FMS: Introduction, components of FMS, material handling systems, Computer control systems, advantages.

Computer Aided Quality Control: Terminology in Quality control, Inspection and testing, Contact inspection methods - optical and non-optical, integration of CAQC with CAD andCIM.

UNIT- V

Computer Aided Processes Planning: Retrieval type and Generative type, benefits Machinability data systems, Computer generated time standards.

Computer integrated production planning: Capacity planning, shop floor control, MRP-I, MRP- II, CIMS benefits. Trends in manufacturing systems: Concepts of Reconfigurable manufacturing, Sustainable manufacturing and lean manufacturing.

Text Books:

CAD/CAM, A Zimmers &Groover, PE, PHI

CAD/CAM-Principles and applications, P.N. Rao, TMH, 3rd edition,2010

References:

Automated Production Systems and CIM by P. Groover Pearson Education, Limited.

CAD/CAM/CIM (Revised second edition)- P. Radhakrishnan, S. Subramanyan, V. Raju- New Age International Edition

CAD/CAM- Theory and practice- Irahim Zeid- Tata McGraw Hill publications.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc20_me44/preview
https://www.youtube.com/watch?v=EgKc9L7cbKc
https://www.youtube.com/watch?v=KXFpTb9cBpY
https://web.iitd.ac.in/~hegde/cad/lecture/L01_Introduction.pdf
https://www.vssut.ac.in/lecture_notes/lecture1530947994.pdf

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

B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60302)Theory 2 FINITE ELEMENT METHODS

Course Objectives:

Familiarize basic principles of finite element analysis procedure.
Explaintheoryandcharacteristicsoffiniteelementsthatrepresentengineeringstructures.
Applyfiniteelementsolutionstostructural,thermal,dynamic problem.
Learntomodelcomplexgeometryproblemsandsolutiontechniques.

Course Outcomes: Uponsuccessfulcompletionofthiscourse,youshouldbeableto

Understandtheconceptsbehindvariationalmethodsandweightedresidualmethodsin FEM.L1
IdentifytheapplicationandcharacteristicsofFEAelementssuchasbars,beams,and isoparametric elements, and 3-D element.L2
Develop element characteristicequationprocedureand generationofglobalstiffness equation will be applied.L2
Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.L1
Abletoidentifyhowthefiniteelementmethodexpandsbeyondthestructuraldomain,for problems involving dynamics, heat transfer and fluid flow.L1

UNIT-I Introduction to finite element methods

Introduction to finite element methods for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.

One dimensional Problems: Finite element modelling of ID bar elements coordinates and shape functions. Requirements for ConvergenceandInterpolationfunctions, Pascal‟s Triangle, Assemblyof global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT-II ID Analysis of Trusses and Beams

Analysisof trusses: StiffnessMatrixfor1Dtruss element, StressCalculationsandProblemswith maximum of three elements.

Analysisofbeams: ElementStiffnessMatrixandLoadvector for 1Dbeamelement, Hermiteshape functions and simple problems.

UNIT-III 2D Analysis

Finiteelementmodelingoftwo-dimensionalstressanalysiswithconstantstraintrianglesand treatment of boundary conditions.Estimation of load Vector, Stresses.
Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT-IV Quadrilateral Elements & Thermal Analysis

Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modellingof 4 nodded and 8 nodded quadrilateral elements and simple problems. Numerical Integration.

Steady state heat transfer analysis: Onedimensionalanalysisofcompositeslabandfin.

UNIT-V Dynamic analysis

Analysisofa1Duniformshaftsubjectedtotorsion –Simpleproblems

Dynamicanalysis: Formulationoffiniteelementmodel,element–massmatrices,evaluationof Eigen values and Eigen vectors for a bar and shaft.

Textbooks:

T.Chandragupta,AshokBelegundu,IntroductiontoFiniteElementinEngineering, Pearson Publications, 4/e, 2011.
S.S.Rao,TheFiniteElementMethodsinEngineering,ElsevierButterworth -Heinemann,2/e, 2011.
S.Md.Jalaludeen,FiniteElementAnalysisinEngineering,2/e,AnuradhaPublications,2016

Reference Books:

JNReddy, AnintroductiontotheFiniteElementMethod,McGraw–Hill, NewYork, 1993.
RDCook,DSMalkusandMEPlesha,ConceptsandApplicationsofFiniteElement Analysis, 3/e, John Wiley, New York, 1989.
KJBathe,FiniteElementProceduresinEngineeringAnalysis,Prentice-Hall,Englewood Cliffs, 1982.
G.LakshmiNarasaiah,FiniteElementAnalysis,1/e, B.S. Publications,2008.
OCZienkiewiczandRLTaylor,theFiniteElementMethod,3/e.McGraw-Hill, 1989.

Online Learning Resources:

https://nptel.ac.in/courses/112/104/112104193/
https://nptel.ac.in/courses/112/104/112104205/
https://nptel.ac.in/courses/105/105/105105041/
https://nptel.ac.in/courses/112/106/112106130/
https://nptel.ac.in/courses/112/103/112103295/

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

B-Tech (ME)-III-II Sem (R20)

(20A60303)Theory -3 HEAT TRANSFER

L	T	P	C
3	0	0	3

Course Objectives:

- Toimpartthebasiclawsofconduction,convectionandradiationheattrans ferandtheir applications
- Tofamiliarizetheconvectiveheattransferconcepts
- Toexplainbasicsofradiationheat transfer
- Tomakeconversantwiththeheattransferanalysisrelatedtothermalsystemslikeheat exchangers, evaporator, and condenser.

CourseOutcomes:

At theendofthecourse,thestudentwillbeableto

Applytheconceptsofdifferentmodesofheattransfer. (L3)

Applyknowledgeofconductionheattransferinthedesignofinsulationoffurnacesand pipes. (L3)

Analyzefreeandforcedconvectionphenomenainexternalandinternalflows. (L4)

Designofthermalshieldsusingtheconceptsofblackbodyandnon-blackbodyradiation. (L5)

Applythebasicsofmasstransferforapplicationsindiffusionofgases. (L3)

UNIT-I Introduction

Basic modes of heat transfer- rate equations- generalized heat conduction equation-various forms - steady state heat conduction solution for plane and composite slabs - cylinders - critical thickness of insulation- heat conduction through fins of uniform cross section- fin effectiveness and efficiency.

Unsteady State Heat Transfer Conduction- Transient heat conduction- lumpedsystemanalysis and use of Heisler charts.

UNIT-II Convection

Convection: Basic concepts of convection–heat transfer coefficients - types of convection – forced convection and free convection.

Free Convection: development of hydrodynamic and thermal boundary layer along a vertical plate – use of empirical relations for convective heat transfer on plates and cylinders in horizontal andvertical orientation

Forced convection: in external flow–concepts of hydrodynamic and thermal boundary layer- use of empirical correlations for flow over plates and cylinders.Fluid friction – heat transfer analogy, approximate solution to laminar boundary layer equation for external flow.Internal flow – Use of empirical relations for convective heat transfer in horizontal pipe flow-problems.

UNIT-III Boiling and Condensation

Different regimes ofboiling- nucleate, transitionandfilmboiling – condensation–filmwiseanddrop wise condensation-problems.

UNIT-IV Heat Exchangers

Types of heat exchangers- parallel flow- counter flow- cross flow heat exchangers- overall heat transfer coefficient- LMTD and NTU methods- fouling in heat exchangers-problems.

UNIT-V

Radiation: Radiation heat transfer – thermal radiation – laws of radiation - Black and Gray bodies shape factor-radiation exchange between surfaces - Radiation shields - Greenhouse effect- simple problems.

Mass Transfer: Conservation laws and constitutive equations - Fick's law of diffusion, isothermal equi-mass - Equimolal diffusion- - diffusion of gases and liquids- mass transfer coefficient.

Textbooks:

P.K.Nag,HeatTransfer,3/e, Tata McGraw-Hill, 2011.

J.P. Holman, HeatTransfer,9/e, Tata McGraw-Hill, 2008.

S. C. Arora&S. Domkundwar , A Coursein Heat and Mass Transfer, Dhan pat Rai& CO.(P) LTD-Delhi , 2007.

R.C.Sachdeva, Fundamentals of Engineering Heat& Mass transfer, New Age International Publishers, 2017.

ReferenceBooks:

F.P. IncroperaandD.P.Dewitt,FundamentalsofHeatandMassTransfer, 6/e, John Wiley, 2007.

Cengel.A.Yunus,HeatTransfer-APracticalApproach,4/e,TataMcGraw-Hill, 2007.

S.P. Sukhatme,ATextbookofHeatTransfer,UniversitiesPress,2005

LienhardandLienhard, AHeatandMassTransfer,CambridgePress,2011.

C.P.KothandaramananandS.Subramanyan,HeatandMassTransferdatabook,NewAge Publications, 2014.

Er.R.K.Rajput,AText bookofHeat &MassTransfer,S.Chandpublishers,1/e,2018.

OnlineLearningResources:

https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heat-transfer-fall- 2015/

https://www.udemy.com/topic/heat-transfer/

https://www.youtube.com/watch?v=TWTQx3W-2k8

https://onlinecourses.nptel.ac.in/noc20_ch21/preview

https://ekeeda.com/degree-courses/mechanical-engineering/heat-transfer

https://www.coursera.org/lecture/thermodynamics-intro/02-04-heat-transfer-gyDfJ

https://www.youtube.com/watch?v=cjJ2LV5lkB8

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

B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60304a) PRODUCTION AND OPERATIONS MANAGEMENT
(Professional Elective–II)

CourseObjectives:
Attheendofthecourse,thestudentwillbeableto learn

- Introductiontothetechnicaldesignandmanufacturingoperationsandsupplymanagementt o the sustainability of an enterprise.
- Needforforecastingandtypesofforecasting.
- Importthebasicprinciples ofproject managementandother businessfunctionssuchasvalue engineering, purchasing, marketing, finance etc.
- Analyzethenewdemandsofthegloballycompetitivebusinessenvironmentthatsupply chain managers face today.
- Knowledgeonvariousschedulingalgorithmsapplicabletosinglemachine,parallel machines, flow shop and job shop models.

CourseOutcomes:
At theendofthecourse,thestudentwillbeableto

- Demonstratetheoperations and supply management to the sustainabilityofanenterpriseL3
- Identifythe need for forecastingandunderstanddifferentforecasting methodsL3
- Identifyvarious production and plant layoutsL3
- Examine the quality control of the productionL3
- ApplyJust in Time (JIT)basicprinciples and applicationsL2
- Recommendtheproductionschedule for productivityL3
- Design, analyze and implementsingle machine,parallel machine, flow shopand job shop scheduling algorithmsL5

UNIT-I **Introduction** 10 Hours **Introduction:** Operations Management – Definition, Objectives, Types of Production
System, Difference between OM & PM, Historical Development of Operations Management, Current Issues in Operation Management, Product Design – Requirements of Good Product Design, Product Development–Approaches, Concepts in Product Development, Standardization, Simplification, Speed to Market, Introduction to Concurrent Engineering.

UNIT -II Forecasting: 8 Hours

Forecasting: Introduction, Statistical Forecasting Techniques, Moving Average, ExponentialSmoothingTechnique,ErrorsinForecastingandEvaluationofForecasting Techniques.

UNIT -III ValueEngineeringandPlantLayout: 8 Hours

Value Engineering and Plant Layout: Value Engineering – Objectives, Types of Values, Function and Cost, Product Life Cycle, Steps in Value Engineering, Methodology in Value Engineering, FAST Diagramand Matrix Method. Facility Location and Layout – Factor Considerations in Plant Location, Comparative Study of Rural and Urban Sites, Methods of Selection of Plant Layout, Objectives of Good layout, Principles, Types of Layouts, Line Balancing

UNIT -IV AggregatePlanningandMRP: 8 Hours

Aggregate Planning and MRP: Aggregate Planning – Definition, Different Strategies, Various Models of Aggregate Planning- Transportation and Graphical Models, Master scheduling, MaterialRequirement Planning (MRP)- Terminology, TypesofDemands, Inputs to MRP, Techniques of MRP, Lot Sizing Methods, Benefits and Drawbacks of MRP, ManufacturingResourcesPlanning(MRPII), Justin Time (JIT)Philosophy,Kanban

System, Calculation of Number of Kanban"s, Pull Systems vs. Push Systems, Requirement for Implementation of JIT, JIT Production Process, Benefits of JIT.

UNIT -V **Scheduling:** 8 Hours

Scheduling: Policies, Types of Scheduling, Scheduling Strategies, Scheduling and Loadin Guidelines, Forward and Backward Scheduling, Grant Charts, Priority Decision Rules, Flo Shop Scheduling, Job Shop Scheduling, Line of Balance. Textbooks:

Buffa E.S. and Sarin R.K., Modern Production / Operations Management, 8th Editio Wiley India Pvt. Ltd., New Delhi, 2009.

Joseph G. Monks, Operations Management-Theory and Problems, 3rd Edition, McGraw Hill Education, 1987.

Reference Books:

James L. Riggs, Jim Rigs, Production Systems: Planning, Analysis and Control, 4th Edition, Wave Land Press, 1992.

Chary S.N., Production and Operations Management, 5th Edition, McGraw Hill Education, 2017.

Richard B. Chase, Ravi Shankar, Robert Jacobs., Operations and Supply Chain Management, 15th Edition, McGraw Hill Education, 2018.

Pannerselvam R., Production and Operations Management,3rd Edition, PHI Learnin Pvt. Ltd., New Delhi, 2012.

Steven Nahmias, Tava Lennon Olsen, Production and Operation Analysis: Strategy Quality – Analytics – Applications, 7th Edition, Waveland Press Inc., 2015.

Online Learning Resources:

https://www.vssut.ac.in/lecture_notes/lecture1429900757.pdf

https://lecturenotes.in/subject/100/production-and-operation-management

https://www.studocu.com/in/document/guru-gobind-singh-indraprastha-university/production-operations-management/full-unit-1-lecture-notes-6/3528988

https://mrcet.com/downloads/digital_notes/ME/III%20year/POM%20NOTES.pdf

https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_OM_NOTES.pdf

https://nptel.ac.in/courses/112107238
https://nptel.ac.in/courses/110107141

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

B-Tech (ME)-III-II Sem (R20)

(20A60304b)NON-DESTRUCTIVE TESTING (NDT)

(Professional Elective–II)

L	T	P	C
3	0	0	3

CourseObjectives:

Introducebasicconceptsofnon-destructive testing.
Familiarizewithcharacteristicsof ultrasonic test,transducers,rejectionandeffectiveness.
Describeconceptof liquid Penetrant, eddy current andmagneticparticletests,its applications and limitations.
Explainthe principles of infraredand thermal testing,applicationsandhoney comb and sandwich structures case studies.

Explainvariousmethods of non-destructivetesting.L1
Applyrelevantnon-destructivetestingmethoddifferentapplications.L1
Explaintheapplicationsofrailways,nuclearandchemicalindustries.L2
Outlinethelimitationsanddisadvantagesof NDE.L2
Explainthe applicationsofNDAofpressure vessels,casting andwelding constructionsL2

UNIT-I Introductiontonon-destructivetesting 8Hrs

Introduction tonon-destructive testing: Radiographic test**,**SourcesofX and Gamma Rays andtheir interactionwithMatter,Radiographicequipment, RadiographicTechniques, Safety Aspects of Industrial Radiography.

UNIT -II Ultrasonictest 8Hrs

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

UNIT -III Liquidpenetrant,EddyCurrent&Magnetic Particle Test 10Hrs

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

Eddy Current Test: Principle ofEddyCurrent, EddyCurrent Test System, Applications of Eddy Current-Testing Effectiveness of Eddy Current Testing.

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

UNIT -IV **Infrared&ThermalTesting** 8Hrs

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

UNIT -V **Industrial Applications of NDE:** 8Hrs

Industrial Applications of NDE: Span of NDE Activities Railways, Nuclear, Non-nuclear and Chemical Industries, Aircraft and Aerospace Industries, Automotive Industries, Offshore Gas and Petroleum Projects, Coal Mining Industry, NDE of pressure vessels, castings, welded constructions. Acoustics Test facilities.

Textbooks:

J Prasad, GCK Nair, Nondestructive test and evaluation of Materials, Tata McGraw-Hill Education Publishers, 2008.

JosefKraut Kramer, HerbertKrautkrämer,Ultrasonictestingofmaterials,3/springer-Verlag, 1983.

3. X. P. V. Maldague, Nondestructive evaluation of materials by infrared thermography, 1/e, Springer-Verlag, 1993.

Reference Books:

Gary Workman, PatrickO. Moore, DoronKishoni,Non-destructive, Handbook, Ultrasonic Testing, 3/e, Amer Society for Nondestructive, 2007.

ASTMStandards, Vol3.01, Metal sandalloys.

Online Learning Resources:

http://www.twivirtualacademy.com/online-courses/ndt/

https://www.classcentral.com/course/swayam-theory-and-practice-of-non-destructive- testing-9872

https://onlinecourses.nptel.ac.in/noc20_mm07/preview

https://www.youtube.com/watch?v=dyMR58TZMbo

https://www.youtube.com/watch?v=Wam-Ewcn3aQ

https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_NDT_LECTURE_NOTES.pdf

https://lecturenotes.in/subject/390/non-destructive-testing

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

B-Tech (ME)-III-II Sem (R20)

L	T	P	C
3	0	0	3

(20A60304c) TOTAL QUALITY MANAGEMENT(TQM)
(Professional Elective–II)

CourseObjectives:

Introduce the students,thebasic concepts of Total QualityManagement.
Expose with various quality issues in Inspection.
GainKnowledgeon qualitycontrol andits applicationstore all time.
Knowtheextentofcustomersatisfactionbytheapplicationofvariousqualityconcepts.
Understand the importance of Quality standards in Production.

Course Outcomes (CO):

At the end of this course, the student will be ableto

Develop an understanding on quality Management philosophies andframeworksL3
AdoptTQMmethodologies for continuous improvement of qualityL2
Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvementL3
Applybenchmarkingandbusinessprocessreengineeringtoimprovemanagement processes.L2
Determine the setoff indications to evaluate performance excellence of an organization.L3

UNIT-I Introduction LectureHrs:10

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT -II Historical Review: LectureHrs:9

Historical Review: Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT -III TQMPrinciples: Lecture Hrs:8

TQM Principles: Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

UNIT -IV TQMTools: Lecture Hrs:9

TQM Tools: Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA–StagesofFMEA, The seven tools of quality, process capability,Concept of Six Sigma, New Sevenmanagementtools,Casestudies.

UNIT -V Quality Systems: Lecture Hrs:8

Quality Systems: Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Textbooks:

Dale H Biesterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.

Subbu raj Rama swamy, Total QualityManagement,Tata McGraw Hill Publishing Company Ltd., 2005.

Joel E. Ross,TotalQuality Management, Third Edition,CRCPress, 2017.

Reference Books:

Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.

Robert L Flood,BeyondTQM, First Edition,John Wiley&SonsLtd, 1993.

RichardS.Leavenworth&EugeneLodewick Grant, Statistical Quality Control, Seventh Edition, Tata McGraw Hill, 2015

SamuelHo,TQM–An Integrated Approach,KoganPageLtd, USA,1995.

OnlineLearningResources:

https://www.youtube.com/watch?v=VD6tXadibk0
https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
https://blog.capterra.com/what-is-total-quality-management/
https://nptel.ac.in/courses/110/104/110104080/
https://onlinecourses.nptel.ac.in/noc21_mg03/preview
https://nptel.ac.in/courses/110/104/110104085/
https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/

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

B. Tech (ME)– III-II Sem (R20)
(20A60306)COMPUTER AIDED DESIGN LABORATORY

L	T	P	C
0	0	3	1.5

Course Objectives:

- To use the commercial Finite Element packages to build Finite Element models and solve a selected range of engineering problems.
- TovalidateaFiniteElementmodel using range of techniques.
- To communicate effectively in writing to report (both textually and graphically) the method used, the implementation and the numerical results obtained.
- To discuss the accuracy of the Finite Element solutions.

Course Outcomes

Ability to solve engineering problems using the commercial software"s such as ANSYS, SIMUFACT, ABAQUS, SIMULIA, Mathematical, MAT LAB, GNU Octave, Scilab, MAPLE/ COMSOL.L5

List of Experiments:

Finite Element Analysis using Simulation package for different structures. The discretization can be done with 1-D, 2-D & 3-D elements to perform the following analysis for post processing:

StaticAnalysis

Stressanalysisof2Dtruss.
StressanalysisofaplatewithacircularholeandL-Bracket –2Dand3D
Stressanalysisofbeams-cantilever
Stress analysis of beams -simplysupported
Stressanalysisofanaxi-symmetriccomponent
TorsionbasedProblem

ThermalAnalysis

Conductiveheattransfer analysisofa 2Dand3Dcomponents
ConductionandConvectiveheattransfer analysisofa2Dcomponent
Heattransfer rateofa composite wall
Coupledfieldanalysisofacomponent

ModalAnalysis

Modefrequencyanalysisofa2Dcomponent
Modefrequencyanalysisofbeams (cantilever,simplysupported)

Note: Students should practice the above problems with combinations of ANSYS, Octave, Scilab, MATLAB/ Mathematica, MAPLE/COMSOLetc. based onthe available software's of either licensed or freeware. Staffcanmake useofFreeware insolvingtheFEAProblemswith different combination of simulation packages.

References:

Nitin S Gokhale and Sanjay Deshpande, Practical Finite Element Analysis, Finite to Infinite Publishers, 1/e, 2008.

JoeStefanelli,FiniteElement AnalysisinPractice-InstructorManual,Auto-desk,2010.

J.M.Ferreira,MATLABcodesforFiniteElementMethod", Springer Publications, 2020.

Heinrich, JuanC.,Pepper, DarrellW, Thefiniteelementmethod:basicconceptsand applications with MATLAB, MAPLE, and COMSOL: CRC Press, 3/e, 2017.

OnlineLearningResources/VirtualLabs:

https://www.youtube.com/watch?v=1gamqpyZjTg

https://www.youtube.com/watch?v=4c-sPXolD0w

https://www.youtube.com/watch?v=XSYRnEfPMqA

https://au.mathworks.com/discovery/finite-element-analysis.html

https://w3.pppl.gov/m3d/reference/fsem_intro.pdf

https://www.youtube.com/watch?v=WXKUCky9CtA&list=PL3YYYtsmbXgdRoY27y3ZEjF 5qE7YYeX_I

https://www.youtube.com/watch?v=n3FDQqrRJqA

https://www.youtube.com/watch?v=oHYVzAih_VM

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

Tech (ME)–III-II Sem (R20)

(20A60307)COMPUTER AIDED MANUFACTURING LABORATORY

L	T	P	C
0	0	3	1.5

CourseObjectives:

- To get practical knowledge on manual part programming of CNC lathe machine by using G codes and M codes.
- TogetpracticalknowledgeonmanualpartprogrammingofCNCmillinganddrillingmachine by using G codes and M codes.
- TogetthepracticalknowledgeonAPTlanguage.
- Toget practicalapplicationofIndustrialRobots

CourseOutcomes: Uponsuccessfulcompletionstudentsshouldbeableto:

UseandunderstandingofPreparatoryandMiscellaneous(G&M) codestogenerateor edit a program which will operate a CNC Lathe/ Milling and Drilling.L1
ApplymathematicalmethodstocalculateWorld/Joint/Toolcoordinatesinrobotics.L2
ApplytheprogrammingconceptsofRobotsfor simpleapplicationsinmaterialhandlingand assemblyL3

ListofExperiments:

Manualpartprogramming(usingGandMcodes)inCNC LatheMachine:
Partprogrammingforlinearinterpolation,circularinterpolation,chamferingandgrooving.
Part programming by using standard Canned cyclesforfacing,turning,taperturning and thread cutting, Chess Bishop profile
Multiple turningoperationswhichcoveralllathe operationscoveringmaximum Gcodes and M codes

Manualpart programming(usingGandMcodes)inCNC MillingMachine:
Partprogrammingforlinearinterpolation,circularinterpolationandcontour motions.
PartprogramminginvolvingCannedcyclesfordrilling,Peckdrilling andboringandpocketing & Mirroring.
PartprogrammingforGear cuttingprofile

APT(AutomaticallyProgrammedTools)Language-Cuttingtoolpathgenerationbyusingany CAM simulation package / Experiment for different machining operations.
APT LatheProgramming‟s –2 Experiments
APTMillingProgramming‟s-2Experiments

Robotics: Byusing5or6–Axis robot
PickandPlacewithpalletizing/de-palletizingofcomponents
Nut,BoltandWasherAssemblywithrobot.

References:

PRadhaKrishnan,ComputerNumericalControl(CNC)Machines,NewCentralBookagency, 2013.
S.R.DEB,RoboticsTechnologyandFlexibleAutomation,McGrawHillEducation, 2017.
CHAO-

HWACHANGandMICHEL.A.MELKANOFF,NCMachineProgrammingand software Design, Prentice Hall Publishers, 1989.

OnlineLearningResources/VirtualLabs:

https://www.youtube.com/watch?v=NCEHRvFQqMo
https://www.youtube.com/watch?v=Gwy_Vh46fCM
https://www.youtube.com/watch?v=0sxLwytzT2Y
https://www.youtube.com/watch?v=rgZT3RtfUqA
https://www.youtube.com/watch?v=osqX7iQEnuI
https://www.youtube.com/watch?v=-F0i1LDk2XI
https://www.youtube.com/watch?v=i-PgeWbDgq4
https://www.youtube.com/watch?v=sJm1Nyb-AkE
https://www.youtube.com/watch?v=UxO0xqvvGcM
https://www.youtube.com/watch?v=Ic-iKGSc7dk

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

B-Tech (ME)-III-II Sem (R20)

(20A60308)HEAT TRANSFER LAB

L	T	P	C
0	0	3	1.5

CourseObjectives:

Studentsundergoingthiscoursewould

- Understanddifferentmodesofheat transfer
- Gainknowledgeabout naturalandforce convectionphenomenon
- Estimateexperimentaluncertainty inmeasurements

CourseOutcomes:

Upon thesuccessfulcompletion ofcourse, students will be able to

Explain differentmodes ofheat transfer L1
Identifyparametersformeasurementforcalculatingheat transfer L3
Determineeffectivenessofheat exchanger L3
Designnewequipmentrelatedtoheat transfer L5
Applyprinciplesofheat transfer inwideapplicationin industries. L2

ListofExperiments:

Determinetheoverallheat transfer coefficientacross thewidth ofcompositewall
Determinethethermalconductivityof metal rod
Determine thethermal conductivityof insulating
powdermaterial throughconcentricsphere apparatus
Determinethe thermal conductivityof insulatingmaterial throughlaggedpipe apparatus
Determine theefficiency of apin fininnaturalandforced convection.
Determinetheheat transfercoefficient foraverticalcylinderinnatural convection
Determinetheheat transfercoefficient inforcedconvectionofairina horizontal tube.
Determinetheheat transfercoefficients onfilm and dropwisecondensationapparatus.
Determinetheeffectivenessofa parallelandcounter flowheat exchanger.
Studythepool boilingphenomenon anddifferent regimesofpool boiling.
Experimentonpool boiling
Determinetheemissivityofthetestplate surface.
Experiment onStefan-Boltzmannapparatus
Determine theheat transfer rate coefficient in fluidized bed apparatus.

Virtual Lab: -

Determination of thermal conductivity of metal rod
https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/determination-of- thermal-conductivity-of-a-metal-rod
NaturalConvection heat transfer

https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab/natural-convection
Heat Transfer by Radiation
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=802&
cnt=1
Heat transfer byConduction
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=801&
cnt=1
The Study of phase change
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=709&
cnt=1
Blackbody Radiation:Determinationof Stefan‟s
Constanthttps://vlab.amrita.edu/index.php?sub=1&brch=194&sim
=548&cnt=1
Newton's Law of Cooling
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=354&
cnt=1
Lee's Disc
Apparatushttps://vlab.amrita.edu/index.php?sub=1&brch=194&si
m=353&cnt=1
Thermos Couple- See beck Effect
https://vlab.amrita.edu/index.php?sub=1&brch=194&sim=351&cnt=1

References:

Abdul Matheen, Heat Transfer Laboratory Manual, Laxmi Publications;2/e,2007.

Online Learning Resources/Virtual Labs:

https://sites.google.com/view/vlab-bnmitmech/home/heat-transfer-lab
https://www.iare.ac.in/sites/default/files/lab1/IARE_HT_LAB_MANUAL.pdf
https://mrcet.com/downloads/digital_notes/ME/III%20year/(R18A0388)Heat%20Transfer%2 0Lab.pdf
https://mrcet.com/downloads/ME/Mech%20III-II.pdf

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

B-Tech (ME)-III-II Sem (R20)

Skill oriented course – IV

Course Code	**Soft Skills**	**L**	**T**	**P**	**C**
20A65502		**1**	**0**	**2**	**2**
Pre-requisite					

Common to CIVIL,MECH, CHEM

Course Objectives:

To encourage all round development of the students by focusing on soft skills
To make the students aware of critical thinking and problem-solving skills
To develop leadership skills and organizational skills through group activities
To function effectively with heterogeneous teams

Course Outcomes (CO):
By the end of the program students should be able to

- Define various elements of effective communicative skills
- Understanding people using emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Assess the situation and take necessary decisions as a leader
- Creating a productive work place atmosphere using social and work-life skills ensuring personal and emotional well-being

UNIT – I	**Soft Skills & Communication Skills**	Lecture Hrs

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:
Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self- expression – articulating with felicity
(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)
Inter personal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.
Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.
Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT – II **Critical Thinking** Lecture Hrs

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities
:
Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT – III **Problem Solving & Decision Making** Lecture Hrs

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:
Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision.
Case Study & Group Discussion

UNIT – IV **Emotional Intelligence & Stress Management** Lecture Hrs

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:
Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.
Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT – V **Leadership Skills** Lecture Hrs

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities
Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making , Group discussion etc.

NOTE-:
1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources

which bear true relevance to the prescribed skill.
2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra Barun K.)Publisher : Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

1. Reference Books:

1.Soft skills: personality development for life success by prashantsharma, BPB publications 2018.

2. Soft Skills By Alex K. Published by S.Chand

3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.

4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books

5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press

6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher : Vayu Education Of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ
3. https://youtu.be/-Y-R9hDl7lU
4. https://youtu.be/gkLsn4ddmTs
5. https://youtu.be/2bf9K2rRWwo
6. https://youtu.be/FchfE3c2jzc

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

B-Tech (ME)-III-II Sem (R20)

(Mandatory Non-Credit Course) (CIVIL, ME, CHEM))
INTELLECTUAL PROPERTY RIGHTS AND PATENTS

20A69901

L	T	P	C
2	0	0	0

CourseObjectives:
This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws,
Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations.

CourseOutcomes: At the end of the course the students will be able to
UnderstandIPRlaw&Cyberlaw
Discussregistration process,maintenance andlitigations associatedwith trademarks
Illustrate thecopyright law
Enumerate thetrade excretal.

UNIT I
Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II
Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law –Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works –Rights of Distribution – Rights of performers – Copyright Formalities and Registration–Limitations–Infringement of Copyright –International Copyright Law-Semiconductor Chip Protection Act.

UNIT III
IntroductiontoPatentLaw–RightsandLimitations–RightsunderPatentLaw–Patent Requirements –Ownership and Transfer –Patent Application Process and Granting of Patent –Patent InfringementandLitigation–InternationalPatentLaw–DoublePatenting–PatentSearching–Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trademark – Trademark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trademark– Likelihood of confusion –Trademark claims – Trademarks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Textbooks:

Deborah E. Bouchoux: "Intellectual Property". Cengage learning, New Delhi

KompalBansal&ParishitBansal "Fundamentals of IPR for Engineers‟ S Publications (Press)

Cyber Law. Texts& Cases, South-Western‟s Special Topics Collections

References:

PrabhuddhaGanguli: „Intellectual Property Rights" Tata Mc-Graw–Hill, New Delhi

Richard Stim: "Intellectual Property", Cengage Learning, New Delhi.

R. Radha Krishnan, S. Balasubramanian: "Intellectual Property Rights", Excel Books. New Delhi.

M.Ashok Kumar and Mohd. Iqbal Ali: "Intellectual property Right "Serials Pub

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

B. Tech (ME)–IV-I Sem (R20)

(20A70301a) REFRIGERATION AND AIR CONDITIONING

(Professional Elective-III)

L	T	P	C
3	0	0	3

CourseObjectives:

Provides insightsin howthermodynamicprinciples areapplied withintherefrigerationandair conditioningindustry.

Introduce the studentshowrealsystemsusedincommercial,industrial refrigerationandair conditioning industries arebuilt-up.

Exposethestudentsonvariousrefrigerationmethodslike VCR, VARandlatest developments.

Know the various air conditioning methods like summer, winter and year-round air conditioningandtomakethestudenttounderstandthepracticalapplication sofrefrigeration andair conditioningsystems.

CourseOutcomes: At theendthestudent willbeableto

Appraisetheimportanceofhumidifiersand dehumidifiersL1
Selecttherequirementsoftemperatureandhumidityfor humancomfortL1
DemonstratetheheatpumpworkinganditscomponentsL2
ListthevariousairconditioningequipmentsL2

UNIT I
IntroductiontoRefrigeration

Necessity and Applications, Carnot Refrigerator, First and Second Law Applied to Refrigerating Machines, Unit ofRefrigeration,COP,EER,DifferentRefrigerationMethods.

Air Refrigeration: Bell-Coleman Cycle, Ideal and Actual Cycles, Open and Dense Air Systems - NumericalProblems-RefrigerationNeeds ofAirCrafts.

UNITIIVaporCompressionRefrigeration(VCR)System

Vapor Compression Refrigeration (VCR) System - Basic Cycle - Working Principle and Essential Components of the Plant - COP - Representation of Cycle On T-S and P-h Charts - Expander Vs. Throttling, Effect of Sub Cooling and Super Heating - Cycle Analysis - Actual Cycle- Influence of Various Parameters on System Performance - Construction and Use of P-h Charts - Numerical Problems. Refrigerants - Desirable Properties - Classification of Refrigerants Used - Nomenclature- SecondaryRefrigerants-Lubricants-OzoneDepletion-GlobalWarming-NewerRefrigerants.

UNITIIIVaporAbsorptionRefrigeration(VAR)System

Vapor AbsorptionRefrigeration (VAR)System-Descriptionand Working of NH3 - Water System and Li Br -Water (Two Shell & Four Shell) System - Calculation of Max COP, Principleof Operation of Three Fluid Absorption System

STEAMJETREFRIGERATIONSYSTEM:
WorkingPrincipleandBasicComponents-Estimation of Motive Steam Required Principle and Operation of: (I) Thermo-Electric Refrigerator (ii) Vortex Tube or Hilsch Tube.

UNITIVIntroductiontoAirConditioning:

Psychrometric Properties & Processes - Characterization of Sensible and Latent Heat Loads - Need for Ventilation, Consideration of Infiltrated Air - Heat Load Concepts. Air Cooler (Evaporative Cooling), Window, Split, Summer, Winter, Year-Round,CentralAirConditioningSystems.

UNITVAirConditioningEquipment

AirConditioningEquipment-Humidifiers-Dehumidifiers-AirFilters,FansandBlowers. Human Comfort**:** Requirements of Temperature, Humidity and Concept of Effective Temperature, ComfortChart.HeatPump-HeatSources-DifferentHeatPumpCircuits.

Textbooks:

RefrigerationandAirConditioning,CPArora,TMH,15/e,2013.
S.CArora&Domkundwar,ACourseinRefrigerationandAirconditioning,Dhanpatrai&Co, 2018.

ReferenceBooks:

RefrigerationandAirConditioning/ManoharPrasad/NewAge,2/e, 2013
Principles ofRefrigeration-Dossat/PearsonEducation,4/e,2007
RefrigerationandAirConditioning-P.L. Ballaney,2/e,2012.
BasicRefrigerationandAir-Conditioning-P.N. Ananth Narayanan/TMH,4/e,2013.

NOTE: Tables/Codes:ThermalEngineeringDataBookcontainingrefrigerantandPsychrometric propertyTables and charts arepermitted inExam

OnlineLearningResources:

https://www.iare.ac.in/sites/default/files/lecture_notes/IARE_RAC_Lecture_Notes.pdf
https://www.studocu.com/en-us/document/saint-louis-university/fluid-dynamics- laboratory/refrigeration-lecture-notes-1/3020577
http://home.iitk.ac.in/~samkhan/ME340A.htm
https://nptel.ac.in/courses/112105129
http://dte.karnataka.gov.in/Institutes/gptkampli/GenericDocHandler/68-fc177b7d-f5d1-4580-b577-b1118df994f4.pdf

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

B. Tech (ME) – IV-I Sem (R20)

(20A70301b) OPERATIONS RESEARCH

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course objective:

Toimpartthebasicconceptsofmodelling,modelsandstatementsoftheoperationsresearch.
Formulateandsolvelinear programmingproblem/situations.
Modelstrategicbehaviourindifferenteconomicsituations.
Tosolvetransportationproblemstominimize cost.
ApplyQueuingtheorytosolveproblemsoftrafficcongestion,countersinbanks,railway bookings etc.
Explainschedulingandsequencingofproductionrunsanddevelopproperreplacement policies.

CourseOutcomes: At theendofthecourse,thestudent willbeableto

Developmathematicalmodelsforpracticalproblems. (L3)
Applylinearprogrammingtotransportationproblems.(L3)
Solvegamesusingvarioustechniques.(L3)
Solveproductionschedulinganddevelopinventorypolicies.(L6)
Applyoptimalityconditionsforconstrainedandunconstrainednonlinearproblems.(L3)
Applydynamicprogrammingmethods.(L3)

UNITIIntroductiontoOR

Introduction to Operations Research (OR): OR definition - Classification of Models, modeling – Methods of solving OR Models, limitations and applications of OR models

Linear Programming(LP): Problem Formulation, Graphical Method, Simplex Method, Big-M Method, Two–Phase Simplex Method, Special Cases of LP- Degeneracy, Infeasibility and Multiple Optimal Solutions; Concept of dual theorem

UNIT–IITransportationandAssignment Problems

TransportationProblem – Formulation; Different Methods ofObtainingInitial BasicFeasibleSolution –North West Corner Rule, Least Cost Method, Vogel's Approximation Method; Optimality Method – Modified Distribution (MODI) Method; Special Cases – Unbalanced Transportation Problem, DegenerateProblem. Assignment Problem – Formulation, HungarianMethodfor SolvingAssignment Problems, Traveling Salesman problem.

UNIT–IIIGametheory&JobSequencing

Game theory: Optimal solution of two-person zero sum games, the max min and min max principle. Games without saddle points, mixed strategies.Reduction by principles of dominance, arithmetic, algebraic method and graphical method.

Job Sequencing: Introduction to Job shop Scheduling and flow shop scheduling, Solution of Job Sequencing Problem, Processing of n Jobs through two machines, Processing of n Jobs through m machines, graphical method.

UNIT–IVQueuingTheory&InventoryControl

Queuing Theory: Introduction – Terminology, Arrival Pattern, Service Channel, Population, Departure Pattern, Queue Discipline, Birth & Death Process, Single Channel Models with Poisson Arrivals, Exponential Service Times with infinite and finite queue length; Multichannel Models with Poisson Arrivals, Exponential Service Times with infinite queue length.
Inventory Control: Introduction, Deterministic models – EOQ model with and without shortages, Production model, Buffer stock and discount inventory models with single price breaks. Selective inventory control.

UNIT–VReplacementandMaintenanceAnalysis& DP

Replacement and Maintenance Analysis: Introduction – Types of Maintenance, Make or buy decision. Types of Replacement Problems, Determination of Economic Life of an Asset, and Simple Probabilistic Model for Items which completely fail-Individual Replacement Model, Group Replacement Model.**Dynamic Programming (DP):** Introduction –Bellman's Principle of Optimality –ApplicationsofDynamicProgramming–ShortestPathProblem–CapitalBudgetingProblem–

SolutionofLinearProgrammingProblembyDP.

Textbooks:

Sharma S.D.,OperationsResearch:Theory,MethodsandApplications, 15/e,KedarNathRam Nath, 2010
TahaH.A.,OperationsResearch,9/e,PrenticeHallofIndia,NewDelhi, 2010.

ReferenceBooks:

Hiller F.S., and Liberman G.J., Introduction to Operations Research, 7/e, Tata McGraw Hill, 2010.
SharmaJ.K.,OperationsResearch:TheoryandApplications,4/e,LaxmiPublications, 2009.
PremKumar Gupta and Hira, Operations Research,3/e, S Chand Company Ltd., New Delhi, 2003.
PannerselvamR.,OperationsResearch,2/e,PenticeHallofIndia,NewDelhi, 2006.
Sundaresan.V,andGanapathySubramanian.K. S,ResourceManagementTechniques:Operations Research, A.R Publications, 2015.

OnlineLearningResources:

http://www2.informs.org/Resources/
http://www.mit.edu/~orc/
http://www.ieor.columbia.edu/
http://www.universalteacherpublications.com/univ/ebooks/or/Ch1/origin.htm
http://www.wolfram.com/solutions/OperationsResearch/

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

B. Tech (ME)–IV-I Sem (R20)

(20A70301c) DESIGN FOR MANUFACTURING

(Professional Elective-III)

L	T	P	C
3	0	0	3

Course objective:

Explaintheproductdevelopmentcycleandmanufacturingissuestobeconsideredindesign.
Familiarizemanufacturingconsiderationincast,forged,andweldcomponents.
Describethemanufactureofsheetmetalcomponents.
Impartknowledgeplasticsas substitutiontometallicparts.

CourseOutcomes: After successfulcompletionofthecourse,thestudentwillbeableto

Designmechanicalcomponentswitheconomicalconsideration L3
Selectmaterialsandmachiningprocesses L1
Identifythenecessityforredesigningcomponentsoutofmanufacturingconsiderations L2
Considerthemanufacturingconsiderationswhiledesigningcast,forgedweldandsheet metal components L4
Designplasticpartswithmanufacturingconsiderations L5

UNIT I Introduction

Introduction: Design philosophy-steps in design process-general design rules for manufacturability- basic principles of designing for economical production-creativity in design.

Materials: Selectionof materialsfor design-developmentsinmaterialtechnology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNITII Machiningprocesses

Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNITIII MetalCastingandJoining

Metal casting: Appraisal of various casting processes, selection of casting process, -general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general designguidelines-preandpost treatment ofwelds-effectsofthermalstressesinweldjoints-designof brazed joints.

UNITIV Forging, Extrusion&Sheetmetalwork

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion&Sheet metalwork: Designguidelines extrudedsections-designprinciplesfor punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT V Plastics

Viscoelasticandcreepbehaviorinplastics-designguidelinesforplasticcomponents-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Textbooks:

GeorgeEDieterandLindaSchmidt,EngineeringDesign,4/e,McGrawHill, 2015.
A.K. ChitaleandR.C. Gupta,ProductDesignandManufacturing,5/e,PHILearning2011.
DavidMAnderson,DesignforManufacturability,CRCPress, 2013.

ReferenceBooks:

JamesGBralla,DesignforManufacturabilityHandbook,2/e,McGrawHill,2004.
Dr.P.C. Sharma,ProductionTechnology,S. Chand&Company,2009.
G.Boothroyd,ProductDesignforManufacture&Assembly,CRCPress,3/e, 2010.

OnlineLearningResources:

https://nptel.ac.in/courses/112/101/112101005/
https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_LECTURE_NOTES.pdf

https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii- spring-2004/lecture-notes/

https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on- design-for-manufacturing.html

https://www.youtube.com/watch?v=ofmbhbVCUqI
https://onlinecourses.nptel.ac.in/noc21_me66/preview

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

B. Tech (ME)–IV-I Sem (R20)

(20A70302a) AUTOMOBILE ENGINEERING

(Professional Elective-IV)

L	T	P	C
3	0	0	3

CourseObjective:

Imparttheknowledgeofvehiclestructureanditscomponents.
Demonstratevariouscomponentsofpetrolenginesanddiesel engines.
Trainsaboutthevariouselectricalsystem,circuits,andtestingofautomobiles.
Explaintheconceptsofsteering,suspensionandbrakingsysteminautomobile.

CourseOutcomes: Aftersuccessfulcompletionofthiscourse,thestudentwillbeableto
Identifydifferentpartsofautomobile L2
Explaintheworkingofvariouspartslike engineandbrakes L2
Describetheworkingofsteeringandthesuspensionsystems. L2
Summarizethewheelsandtires L3
Outlinethefuturedevelopments intheautomobileindustry L1

UNITI Introductiontovehiclestructureandenginecomponents

Vehicle construction - Chassis and body - Specifications – Chassis Layout and its components, Types of chassis. Engine - Types - Construction -Location of engine - Cylinder arrangement - Construction details. Lubricationsystem- Types - Oil pumps - Filters. Crankcase ventilation.

UNITII Ignitionandfuelsupplysystems

Ignition system - Coil and Magneto - Spark plug - Distributor – Electronic ignition system - Fuel system - Carburetor - Fuel pumps - Fuel injection systems - Mono point and Multi point – Unit Injector – Nozzle types - Electronic Fuel Injection system (EFI) – GDI, MPFI, DTSI.

UNIT–III Steeringandsuspensionsystem

Principle of steering - Steering Geometry and wheel alignment - Steering linkages – Steering gearboxes - Power steering – Ackerman’s steering gear mechanism & Davis’s steering gear mechanism front axle - Suspension system - Independent and Solid axle – coil, leaf spring and air suspensions - torsion bar - shock absorbers.

UNIT–IV BrakingSystem

Brakes - Needs – Classification –Drum and Disc Mechanical - Hydraulic and pneumatic - Vacuum assisted – Retarders – Anti-lock Braking System (ABS).

UNIT–V Automobileelectricalsystemsandadvancesinautomobileengineering

Battery-General electrical circuits- Active Suspension System (ASS) - Electronic Brake Distribution (EBD) – Electronic Stability Program (ESP), Traction Control System (TCS) - Global Positioning System (GPS), Hybrid vehicle, Fuel Cell.

Textbooks:

KirpalSingh,AutomobileEngineering,Vol.1&2,StandardPublications,13/e,2020.
William.H. Crouse,AutomotiveMechanics,10/e,McGraw-Hill,2006.
David A. Corolla, Automotive Engineering: Powertrain, Chassis System and Vehicle Body, Butterworth-Heinemann Publishing Ltd, 2009.
Richard Stone,Jeffrey K.Ball,Automotive Engineering Fundamentals" SAEInternational, 2004.

ReferenceBooks:

Bosch,AutomotiveHandBook,6/e,SAEPublications,2007.
K. Newton and W. Steeds, The motor vehicle, 13/e, Butterworth-Heinemann Publishing Ltd, 1989.
JosephHeitner,AutomotiveMechanicsPrinciplesandPractices,2/e,CBSpublishing2004.

OnlineLearningResources:

https://nptel.ac.in/courses/107106088
https://nptel.ac.in/courses/107106080
https://hindustanuniv.ac.in/assets/pdf/ug/CBCS/cbcs-automobile-2018.pdf
https://ed.iitm.ac.in/~shankarram/Course_Files/ED5160/ED5160.htm
https://dbatu.ac.in/wp-content/uploads/2020/07/B-Tech-Automobile_Final-Yr_22.06.2020-1. pdf
https://www.youtube.com/channel/UCGLlbmSTaLNUPhDwsMe-SgQ

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

B. Tech (ME)–IV-I Sem (R20)

(20A70302b) MECHANICAL VIBRATIONS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

CourseObjective:

- Demonstrate basic concepts and definitions of mechanical vibrations.To write equation of motion for discrete spring-mass systems with different configuration using classical and energy methods.
- To train the students about basic concepts of forced vibrations, vibration transmissibility and isolation and seismic instruments. Further to understand about various vibration control methods.
- To familiarize the students about two-degree freedom system and various types of vibration absorbers.
- Toanalyzethetwodegreeand multidegreeoffreedomsystems.

CourseOutcomes: Aftersuccessfulcompletionofthecourse,thestudentwillbeableto

Findnaturalfrequencyofun-dampedsingledegreefreedomsystems L3
Analyzethetwo-degreefreedomsystemswithandwithoutdamping L3
Calculatetransmissibilityandisolation L4
Solveproblemsonvibrationabsorber L4
Calculatenaturalfrequenciesofmultidegreefreedomsystem L4
Measurevibrationparameters L3
Usemechanicalexcitersandelectrodynamicshaker L1

UNIT ISingleDegreeFreedomSystems

Single Degree Freedom Systems: Un-damped free vibration: Classical method, Energy method, equivalent systems, torsional systems. Damped free vibration- Viscous damping, under damping, critical damping, over damping. Coulomb damping, equivalent dampingcoefficient.Simpleproblems.**Whirling of shafts: Transverse vibrations:** Dunkerley's lower bound approximation, Critical speedof shafts.

UNITIIForcedvibrationsofSingleDegreeFreedomSystems

Steady state forced vibration, sources of excitation, impressed harmonic force, resonance impressed forceduetounbalance, motion excitation, transmissibilityandisolation, performance of different type of isolators, power absorbed by viscous damping.

UNITIII TwoDegreeFreedomSystems:

Formulation of Equation of motion, Natural frequencies and modes of vibration by classical method, coupled pendulum, forced vibration, dynamic vibration absorber.

UNITIV MultiDegreeFreedomSystems:

Lagrangianmethodforformulationofequationofmotion Influenceco-efficient method,Lumped mass and distributed mass systems, Stodola method, Holzer's method, model analysis of freeand forced vibrations.

UNITV VibrationmeasurementandApplications

Transducers: variable resistance transducers, Piezoelectric transducers, electro dynamic transducers and linear variable differential transformer transducer; Vibration pickups: vibrometer, accelerometer, velocimeter and phase distortion; Frequency-measuring instruments; Vibration exciters- Mechanical exciters and electro dynamic shaker.

Textbooks:

SingiresuS.Rao,MechanicalVibrations,6/e,PearsonEducation,2018.
G.K. Groover,MechanicalVibrations,Nemchand&Bro,8/e,2009.

ReferenceBooks:

L.Meirovich,ElementsofVibrationsAnalysis,TataMcGrawHill,1986.
S.GrahamKelly,MechanicalVibrations,TataMcGrawHill,1996
WilliamThomson,TheoryofVibrationswithApplications,5/e,Pearson,2008
WilliamWeaver,Timoshenko,andYoung,VibrationProblemsinEngineering,5/e,John Wiley, 2013.
C.Nataraj,VibrationofMechanicalSystems,1/e,CengageLearning,2012.

OnlineLearningResources:

https://nptel.ac.in/courses/112107212
https://nptel.ac.in/courses/112103111
https://nptel.ac.in/courses/112103112
https://nptel.ac.in/courses/101105081
https://www.iare.ac.in/sites/default/files/PPT/MVSD%20PPT.pdf
https://www.iare.ac.in/sites/default/files/lecture_notes/MV_LECTURE_NOTES.pdf

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

B. Tech (ME)–IV-I Sem (R20)

(20A70302c) MODERN MANUFACTURING METHODS

(Professional Elective-IV)

L	T	P	C
3	0	0	3

Course Objectives:

DefinevariousModernMachiningProcesses.
Acquireknowledgeintheelementarymechanismandmachinabilityofmaterialswith different Modern Machining Processes.
Determinebasicprinciplesofoperationfor eachprocessandtheir applications.
StatevariousparametersinfluencingMRRinNon–TraditionalMachiningProcess.
ClassifyandunderstandtheworkingofAdditiveManufacturingProcesses.

Course Outcomes: At theendofthecourse,thestudent willbeableto

Illustrateadvancedmachiningprocesses,cuttingtoolsandcuttingfluidsforaspecificmaterial and part features.L3
Classifythemechanism ofMechanicalEnergybasedmachiningprocesses,itsapplications and limitations.L1
DifferentiateElectricalEnergyBasedmachiningprocesses,mechanismofmetalremoval, machine tool selection.L2
InterpretElectroChemicalmachiningprocess,economicaspectsofECMandproblems on estimation of metal removal rate.L2

UNITI

Non – Traditional Machining Processes: Introduction, Need, Classification and Brief Overview,ConsiderationsinProcessselection,Materials,Applications.

Mechanical Energy Based Processes: Abrasive Jet Machining, Water Jet Machining, Abrasive Water JetMachining, Ultra SonicMachining–WorkingPrinciple, DescriptionofEquipment, Process Parameters, Metal Removal Rate, Applications, Advantages and Limitations.

UNIT II

ElectricalEnergy Based Processes: Electric DischargeMachining – WorkingPrinciples, Description of Equipment, Process Parameters, Surface Finish and MRR, Electrode / Tool, Power and Control Circuits, Tool Wear, Dielectric Fluid, Flushing, Advantages, Limitations and Applications. Wire cut EDM – Working Principle and Applications.

UNIT III

Chemical and Electro Chemical Energy Based Processes: Chemical Machining and Electro Chemical Machining – Working Principle, Description of Equipment, Etchants, Maskants,Techniques of Applying Maskants, Process Parameters, Surface Finish and MRR, Electro Chemical Grinding, Electro Chemical Honing,Applications, Advantages and Limitations.

UNIT IV

Thermal Energy Based Processes: Laser Beam Machining and Drilling, Plasma Arc Machining, Electron Beam Machining – Working Principle, Description of Equipment, Process Parameters, Applications, Advantages and Limitations.

UNIT V

Additive Manufacturing: Introduction to Additive Manufacturing, Classification of Additive Manufacturing Processes, Working Principle, Advantages, Limitations and Applications of Stereolithography (SLA), Fused Deposition Modeling, Selective Laser Sintering, Laminated Object Manufacturing

Textbooks:

Jain V.K., Advanced Machining Processes, 1st Edition, Allied Publishers Pvt. Ltd., New Delhi, 2007.

PandeyP.CandShanH.S.,ModernMachiningProcesses, 1/e,McGrawHill,NewDelhi, 2007.

IanGibson,DavidW.Rosen,BrentStucker,AdditiveManufacturingTechnologies:Rapid Prototyping to Direct Digital Manufacturing, 1/e, Springer, 2010.

ReferenceBooks:

ChuaC.K.,LeongK.F.andLimC.S.,RapidPrototyping:PrinciplesandApplications,2/e, World Scientific Publishers, 2003.

BenedictG.F.,NontraditionalManufacturingProcesses,1/e,CRCPress, 1987.

MishraP.K.,NonconventionalManufacturing,1/e,NarosaPublishingHouse,NewDelhi, 2014.

McGeoughJ.A.,AdvancedMethodsofMachining,1/e,Springer, 1988.

OnlineLearningResources:

https://nptel.ac.in/courses/112/107/112107078/
https://youtu.be/t3y_Ys3LgGM
https://www.youtube.com/watch?v=E4VZ_rFqpG4&t=1s
https://youtu.be/-tcaR7oSx_w
https://youtu.be/Uybg6VDLoRQ
https://youtu.be/Uybg6VDLoRQ

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

B. Tech (ME)–IV-I Sem (R20)

Professional Elective Course– V (MOOC)

L	T	P	C
3	0	0	3

20A70303

1. Heat exchangers, Fundamentals and design analysis
2. Mechatronics
3.Theory of Composite Materials

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

B.Tech IV-I Sem (R20)

Course Code (20A75401a)	1. MANAGEMENT SCIENCE (Humanities Elective)	L	T	P	C
		3	0	0	3

Common to All Branches

COURSE OBJECTIVES: The objectives of this course are

	To provide fundamental knowledge on management, administration, organization & its concepts.
	To make the students understand the role of management in Production process and marketing management
	To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
	To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
	To make the students aware of the contemporary issues in management

Course Outcomes (CO): At the end of the course, students will be able to

	Define the Management, and its Functions
	Understand the concepts & principles of management and designs of organization in a practical world
	Apply the knowledge of Work-study principles & Quality Control techniques in industry
	Analyse the concepts of HRM in Recruitment, Selection and Training & Development.
	Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyse the business through SWOT.
	Create Modern technology in management science.

UNIT - I **INTRODUCTION TO MANAGEMENT**

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor’s Scientific Theory-Henry Fayol’s principles - Elton Mayo’s Human relations - Systems Theory - **Organizational Designs** - Line organization - Line & Staff Organization - Functional Organization - Committee form of Organization - Social responsibilities of Management.

LEARNING OUTCOMES: At the end if the Unit, the learners will be able to

- Understand the concept of management and organization
- Analyze the organization chart & structure for an enterprise.
- Apply the concepts & principles of management in real life industry.
- Evaluate and interpret the theories and the modern organization theory.

UNIT - II **OPERATIONS & MARKETING MANAGEMENT**

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), - Statistical Quality Control- **Materials Management -** Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure - **Marketing Management -** Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

- Understand the core concepts of Management Science and Operations Management
- Apply the knowledge of Method of Production principles in real life industry.
- Analyze Marketing Mix Strategies for an enterprise
- Evaluate Materials departments & Determine EOQ
- Create and design advertising and sales promotion

UNIT - III **HUMAN RESOURCES MANAGEMENT (HRM)**

HRM - Evolution of HRM - Definition and Meaning – Nature - Managerial and Operative functions - - Job Analysis - Human Resource Planning (HRP) – Process of Recruitment & Selection - Training and Development - Performance Appraisal - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration.

LEARNING OUTCOMES: At the end if the Unit, the learners will

Understand the concepts of HRM in Recruitment, Selection, Training & Development
Apply Managerial and operative Functions of HRM
Analyze the need of training
Evaluate performance appraisal Techniques
Design the basic structure of salaries and wages Administration.

UNIT - IV **STRATEGIC & PROJECT MANAGEMENT**

Strategy Definition & Meaning - Vision - Mission - Goals - Steps in Strategy Formulation and Implementation SWOT Analysis **Project Management -** Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Project Crashing (Simple problems).

LEARNING OUTCOMES: At the end of the Unit, the learners will be able to

Understand Mission, Objectives, Goals & strategies for an enterprise
Apply SWOT Analysis to strengthen the project
Analyze Strategy formulation and implementation
Evaluate PERT and CPM Techniques
Creative in completing the projects within given time

UNIT - V **Contemporary Issues In Management**

The concept of Management Information System (MIS) - Materials Requirement Planning (MRP) - Customer Relations Management (CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management (SCM) - Enterprise Resource Planning (ERP) - Business Process Outsourcing (BPO) - Business Process Re-engineering - knowledge Management.

LEARNING OUTCOMES At the end if the Unit, the learners will be able to

Understand modern management techniques
Apply Knowledge in Understanding in modern management techniques
Analyze Concept of CRM, MRP, TQM
Evaluate Six Sigma concept and SCM

Textbooks:

A.R Aryasri, Management Science, TMH, 2013
Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

Reference Books:

Koontz & Weihrich, Essentials of Management, 6/e, TMH, 2005.
Thomas N.Duening & John M.Ivancevich, Management Principles and Guidelines, Biztantra.
Kanishka Bedi, Production and Operations Management, Oxford University Press, 2004.
Samuel C.Certo, Modern Management, 9/e, PHI, 2005

Online Learning Resources:

www.slideshare.net/jhayabesamis/chapter-1-the-nature-and-concept-of-management-122625641?
www.slideshare.net/vivekpratapsingh14/school-of-management-thoughts?
https://www.slideshare.net/89ajpaul/organizational-design-anf-structure
https://www.slideshare.net/sujeet2685/plant-layout-46555840#
https://www.slideshare.net/drmadhurverma/materials-38395397
https://www.slideshare.net/ShaliniShetty3/introduction-to-marketing-management-72210724?
https://www.slideshare.net/srinidhiraman/human-resource-management-ppt-43320777
https://www.slideshare.net/wicaksana/training-and-development-33535063
https://www.slideshare.net/ayushijain107/strategic-management-ppt-58012275

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

B.Tech IV-I Sem (R20)

Course Code (20A75401b)	2. BUSINESS ENVIRONMENT (Humanities Elective)	L	T	P	C
		3	0	0	3

Common to All Branches

Course Objectives:

	To make the student understand about the business environment
	To enable them in knowing the importance of fiscal and monitory policy
3	To facilitate them in understanding the export policy of the country
	To Impart knowledge about the functioning and role of WTO
	To Encourage the student in knowing the structure of stock markets Course

Outcomes (CO): At the end of the course, students will be able to

1.	Define Business Environment and its Importance.
2.	Understand various types of business environment.
3	Apply the knowledge of Money markets in future investment
4	Analyse India's Trade Policy
5	Evaluate fiscal and monitory policy
	Develop a personal synthesis and approach for identifying business opportunities

UNIT - I **Overview of Business Environment**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types - Internal & External, Micro and Macro. Competitive structure of industries - Environmental analysis - advantages & limitations of environmental analysis & Characteristics of business.

Learning Outcomes: - After completion of this unit student will

Understand the concept of Business environment
Classify various types of business environment
Evaluate the environmental analysis in business
Discuss the Characteristics of Business.

UNIT - II **Fiscal Policy**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Public debt - Development activities financed by public expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget - Monetary Policy - Demand and Supply of Money – RBI - Objectives of monetary and credit policy - Recent trends - Role of Finance Commission.

Learning Outcomes: - After completion of this unit student will

Understand the concept of public revenue and public Expenditure
Identify the functions of RBI and its role
Analyze the Monitory policy in India

Know the recent trends and the role of Finance Commission in the development of our country
Differentiate between Fiscal and Monitory Policy

UNIT - III **India's Trade Policy**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank - Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

Learning Outcomes: - After completion of this unit student will
Understand the role of Indian international trade
Understand and explain the need for Export and EXIM Policies
Analyze causes for Disequilibrium and correction measure
Differentiate between Bilateral and Multilateral Trade Agreements

Introduction – Nature, meaning, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - Agreements in the Uruguay Round – TRIPS, TRIMS, and GATT - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

Learning Outcomes: - After completion of this unit student will
Understand the role of WTO in trade
Analyze Agreements on trade by WTO
Understand the Dispute Settlement Mechanism
Compare and contrast the Dumping and Anti-dumping Measures.

Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI - Stock Exchanges - Investor protection and role of SEBI.

Learning Outcomes: - After completion of this unit student will
Understand the components of Indian financial system
Know the structure of Money markets and Capital markets
Analyze the Stock Markets
Apply the knowledge in future investments
Understand the role of SEBI in investor protection.

Textbooks:

1.Business Environment Text & Cases: JUNE 2017
Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India.
K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016

Reference Books:

1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India.
Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India.
Chari. S. N (2009), International Business, Wiley India.
4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.

Online Learning Resources:
https://www.slideshare.net/ShompaDhali/business-environment-53111245
https://www.slideshare.net/jitenparmar313/fiscal-policy-65521889
https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt
https://www.slideshare.net/prateeknepal3/ppt-mo

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

B.Tech IV-I Sem (R20)

Course Code	3. ORGANIZATIONAL BEHAVIOUR	L	T	P	C
	20A75401c (Humanities Elective)	3	0	0	3

Common to All Branches

Course Objectives:

1	To make them aware of concepts & analysis in organizational behaviour
2	To offer knowledge to students on self-motivation, leadership and management
3	To facilitate them to become powerful leaders
4	To Impart knowledge about group dynamics
5	To make them understand the importance of change and development

COURSE OUTCOMES: At the end of the course, students will be able to

1	Define the Organizational Behaviour, its nature and scope
2	Understand the nature and concept of Organizational behaviour
3	Apply theories of motivation to analyse the performance problems
4	Analyse the different theories of leadership
5	Evaluate group dynamics

UNIT - I

6	Develop as powerful leader

Introduction Of Organizational Behavior and Various Concepts

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective - Understanding Individual Behavior – Attitude - Perception - Learning – Personality.

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Organizational Behavior
Contrast and compare Individual & Group Behavior and attitude
Evaluate personality types

UNIT - II **Motivation and Organization Outcome**

Theories of Motivation - Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy - McClelland's theory of needs – Mc Gregor's theory X and theory Y – Adam's equity theory – Locke's goal setting theory –

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Motivation
Analyze the Theories of motivation
Explain how employees are motivated according to Maslow's Needs Hierarchy

UNIT - III**Leadership**

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Alderfer's ERG theory – traits - Leaders Vs Managers.

Conflict Management - Evaluating Leader - Women and Corporate leadership.

LEARNING OUTCOMES: - After completion of this unit student will

Understand the concept of Leadership
Contrast and compare Trait theory and Managerial Grid
Distinguish the difference between Transactional and Transformational Leadership
Evaluate the qualities of good leaders

UNIT - IV **Organizational Culture**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

Understand the importance of organizational change and development
Apply change management in the organization
Analyze work stress management
Evaluate Managerial implications of organization

UNIT - V **Organizational Change and Development**

Introduction – Nature, Meaning, scope, definition and functions - Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

LEARNING OUTCOMES: - After completion of this unit student will

Understand the importance of organizational change and development
Apply change management in the organization
Analyze work stress management
Evaluate Managerial implications of organization

Textbooks:

Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011
P Subba Rao, Organisational Behaviour, Himalya Publishing House 2017

Reference Books:

McShane, Organizational Behaviour, TMH 2009
Nelson, Organisational Behaviour, Thomson, 2009.
Robbins, P.Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009.
Aswathappa, Organisational Behaviour, Himalaya, 2009

https://www.slideshare.net/payalrchhabra/organisational-behavior-15668552
https://www.slideshare.net/nilendrakumar7/motivation-and-team-building
https://www.slideshare.net/Knight1040/organizational-culture-9608857
https://www.slideshare.net/harshrastogi1/group-dynamics-159412405
https://www.slideshare.net/kohlisudeep18/organisational-developmet

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

B. Tech (ME)–IV-I Sem (R20)

Open Elective Course – III

Common to All Branches

L	T	P	C
3	0	0	3

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

B. Tech(ME)–IV-I Sem (R20)

Open Elective Course – IV

L	T	P	C
3	0	0	3

Common to All Branches

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

B. Tech(ME)–IV-I Sem (R20)

20A70306 INDUSTRIAL AUTOMATION

(Skill Oriented Course-III)

L	T	P	C
1	0	2	2

Course Objectives

- IntroducebasicconceptsandprinciplesofIndustrialAutomation.
- Familiarizewithfluidpowersystemscircuits.
- DescribeconceptsofSCADAsoftware
- ExplaintheprinciplesofPLCand8085microprocessor.
- Exposethestudents onMechatronics.

CourseOutcomes: Attheendofthecourse,studentwillbeableto

Summarizesthehowfluidpowersystemwork L3
DiscussaboutSCADAsoftware L1
Developtheskillsrelatedtopredicttheoutputfor various programs.L2
ExplaintheconceptsofmechatronicsL1

ListofExperiments:

Module1: Design and testing of fluid power circuits to control IntroductiontoFluidpowersystems,Symbolicrepresentationofhydraulicandpneumaticcomponent s.

Tasks:-

Pneumatictrainer kitwithFRLUnit,Singleactingcylinder,pushbutton.
PneumatictrainingkitwithFRLunit,Doubleactingcylinder,manuallyactuatedDCV.
PneumatictrainerkitwithFRLunit,Doubleactingcylinder,PilotactuatedDCV.
Pneumatictrainer kitwithFRLunitDoubleactingcylinder,
DoublesolenoidactuatedDCV, DCV with sensor / magnetic reed.
Hydraulicpower packwithpumpsandpressurereliefvalve.

Module2:

OpensourceSCADAsoftwaresuchasFreeSCADA,OpenSCADA,
IndigoSCADACodeSysOpensourcefor PLC
programmingandinterfacingwithrealtime PLC
DeltaPLCsoftware–freewareandcorrespondingPLCprogrammingsoftware.
8085MicroprocessorTrainerwithPowerSupply
TrafficLightControlSystem

Module3: Mechatronics

Experiment onP,PIandPIDController.
SimulationofHydraulicActuationSystem.

SimulationofPneumaticActuationSystem.
SimulationonStepperMotor.
SimulationonLogicgates,decodersandflip-flops.

References:

B. Gavali, S. A. Patil and A. R. Koli, "Technology-Based Learning system in Programmable Logic Controller Education," 2016 IEEE Eighth International Conference on Technology for Education (T4E), Mumbai, 2016, pp. 264-265.

Groover, Mikell ,Fundamentals of Modern Manufacturing: Materials, Processes, and Systems, 2014.

Lamb, Frank. Industrial Automation: Hands On (English Edition). NC, McGraw-Hill Education, 2013. ISBN 978-0071816458.

Note:-Trainercanusefreewaresimulationsoftware's.

OnlineLearningResources/VirtualLabs:

http://iotmumbai.bharatividyapeeth.edu/media/pdf/lab_manuals/Manual_EE5I_EIA_22526.pdf
https://faculty.ksu.edu.sa/sites/default/files/lab-manual_v3.pdf
https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?article=1494&context=eesp

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU

DEPARTMENT OF MECHANICAL ENGINEERING

B. Tech(ME)–IV-I Sem (R20)

20A70307 Evaluation of Industry Internship

L	T	P	C
0	0	0	3

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
III B.TECH – I SEMESTER (R20) (common to all branches) **- 2020 Admitted Batch** (THEORY)

Open Elective Course – I

Subject Code	Title of the Subject	L	T	P	C
2050305	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Course Objectives:

To introduce various optimization techniques i.e classical, linear programming,

Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

Electrical and electronic engineering circuits design problems in real world situations.

To explain the concept of Dynamic programming and its applications to project

Learn the knowledge to formulate optimization problems

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

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

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

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

UNIT – IV

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

UNIT V

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

Course Outcomes:

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

understand optimization of electrical and electronics engineering problems

apply classical optimization techniques, linear programming, simplex algorithm,

• transportation problem apply unconstrained optimization and constrained non-linear programming and

dynamic programming Formulate optimization problems.

TEXT BOOKS:

Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

Genetic Programming- Koza

Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
III B.TECH – II SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – II

Subject Code	Title of the Subject	L	T	P	C
20A60305	**SOLAR ENERGY SYSTEMS**	3	0	0	3

Course objectives

Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.
Study of various solar energy technologies with different types of concentrating collectors.
Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.
Understanding the basics of economics involves in the solar system.
Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I
SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces.
Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II
SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III
SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV
ECONOMICS:
Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V
THERMAL POWER:
The power concepts- design aspects, thermo-chemical reactor.
SOLAR POND AND SOLAR STILLS:
Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :
Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.
Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.
Developing solar cells in the field of nano technology.
Calculating the cash flow and costs involves in the solar energy systems.
Designing and developing of thermo chemical reactor with respect to thermal power.

Reference Books:
Solar Energy Thermal Process Diffice and Beckman
Solar Heating and Cooling by Kreith and Kreider
Solar Energy Utilization by G.D.Rai
Solar Energy Utilization by G.D.Rai , Khanna Publishers.
Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,
Applied Solar Energy by Meinel and Meinel
Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
Energy Resources Utilization and Technologies By Anjaneyulu, BS Pub.,

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
IV B.TECH – I SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – III

Subject Code	Title of the Subject	L	T	P	C
20A70304	**MODERN MANUFACTURING METHODS**	3	0	0	3

Course Objectives:

- To learn the importance and basics of unconventional machining.
- To understand the rapid prototyping processes.
- To have the knowledge of different micro machining methods
- To understand the working principles of various Non-traditional machining methods.
- To learn about Non-traditional forming processes.

UNIT-I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT-II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations, Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT-III

Electro –Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT-IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT-V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Course Outcomes:

At the end of this course the student should be able to understand

- Technical aspects of precision machining.
- Applications of rapid prototyping technologies.
- Tool selection for non traditional processes.
- Knowledge of economic aspects of Non traditional processes.
- Fabrication of microelectronic devices.

TEXT BOOKS:

- Manufacturing processes for engineering materials by Serope Kalpakjian and Steven R Schmid, 5edn, Pearson Pub.
- Advanced machining processes, VK Jain, Allied publishers.

REFERENCES:

- New Technology , Bhattacharya A, The Institution of Engineers, India 1984
- Manufacturing Technology, Kalpakzian, Pearson
- Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

JNTUA COLLEGE OF ENGINEERING (Autonomous): ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING
IV B.TECH – I SEMESTER (R20) (common to all branches)
(THEORY)

Open Elective Course – IV

Subject Code	Title of the Subject	L	T	P	C
20A70305	**MATERIAL HANDLING EQUIPMENTS**	3	0	0	3

Course Objectives:

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

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

To realize the importance of materials both in product and service.
planning/ production and plant layouts, studying about strategies of material handling and equipments, and selection of site locations.

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

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

UNIT-V

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

Course Outcomes :

The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.

The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.

The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system

The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.

The students will be able to design of fork lift trucks.

REFERENCES

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

Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

P.S.G. Tech., “Design Data Book”, Kalaikathir Achchagam, Coimbatore, 2003.

Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		**MATERIAL SCIENCE FOR ENGINEERING**	**L**	**T**	**P**	**C**
Semester		**20A03M11**	**3**	**1**	**0**	**4**

Course Objectives:

To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
To Explain the methods to change the properties of materials through heat treatment processes.
To Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
To Familiarize properties and applications of ceramics, polymers and composite materials.

Course Outcomes (CO):

Explain the principles of binary phases
Apply heat treatment to different applications
Select steels and cast irons for a given application
Utilize nonferrous metals and alloys in engineering
Choose composites for various applications
Assess the properties of Nano-scale materials and their applications

UNIT - I **Structure of Metals & Constitution of Alloys** 8 Hrs

Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.

Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT - II **Heat Treatment of Steels**: 8 Hrs

Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe_3Calloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT - III **Steels and Cast Irons** 10 Hrs

Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels- stainless steels and tool steels.

Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - IV **Non-ferrous Metals and Alloys** 10 Hrs

Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Microstructure, properties and applications of titanium and its alloys.

UNIT - V **Ceramics, Polymers and Composites:** 10 Hrs

Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.

Textbooks:

V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley Sons, 2009.

Reference Books:

Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Online Learning Resources:

https://nptel.ac.in/courses/113102080
https://www.digimat.in/nptel/courses/video/113102080/L01.html

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		COMPUTER AIDED MACHINEDRAWING	L	T	P	C
Semester		20A03M12	3	1	0	4

Course Objectives:

Introduce conventional representations of material and machine components.
Train to use software for 2D and 3D modeling.
Familiarize with thread profiles, riveted, welded and key joints.
Teach solid modeling of machine parts and their sections.
Explain creation of 2D assembly drawings from 3D assemblies.

Demonstrate the conventional representations of materials and machine components
Model riveted, welded and key joints using CAD system
Create solid models and sectional views of machine components
Generate solid models of machine parts and assemble them
Translate 3D assemblies into 2D drawings

UNIT - I **Isometric and Orthographic Projections** 8 Hrs

Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes Figures, Simple and Compound Solids-Conversion of isometric Projections/Views of Orthographic Views-Conventions.

UNIT - II **Perspective projections** 8 Hrs

Perspective projections –Planes and simple solids. Vanishing point Method only.

UNIT - III **Detachable joints & Permanent Joint** 10 Hrs

Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.
Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.
Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

UNIT - IV **Keys and Couplings** 10 Hrs

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.
Shaft coupling: bushed pin-type flange coupling, universal joint, Oldhams' coupling.
Sectional views: Creating solid models of complex machine parts and create sectional views.

UNIT - V **Assembly drawings:** 10 Hrs

Piston, connecting rod, Eccentric, Screw jack, Plumber block, Pipe vice, Clamping device,Tail stock,Air Cock, Machine vice, Carburetor.

Textbooks:

K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.
Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.

Reference Books:

James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Online Learning Resources:

https://www.youtube.com/watch?v=4U0kmyXT47o
https://www.youtube.com/watch?v=EA3YOMfh99M
https://www.bietdvg.edu/media/department/ME/data/learning-materials/CAMD_MANUAL18ME36A_FINAL.pdf
https://www.youtube.com/watch?v=4vw1GpigfMk

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		**3D PRINTING MATERIALS**	L	**T**	**P**	**C**
Semester		**20A03M13**	**3**	**1**	**0**	**4**

Course Objectives:

Explain the need of 3D Printing Technology.
Familiarize manufacturing of polymer components.
Describe the manufacture of products through powder metallurgy.
Impart knowledge on various material characterization techniques.

Course Outcomes (CO):

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

Development mechanical components with powder metallurgy technique
Select materials for Additive Manufacturing
Explain the concept of material characterization
Understand the concepts of powder shaping and sintering

UNIT - I **Introduction** 8 Hrs

Need for AM, Historical Development, Fundamentals of AM, AM Process Chain, Advantages and Limitations of AM, Classification of AM Systems, Materials used in AM

UNIT - II **Polymers Basic Concepts** 10 Hrs

Polymers Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD]

Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques.

UNIT - III **Powder Metallurgy** 10 Hrs

Powder Metallurgy Basic Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM, Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes

UNIT - IV **Powder Shaping and Sintering** 10 Hrs

Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.

Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components

UNIT - V **Introduction to Characterization** 10 Hrs

Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization. Microstructures of Powder by Different techniques characterization methods -BET surface area analyzer, Atomic force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), Small Angle X-ray Scattering (SAXS) and High Power X-ray.

Textbooks:

Chee Kai Chua, Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific.
G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4/e, 2005.

Reference Books:

Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.

Online Learning Resources:

https://nptel.ac.in/courses/112104265
https://nptel.ac.in/courses/112103306
https://nptel.ac.in/courses/108108115
https://onlinecourses.nptel.ac.in/noc20_mg70/preview
https://nptel.ac.in/courses/116102052

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPURAMU
DEPARTMENT OF MECHANICAL ENGINEERING (R20)

Course Code		APPLICATIONS OF 3D PRINTING	L	T	P	C
Semester		20A03M14	3	1	0	4

Course Objectives:

Explain the typical application areas of additive manufacturing.
Familiarize with the applications of 3D printing in Design and Engineering area.
Describe the concepts of manufacturing of bio-medical implants.
Impart knowledge onApplications in Automotive, Civil and other fields.

Course Outcomes (CO):

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

Design CAD model and verification of CAD model
Select type of 3D printing technology for different applications
Identify the various applications of 3D printing in manufacturing and aerospace
Explain the various Applications of 3D printing in Automotive, Civil and other fields
List the various applications of 3D printing technology

UNIT - I **Typical application areas of Additive Manufacturing:** 8 Hrs

Finishing Processes- Cutting Processes, Sand-Blasting and Polishing, Coating, Painting.

UNIT - II **Applications in Design and Engineering:** 10 Hrs

Applications in Design: CAD Model Verification, Visualizing Objects, Proof of Concept, Marketing and Commercial Applications,

Applications in Engineering Analysis and Planning: Scaling, Form and Fit, Flow Analysis, Stress Analysis, Mock-Up Parts, Pre-Production Parts, Diagnostic and Surgical Operation Planning, Design and Fabrication of Custom Prosthesis and Implant,

UNIT - III **Applications in Manufacturing and Tooling**: 8 Hrs

Classification of rapid tooling, Direct Soft Tooling, Indirect Soft Tooling, Direct Hard Tooling.

UNIT - IV **Applications in Bio-medical and Aerospace:** 8 Hrs

Operation Planning for Cancerous Brain Tumor Surgery, Planning Reconstructive Surgery with RP Technology, Craniofacial Reconstructive Surgery Planning, Biopsy Needle Housing, Knee Implants, Scaffolds for Tissue Engineering, Customized Tracheobronchial Stents, Inter-Vertebral Spacers, Cranium Implant, Design Verification of an Airline Electrical Generator, Engine Components for Fanjet Engine, Fabrication of Flight-Certified Production Castings.

UNIT - V **Applications in Automotive, Civil and other fields** 10 Hrs

Prototyping Complex Gearbox Housing for Design Verification, Prototyping Advanced Driver Control System with Stereolithography, Creating Cast Metal Engine Block with RP Process, Using Stereolithography to Produce Production Tooling, Civil engineering- 3D printing in house construction, Development of Contour Crafting Process, Building Disaster Relief Shelters, Metal Frames For Solid Structures, other fields- Coin industry, Jewelry Industry, tableware industry.

Textbooks:

Chee Kai Chua, Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific.
Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.

Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.

Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.

RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Online Learning Resources:

https://www.mdpi.com/2073-4360/12/6/1334

https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf

https://lecturenotes.in/subject/197

https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf

https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf

https://www.youtube.com/watch?v=NkC8TNts4B4

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) Anantapur COURSES OFFERED FOR HONOURS DEGREE IN Advanced Manufacturing systems (offered only for Mechanical Students)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Additive Manufacturing	3	1	4
2		Precision Engineering	3	1	4
3		Quality Engineering in Manufacturing	3	1	4
4		Simulation of Manufacturing Systems	3	1	4
5		MOOC I:Laser based Manufacturing			2
6		MOOC II: Automation in Manufacturing			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS) Anantapur COURSES OFFERED FOR HONOURS DEGREE IN INTERNAL COMBUSTION ENGINES (offered only for Mechanical Students)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Internal combustion Engine Design	3	1	4
2		Engine Auxiliary Systems	3	1	4
3		Alternative fuels for I.C.Engines	3	1	4
4		Engine pollution and control	3	1	4
5		MOOC I: Hybrid and Electric vehicles			2
6		MOOC II: Automotive safety			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ADDITIVE MANUFACTURING	L	T	P	C
Semester			3	1	0	4

Course Objectives: Student will be able to

- To introduce students the basics of additive manufacturing/rapid prototyping and its applications in various fields, reverse engineering techniques.
- To teach students about mechanical properties and geometric issues relating to specific rapid prototyping applications.

Course Outcomes (CO): Student will be able to

CO1: describe additive manufacturing and explain its advantages and disadvantages

CO2: explain the processes used in additive manufacturing for a range of materials and applications

CO3: understand the role of additive manufacturing in the design process and the implications for design

CO4: describe the effects of surface finish and microstructural properties on behaviour for components produced using additive manufacturing

CO5: display an awareness of residual stresses that may occur during additive manufacturing and their effects.

UNIT - I		Lecture Hrs:

INTRODUCTION:

Need - Development of AM systems – AM process chain - Impact of AM on Product Development - Virtual Prototyping- Rapid Tooling – RP to AM -Classification of AM processes-Benefits-Applications.

UNIT – II		Lecture Hrs:

REVERSE ENGINEERING AND CAD MODELING:

Basic concept- Digitization techniques – Model reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data requirements – Geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing, Tool path generation-Software for AM- Case studies.

UNIT – III		Lecture Hrs:

LIQUID BASED AND SOLID BASED ADDITIVE MANUFACTURING SYSTEMS:

Stereolithography Apparatus (SLA): Principle, pre-build process, part-building and post-build processes, photo polymerization of SL resins, part quality and process planning, recoating issues, materials, advantages, limitations and applications. Solid Ground Curing (SGC): working principle, process, strengths, weaknesses and applications. Fused deposition Modeling (FDM): Principle, details of processes, process variables, types, products, materials and applications. Laminated Object Manufacturing (LOM): Working Principles, details of processes, products, materials, advantages, limitations and applications - Case studies.

UNIT – IV		Lecture Hrs:
POWDER BASED ADDITIVE MANUFACTURING SYSTEMS: Selective Laser Sintering (SLS): Principle, process, Indirect and direct SLS- powder structures, materials, post processing, surface deviation and accuracy, Applications. Laser Engineered Net Shaping (LENS): Processes, materials, products, advantages, limitations and applications– Case Studies.		
UNIT – V		Lecture Hrs:
OTHER ADDITIVE MANUFACTURING SYSTEMS Three dimensional Printing (3DP): Principle, basic process, Physics of 3DP, types of printing, process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies. Shape Deposition Manufacturing (SDM), Ballastic Particle Manufacturing (BPM), Selective Laser Melting, Electron Beam Melting.		
Textbooks:		
Gibson, I., Rosen, D.W. and Stucker, B., “Additive Manufacturing Methodologies: Rapid Prototyping to Direct Digital Manufacturing”, Springer, 2010. Chua, C.K., Leong K.F. and Lim C.S., “Rapid prototyping: Principles and applications”, second edition, World Scientific Publishers, 2010. Gebhardt, A., “Rapid prototyping”, Hanser Gardener Publications, 2003. Liou, L.W. and Liou, F.W., “Rapid Prototyping and Engineering applications : A tool box for prototype development”, CRC Press, 2011.		
Reference Books:		
Kamrani, A.K. and Nasr, E.A., “Rapid Prototyping: Theory and practice”, Springer, 2006. Hilton, P.D. and Jacobs, P.F., Rapid Tooling: Technologies and Industrial Applications, CRC press, 2005		
Online Learning Resources:		
https://nptel.ac.in/courses/112/103/112103306/		

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		PRECISION ENGINEERING	L	T	P	C
Semester			3	1	0	4

Course Objectives:

To impart knowledge about basics of precision machining and different Manufacturing technique in precision engineering.

- Accuracy and alignment tests.
- Influences of static stiffness and thermal effects.
- Precision machining.
- Nano measuring systems.
- Various lithography techniques

Course Outcomes (CO): Student will be able to

- Apply fits and tolerances for parts and assemblies according to ISO standards
- Apply selective assembly concept for quality and economic production
- Assign tolerances using principles of dimensional chains for individual features of a part or assembly.
- Evaluate the part and machine tool accuracies.

UNIT – I	**CONCEPTS OF ACCURACY**	Lecture Hrs:9

Introduction – Concept of Accuracy of Machine Tools – Spindle and Displacement Accuracies – Accuracy of numerical Control Systems – Errors due to Numerical Interpolation Displacement Measurement System and Velocity lags.

GEOMETIC DEIMENSIONING AND TOLERANCING: Tolerance Zone Conversions – Surfaces, Features, Features of Size, Datum Features – Datum Oddly Configured and Curved Surfaces as Datum Features, Equalizing Datum's – Datum Feature of Representation – Form controls, Orientation Controls – Logical Approach to Tolerancing.

UNIT – II	**DATUM SYSTEMS**	Lecture Hrs:9

Design of freedom, Grouped Datum Systems – different types, two and three mutually perpendicular grouped datum planes; Grouped datum system with spigot and recess, pin and hole; Grouped Datum system with spigot and recess pair and tongue – slot pair – Computation of Transnational and rotational accuracy, Geometric analysis and application.

UNIT – III	**TOLERANCE ANALYSIS**	Lecture Hrs:9

Process Capability, Mean, Variance, Skewness, Kurtosis, Process Capability Metrics, Cp, Cpk, Cost aspects, Feature Tolerances, Geometric Tolerances. Surface finish, Review of relationship between attainable tolerance grades and different machining process, Cumulative effect of tolerances sure fit law, normal law and truncated normal law.

UNIT – IV	**TOLERANCE CHARTING TECHNIQUES**	Lecture Hrs:9

Operation Sequence for typical shaft type of components, Preparation of Process drawings for different operations, Tolerance worksheets and centrally analysis, Examples, Design features to facilitate machining; Datum Features – functional and manufacturing Components design – Machining Considerations, Redesign for manufactured, Examples.

UNIT – V	**FOUNDAMENTALS OF NANOTECHNOLGY**	Lecture Hrs:9

Systems of nanometer accuracies – Mechanism of metal Processing – Nano physical processing of atomic bit units. Nanotechnology and Electrochemical atomic bit processing.

MEASURING SYSTEMS PROCESSING: In processing or in-situ measurement of position of processing point-Post process and on-machine measurement of dimensional features and surface-mechanical and optical measuring systems.

Textbooks:

Engineering Design – A systematic Approach / Matousek / Blackie & Son Ltd., London
Precision Engineering/VC Venkatesh& S Izman/TMH

Reference Books:

Precision Engineering in Manufacturing/Murthy R.L./New Age International (P) limited, 1996.
Geometric Dimensioning and Tolerancing / James D. Meadows / Marcel Dekker inc. 1995.
Nano Technology / Norio Taniguchi / Oxford University Press, 1996

Online Learning Resources:

https://www.itsligo.ie/courses/beng-precision-engineering-design-online/
https://www.bachelorsportal.com/studies/249110/precision-engineering-and-design.html
https://engineering.purdue.edu/online/courses/precision-manufacturing-systems

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		QUALITY ENGINEERING IN MANUFACTURING	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Explore knowledge of basic sciences engineering and manufacturing process.

Manage projects in various sectors of economy which facing on conceptual , technological and human aspects.

Identify the bottle ends and production process.

Similarity of the manufacturing process to analyze the overall performance

Course Outcomes (CO): Student will be able to

Applications of the user friendly software packages to simulate the manufacturing entities.

Analyze the data by using different performance analysis techniques.

Modelling various operators in manufacturing systems

UNIT - I **QUALITY VALUE AND ENGINEERING** Lecture Hrs:09

An overall quality system, quality engineering in production design, quality engineering in design of production processes. Loss Function and Quality Level: Derivation and use of quadratile loss function, economic consequences of tightening tolerances as a means to improve quality, evaluations and types tolerances.(N-type,S-type and L-type)

UNIT - II **TOLERANCE DESIGN AND TOLERANCING** Lecture Hrs:09

Functional limits, tolerance design for N-type. L-type and S-type characteristics, tolerance allocation fbr multiple components. Parameter and Tolerance Design: Introduction to parameter design, signal to noise ratios, Parameter design strategy, some of the case studies on parameter and tolerance designs.

UNIT - III **ANALYSIS OF VARIANCE (ANOVA)** Lecture Hrs:09

Introduction to ANOVA, Need for ANOVA, NO-way ANOVA, One-way ANOVA, Two-way ANOVA, Critique of F-test, ANOVA for four level factors, multiple level factors.

UNIT - IV **ORTHOGONAL ARRAYS** Lecture Hrs:09

Typical test strategies, better test strategies, efficient test strategies, steps indesigning, conducting and analyzing an experiment. Interpolation of Experimental Results: Interpretation methods, percent contributor, estimating the mean.

UNIT - V **SIX SIGMA AND THE TECHNICAL SYSTEM** Lecture Hrs:09

Six sigma DMAIC methodology, tools fpr process improvement, six sigma in services and small organizations, statistical foundations, statistical methodology.

Textbooks:

Taguchi Techniques for Quality Engineering / Phillip J. Ross / McGraw Hill/ Intl. II Edition, 1995.

2**.** Quality Engineering in Production systems *I* G. Taguchi, A. Elsayed et al **/**Mc.Graw Hill Intl. Edition, 1989**.**

Reference Books:

Taguchi Methods explained: Practical steps to Robust Design **/**Papan P. Bagchi*I* Prentice Hall Pvt. Ltd., New Delhi.

Online Learning Resources:

https://nptel.ac.in/courses/112/107/112107259/
https://onlinecourses.nptel.ac.in/noc20_me27/preview
https://nptel.ac.in/noc/courses/noc20/SEM1/noc20-me27/

https://nptel.ac.in/courses/110/101/110101010/ https://onlinecourses.nptel.ac.in/noc20_mg18/preview

Course Code		Simulation of Manufacturing Systems	L	T	P	C
Semester			3	1	0	4

Course Objectives:

- To provide knowledge simulation and simulation steps
- To provide knowledge on parameter estimation and hypothesis
- To provide knowledge on building simulation model how to validation and verification is done
- To provide knowledge on generation of random variants and variables
- To provide knowledge on some simulation languages
- To provide knowledge on some Applications of Simulation

Course Outcomes (CO): Student will be able to

- Students gain knowledge on various types of simulation and simulation languages steps in simulation and applications of simulation.
- Students gain knowledge on parameter estimation and hypothesis.
- Students can build simulation model and also can validation and verify model.
- Can Generation of random variants and variables.

UNIT - I Lecture Hrs:09

System - ways to analyze the system - Model - types of models - Simulation - Definition - Types of simulation models - steps involved in simulation - Advantages & Disadvantages. Parameter estimation - estimator - properties - estimate - point estimate - confidence interval estimates - independent - dependent - hypothesis - types of hypothesis- step - types l& 2 errors - Framing - string law of large numbers.

UNIT - II Lecture Hrs:09

Building of Simulation model validation - verification - credibility - their timing - principles of valid simulation Modeling - Techniques for verification - statistical procedures for developing credible model.Modeling of stochastic input elements - importance - various procedures - theoretical distribution - continuous - discrete their suitability in modeling.

UNIT - III Lecture Hrs:09

Generation of random variables - factors for selection methods - inverse transform - composition - convolution - acceptance - rejection - generation of random variables - exponential - uniform - weibull - normal Bernoullie - Binomial uniform - poisson - Simulation languages - comparison of simulation languages with general purpose languages Simulation languages vs Simulators - software features - statistical capabilities - G P S S - S1MAN- SIMSCRIPT - Simulation of WMJI queue - comparison of simulation languages.

UNIT - IV Lecture Hrs:09

Output data analysis - Types of Simulation w. r. t output data analysis – warm up period- Welch algorithm - Approaches for Steady - State Analysis - replication - Batch means methods - corn pan Sons.

UNIT - V Lecture Hrs:09

Applications of Simulation - flow shop system - job shop system - M/MI1 queues with infinite and finite capacities - Simple fixed period inventory system – New boy paper problem.

Textbooks:

Simulation Modelling and Analysis / Law, A.M.&Kelton / McGraw Hill, Edition/ New York, 1991.

Discrete Event System Simulation *I* Banks J. & Carson J.S., PH *I* Englewood Cliffs N/ 1984.
Reference Books:
Simulation of Manufacturing Systems / Carrie A. / Wiley, NY, 1990. A Course in Simulation / Ross, S.M., McMillan, NY, 1990. Simulation Modelling and S1MNET/ Taha HA. / PH, Englewood Cliffs, NJ, 1987
Online Learning Resources:
https://nptel.ac.in/courses/112/107/112107220/ https://www.youtube.com/watch?v=wbLItIE-78E https://www.youtube.com/watch?v=tiarT1YS-lM

Course Code		MOOC-I Laser based manufacturing	**L**	**T**	**P**	**C**
Semester			**0**	**0**	**0**	**2**

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		MOOC-II AUTOMATION IN MANUFACTURING	L	T	P	C
Semester			0	0	0	2

Course Objectives:

At the end of this course

- The course should enable to understand the principles of automation, importance of automated flow lines and its types.
- The Student should be able to understand outline the system configurations used in automated production
- Students should be able to recognize and articulate the foundational assumption of the transfer mechanism, types of transfer mechanism that may be used for work part transfer
- Student able to describe automated assembly systems, and their associated system configurations , list the hardware components used for parts delivery at workstations Outline typical automated assembly processes

Course Outcomes (CO): Student will be able to

- After completion of this unit students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- After completion of this course students are able to understand to know what is automation, types of automation, components of automation, strategies and levels of automation
- After completion of this course students are able to understand the types of flow lines, quantitative analysis of flow lines, how the assembly is carried out on automated flow line without interruption and how to balance the line and flexible assembly lines
- Students are able to understand automated transfer and storage system, recognize the equipments used in automated transfer and storage system.

UNIT - I	**OVER VIEW OF MANUFACTURING AND AUTOMATION**	Lecture Hrs:09

Production systems, Automation in production systems, Automation principles and strategies, Manufacturing operations, production facilities. Basic elements of an automated system, levels of automation; Hardware components for automation and process control, programmable logic controllers.

UNIT – II	**MATERIAL HANDLING AND IDENTIFICATION TECHNOLOGIES**	Lecture Hrs:09

Material handling, equipment, Analysis. Storage systems, performance and location strategies, Automated storage systems, AS/RS, types. Automatic identification methods, Barcode technology, RFID.

UNIT – III	**MANUFACTURING SYSTEMS AND AUTOMATED PRODUCTION LINES:**	Lecture Hrs:09

Manufacturing systems: components of a manufacturing system, Single station manufacturing cells; Manual Assembly lines, line balancing Algorithms, Mixed model Assembly lines, Alternative Assembly systems. Automated production lines, Applications, Analysis of transfer lines.

UNIT – IV	**AUTOMATED ASSEMBLY SYSTEMS**	Lecture Hrs:09

Fundamentals, Analysis of Assembly systems. Cellular manufacturing, part families, cooling, production flow analysis. Group Technology and flexible Manufacturing systems, Quantitative Analysis		
UNIT – V	**QUALITY CONTROL AND SUPPORT SYSTEMS**	Lecture Hrs:09
Quality in Design and manufacturing, inspection principles and strategies, Automated inspection, contact Vs non contact, CMM. Manufacturing support systems. Quality function deployment, computer aided process planning, concurrent engineering, shop floor control, just in time and lean production.		
Textbooks:		
Automation, production systems and computer integrated manufacturing/ Mikell.PGroover/PHI/3rd edition/2012. Automation, Production Systems and CIM/ Mike J P. Grower/PHI		
Reference Books:		
CAD/CAM/CIM/ P. **R**adha Krishnan **& S**. Subrahamanyarn and Raju/New Age International Publishers/2003. System Approach to Computer Integrated Design and Manufacturing/ Singh/John Wiley /96. Computer Aided Manufacturing/Tien-Chien Chang, Richard A. Wysk and Hsu-Pin Wang/ Pearson/ 2009		
Online Learning Resources:		
https://nptel.ac.in/courses/112/104/112104288/ https://nptel.ac.in/courses/112/103/112103293/ https://nptel.ac.in/courses/112/103/112103174/ https://youtu.be/v-3TmN4HhLc https://youtu.be/-NINgz6KQTA https://youtu.be/CmQa2xoQdzk https://youtu.be/yeHE4se7u5M		

COURSES OFFERED FOR HONOURS DEGREE IN
INTERNAL COMBUSTION ENGINE (R20)

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1		Internal combustion Engine Design	3	1	4
2		Engine Auxiliary Systems	3	1	4
3		Alternative fuels for I.C.Engines	3	1	4
4		Engine pollution and control	3	1	4
5		MOOC I: Hybrid and Electric vehicles			2
6		MOOC II: Automotive safety			2

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

CourseCode		INTERNAL COMBUSTION ENGINE DESIGN 20A03H11	L	T	P	C
Semester			3	1	0	4

CourseObjectives:

Toprovidethebasic groundingonthepistonenginedesignphilosophy.

CourseOutcomes(CO): Student willbeableto

Thestudentwouldhavegainedaninsight/understandingontherudimentsofpistonenginedesign philosophy as a prelude to higher level design activities for variedapplications.

UNIT–I	GENERAL DESIGN PRINCIPLES	Lecture Hrs:9

Principleofsimilitude,Choiceofmaterial,Stress,FatigueandNoise,Vibration andHarshnessconsiderations(NVH)

UNIT–II	DESIGNSPECIFICSOFTWO-STROKEENGINESYSTEMS	Lecture Hrs:9

Scavenging,Arrangementandsizingofports,pistonassembly,intakeandexhaustsystem,applicationtoautomotivegasolineengines.

UNIT–III	DESIGNOF MAJOR COMPONENTS	Lecture Hrs:9

Pistonsystem,Powercylindersystem,Connectingrodassembly,Crankshaftsystem,ValveGearing,Stressanalyses

UNIT–IV	DESIGNOFOTHERCOMPONENTS/SUBSYSTEMS	Lecture Hrs:9

Inlet and exhaust manifolds, cylinder block, cylinder-head, crankcase. Design aspects of enginemountings,gaskets,bearings.Basics ofignition,lubricationandcoolingsystemdesign. Introductiontodesignofcatalytic converters,particulatetrapsandEGR systems.

UNIT–V	DESIGN OF FUEL FLOW SYSTEMS	Lecture Hrs:9

Design of injectors systems, carburetors and fuel supply systems in CI Engines

Textbooks:

AnIntroductiontoEngineTestingandDevelopment,RichardD.Atkids,SAEInternational,USA,2009.
Design andSimulation ofFour-StrokeEngines,GordonP.Blair,SocietyofAutomotiveEngineers,Inc.,USA,1999.
Diesel Engine Reference Book, Second Edition, RodicaBaranescu and Bernard Challen(Editors),SocietyofAutomotiveEngineers,Inc.,USA,1999.
Engineering Design,A SystematicApproach,G.Pahl, W.Beltz J.Fieldhusen and K.H.Grote,Springer
ModernEngineTechnologyfromAtoZ,RichardVanBasshuysenandFredSchafer,SAEInternational,USAandSiemensVDO,Germany,2007.
Springer–Verlag,Wien,Austria,2006.
VehicularEngineDesign,KevinL.Hoag,SAEInternational USA/

ReferenceBooks:

EngineeringFundamentalsoftheInternalCombustionEngine,WillardW.Pulkrabek,Second Edition,Prentice–HallofIndiaPvt.Ltd.,NewDelhi,2006.
InternalCombustionEngineDesign,A.KolchinandV.Demidov,MIRPublishers,Moscow,1984.
InternalCombustionEngineFundamentals,JohnB.Heywood,McGraw–HillBookCompany,1988.
InternalCombustionEngineHand book:Basics,Components,SystemsandPerpectives,RichardVanBasshuysenandFredSchafer(Editors)SAEInternationalUSAandSiemes VDOAutomotive,Germany,2002.
IntroductiontoEngineValvetrains,YushuWang, SAE International,USA,2007.
Introduction to Internal Combustion Engines, Richard Stone, Fourth Edition SAEInternational,USAandMacmillanPress,2012.

OnlineLearningResources:

1.https://nptel.ac.in/courses/112/104/112104033/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ENGINE AUXILIARY SYSTEMS 20A03H12	L	T	P	C
Semester			3	1	0	4

Course Objectives:

- Know about the concept of carburation.
- Know about the concept of gasoline injection and ignition systems.
- Understand diesel fuel injection.
- Understand the design and construction of various intake systems and its components.
- Know about the various types and the concepts of lubrication and cooling system.

Course Outcomes (CO): Student will be able to

- Understand the concept of air fuel mixture and the various components in the carburetor
- Understand the types of gasoline fuel injection , and the mechanism of ignition system.
- Know about the various techniques involved in diesel fuel injection.
- Understand the various design constraints and the types of intake and exhaust manifolds.
- Understand the concept and various types of lubrication and cooling system

UNIT – I — CARBURETION — Lecture Hrs:9

Properties of air-petrol mixtures, Mixture requirements for steady state and transient operation, Mixture formation studies of volatile fuels, Design of elementary carburetor, Chokes, Effects of altitude on carburetion, Carburetor for 2-stroke and 4-stroke engines, Carburetor systems for emission control.

UNIT – II — GASOLINE INJECTION AND IGNITION SYSTEMS — Lecture Hrs:9

Petrol Injection, Pneumatic and Electronic Fuel Injection Systems types. Ignition system requirements, Timing, Ignition Systems, Breaker mechanism and Spark plugs, Factors affecting energy requirement of the ignition system, Factors affecting spark plug operation, Electronic Ignition Systems.

UNIT – III — DIESEL FUEL INJECTION — Lecture Hrs:9

Factors influencing fuel spray atomization, Penetration and Dispersion of diesel and heavy oils and their properties, Rate and duration of injection, Fuel line hydraulics, Fuel pump, Injectors.

UNIT – IV — MANIFOLDS AND MIXTURE DISTRIBUTION — Lecture Hrs:9

Intake system components, Discharge coefficient, Pressure drop, Air filter, Intake manifold, Connecting pipe, Exhaust system components, Exhaust manifold and exhaust pipe, Spark arresters, Waste heat recovery, Exhaust mufflers, Type of mufflers, exhaust manifold expansion.

UNIT – V — LUBRICATION AND COOLING SYSTEMS — Lecture Hrs:9

Lubricants, Lubricating systems, Lubrication of piston rings, Bearings, Oil consumption, Oil cooling. Heat transfer coefficients, liquid and air cooled engines, Coolants, Additives and

lubricity improvers, Concept of adiabatic engines.
Textbooks:
1.Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India) Pvt.Ltd.2000. 2.Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999. 3.Mathur,M.L., and Sharma,R.P., A Course in Internal Combustion Engines, Dhanpat Rai Publications (P) Ltd., 1998. 4.Ganesan, V., Internal Combustion Engines, Tata McGraw-Hill Book Co., 1995.
Reference Books: **1.**Duffy Smith, Auto Fuel Systems, The Good Heart Willcox Company Inc., Publishers, 1987. 2.Edward F, Obert, Internal Combustion Engines and Air Pollution, Intext Education Publishers, 1980.
Online Learning Resources
1. https://nptel.ac.in/courses/112/103/112103262/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		ALTERNATIVE FUELS FOR IC ENGINES 20A03H13	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Togive anin-depthknowledge ofvarious fuels and alternative fuels used in IC Engines

Course Outcomes (CO): Student will be able to

Onsuccessfulcompletionofthiscoursethestudentwillbeabletounderstandabout the usage of alternative fuels in IC Engines and its effect on environment

UNIT – I	Introduction	Lecture Hrs:9

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

UNIT – II	FUELS	Lecture Hrs:9

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

UNIT – III	ALCOHOL FUELS	Lecture Hrs:9

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

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

UNIT – IV	GASEOUS FUELS	Lecture Hrs:9

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

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

UNIT – V	VEGETABLE OILS	Lecture Hrs:9

Properties - Esterification - Performance in Engines.

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

Textbooks:

Internal combustion engines by V . Ganesan, Tata McGraw Hill book cop. 2007

Richard L.Bechtold, Automotive Fuels Guide Book, SAE Publications,1997.

Reference Books:

Osamu Hirao and Richard K.Pefley, Present and Future Automotive Fuels, John Wiley and sons, 1988.

Keith Owen and Trevor Eoley, Automotive Fuels Handbook, SAE Publications, 1990.

https://nptel.ac.in/courses/103/102/103102026/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		ENGINE POLLUTION AND CONTROL 20A03H14	L	T	P	C
Semester			3	1	0	4

Course Objectives:

Understandeffectofvehiclepopulationandemittedpollutantsonhumanhealthandenvironmentandvarioustypesofemissions.
Understandtheformationmechanismofvarioustypesofpollutantsfrom SIandCIengines.
Conceivethesignificance.of.emission.control.methods.
Understandtheconstructionandworkingofemissionmeasuringinstruments.
Befamiliarwithemissionstandardsandtestprocedures.

Course Outcomes (CO): Student will be able to

- Analysetheimpact of vehiclepopulationonpollutionandtheeffectsHC,CO,CO2,NOX,smoke,particulates,leadandaldehydes onhealthandenvironment.

Describetheeffectsoftransientoperationofvehicleonemissionsandtypesofemissions.Describetheformationmechanismof HC,CO,CO2,NOX,smoke,particulatesandaldehydesinSIandCIengines.

Comprehendthefactorsthatleadtoglobalwarmingandtheissues.Analysethedesignandoperatingparametersonemissions.Describeaboutnoisepollution,measurementandcontrol.

AwareofUS,Euro,JapanandIndianemissionnorms,standardsCVSsamplingandtestprocedures.Analyse in-cylinderemissioncontrolmethodssuchasEGR,airinjection,fuelmodifications,waterinjection,ignitionandinjectiontiming.

Describeengine-outemissioncontrolmethodsuchasthermalreactorsandcatalyticconverters.Describetheconstructionandworkingofemissionmeasuringinstrumentssuchas NDIR,FID,smokemetersChemiluminiscentanalyserandgaschromatograph.Differentiatebetweentwostrokeandfourstrokeenginepollutions.

UNIT – I	POLLUTANT FORMATION-ENGINES AND TURBINES	Lecture Hrs:9

Atmosphericpollutionfrompistonenginesandgasturbines,Globalwarming.Formationofoxidesofnitrogen, Carbonmonoxide,Hydrocarbon,aldehydesandSmoke,Particulateemission,Effectsofpollutionsonenvironment.

UNIT – II	POLLUTIONMEASUREMENT	Lecture Hrs:9

Nondispersiveinfraredgasanalyzer,Gaschromatography,Chemiluminescentanalyzerandflameionization detector,Smokemeasurement,Noisepollution,Measurementandcontrol.

UNIT – III	POLLUTIONCONTROL-INCYLINDERMETHODS	Lecture Hrs:9
Enginecomponent,Fuelmodification,Evaporativeemissioncontrol,EGR,Airinjection,WaterInjection,Applicationofmicroprocessorinemissioncontrol.		
UNIT – IV	**POLLUTIONCONTROLAFTERTREATMENT**	**Lecture Hrs:9**
Thermalreactors,Catalyticconverters,&ParticulateTraps		
UNIT – V	**CYCLESANDEMISSIONSTANDARDS**	**Lecture Hrs:9**
Useofdrivingcyclesforemissionmeasurement,Chassisdynamometer,CVSsystem,Nationaland Internationalemissionstandards.		

Textbooks:

1.CrouseWilliam,AutomotiveEmissionControl,GreggDivision/McGraw-Hill.1980

2.Ernest,S.,Starkman,CombustionGeneratedAirPollutions,PlenumPress,1980.

Reference Books:

George,SpringerandDonaldJ.Patterson,Engineemissions,PollutantFormationandMeasurement ,Plenumpress,1972.

Obert,E.F.,InternalCombustionEnginesandAirPollution,IntextEducationalPublishers,1980.

Online Learning Resources:

1. https://nptel.ac.in/courses/112/104/112104033/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR
Department of Mechanical Engineering (R20)

Course Code		MOOC I: HYBRID AND ELECTRICVEHICLES 20A03H15	L	T	P	C
Semester						2

Course Objectives:

Understand working of Electric Vehicles and recent trends.
Know-how & aptitude towards future trends in Hybrid Electric Vehicles

Course Outcomes (CO): Student will be able to

Familiarize on concepts of electric vehicle & performance of electric vehicles
Gain knowledge on Electric Propulsion Systems & Generators
Acquire the knowledge on hybrid electric drive train systems
Gain knowledge on motor controllers and control systems & energy storages
Attain the knowledge on Energy Storages -Fuel Cells & Solar Cars and Control systems.

UNIT – I	ELECTRIC VEHICLES	Lecture Hrs:9

Layout of an electric vehicle, performance of electric vehicles – traction motor characteristics, tractive effort, transmission requirements, vehicle performance, energy consumption, advantage and limitations, specifications, system components, electronic control system.

UNIT – II	ELECTRIC PROPULSION SYSTEMS & GENERATORS	Lecture Hrs:9

DC motors, AC motors, permanent magnet motors, brushless DC and reluctance motors, characteristics, regenerative braking. DC generators, AC generators, voltage and frequency regulations

UNIT – III	HYBRID VEHICLES	Lecture Hrs:9

Concepts of hybrid electric drive train, types, architecture of series and parallel hybrid electric drive train, merits and demerits, series and parallel hybrid electric drive train design

UNIT – IV	MOTOR CONTROLLERS AND CONTROL SYSTEMS & ENERGY STORAGES	Lecture Hrs:9

Control system principles, speed and torque control – DC motors and AC motors. Electromechanical batteries- types of batteries –lead acid batteries, nickel based batteries, lithium based batteries, electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, ultra-capacitors.

UNIT – V	FUEL CELLS & SOLAR CARS	Lecture Hrs:9

Fuel cell, construction, working, equations, possible fuel sources, fuel reformer, design. Solar carsphotovoltaic cells, tracking, efficiency and cost comparison.

Textbooks:
MehrdadEhsani, Yimin Gao, sebastien E. Gay and Ali Emadi, “Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design”, CRS Press, 2014. James Larminie and John Loury, “Electric Vehicle Technology-Explained”, John
Sandeep Dhameja, “Electric Vehicle Battery Systems”, Butterworth –Heinemann, 2012. Donwhite Consultant Incorporate – Handbook of EMI / EMC – Vol I – 2015 Ronald K Jurgen, “Electric and Hybrid – Electric Vehicles”, SAE, 2012 Ron Hodkinson and John Fenton, “Light Weight Electric/Hybrid Vehicle Design”, ButterworthHeinemann, 201
Online Learning Resources:
1. https://nptel.ac.in/courses/108/103/108103009/

JNTUA COLLEGE OF ENGINEERING (AUTONOMOUS), ANANTAPUR

Department of Mechanical Engineering (R20)

Course Code		MOOC II: AUTOMOTIVE SAFETY 20A03H16	L	T	P	C
Semester						2

Course Objectives:

Understand the Design of the body for safety.
Understand the various types of safety concepts.
Understand the concept of scavenging in two stroke engines.
Understand the design concept of safety equipment's.
Understand the experimental methods for comfort and convenience system.

Course Outcomes (CO): Student will be able to

Know about the basics about the vehicle.
Understand the safety aspects in the vehicle
Know and understand the various safety aspects
To get the knowledge in sensors provided in the vehicle to avoid the crash and to detect the defects in the vehicle
To know about the comfort and convenience system

UNIT – I	**INTRODUCTION**	Lecture Hrs:9

Design of the body for safety, Energy equation, Engine location, Deceleration of vehicle inside passenger compartment, Deceleration on impact with stationary and movable obstacle, Concept of crumble zone, Safetysandwich construction.

UNIT – II	**SAFETY CONCEPTS**	Lecture Hrs:9

Active safety: Driving safety, Conditional safety, Perceptibility safety, Operating safety- Passive safety: Exterior safety, Interior safety, Deformation behaviour of vehicle body, Speed and acceleration characteristics of passenger compartment on impact.

UNIT – III	**SAFETY EQUIPMENTS**	Lecture Hrs:9

Seat belt, Regulations, Automatic seat belt tightener system, Collapsible steering column, Tiltable steering wheel, Air bags, Electronic system for activating air bags, Bumper design for safety, Antiskid braking system, Regenerative Braking System, Cruise Control, Adaptive Cruise Control Devices

UNIT – IV	**COLLISION WARNING AND AVOIDANCE**	Lecture Hrs:9

Collision warning system, Causes of rear end collision, Frontal object detection, ear vehicle object detection system, Object detection system with braking system interactions, Driver Fitness Detection.

UNIT – V	**COMFORT AND CONVENIENCE SYSTEM**	Lecture Hrs:9

Steering and mirror adjustment, Central locking system , Garage door opening system, Tyre pressure controlsystem, Rain sensor system, Environment information system, Manual and Automated Wiper System, GPS.

1.Bosch - "Automotive Handbook" - 5th edition - SAE publication - 2000.

J.Powloski - "Vehicle Body Engineering" - Business books limited, London - 1969.
Ronald.K.Jurgen - "Automotive Electronics Handbook" - Second edition- McGraw-Hill Inc., - 1999.

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc20_de06/preview

Open Elective Course – I Civil

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**Experimental Stress Analysis**	**L**	**T**	**P**	**C**
20A50105		**3**	**0**	**0**	**3**
	Semester		**V**		

Course Objectives:

1. To understand different methods of experimental stress analysis
2. To understand the use of strain gauges for measurement of strain
3. To be exposed to different Non destructive methods of concrete
4. To understand the theory of photo elasticity and its applications in analysis of structures
5. To understand different methods of photo elasticity

Course Outcomes (CO):

1. Understand different methods of experimental stress analysis
2. Understand the use of strain gauges for measurement of strain
3. Expose to different Non destructive methods of concrete
4. Understand the theory of photo elasticity and its applications in analysis of structures
5. Understand different methods of photo elasticity

UNIT - I

PRINCIPLES OF EXPERIMENTAL APPROACH:Merits of Experimental Analysis Introduction, uses of experimental stress analysisAdvantages of experimental stress analysis, Different methods –Simplification of problems.

UNIT - II

STRAIN MEASUREMENT USING STRAIN GAUGES :Definition of strain and its relation of experimental Determinations Properties of Strain-
Gauge Systems-Types of Strain Gauges –Mechanical, Acoustic and Optical Strain Gauges. Introduction to Electrical strain gauges - Inductance strain gauges – LVDT – Resistance strain gauges – Various types –Gauge factor – Materials of adhesion base.

UNIT - III

STRAIN ROSSETTES AND NON – DESTRUCTIVE TESTING OF CONCRETE: Introduction – The three elements Rectangular Rosette – The Delta Rosette Corrections for Transverse Strain Gauge.

Ultrasonic Pulse Velocity method –Application to Concrete. Hammer Test – Application to Concrete.

UNIT - IV

THEORY OF PHOTOELASTICITY: Introduction –Temporary Double refraction – The stress Optic Law –Effects of stressed model in a polar scope for various arrangements – Fringe Sharpening. Brewster's Stress Optic law.

UNIT - V

TWO DIMENSIONAL PHOTOELASTICITY:Introduction – Isochramic Fringe patterns-Isoclinic Fringe patterns passage of light through plane Polariscope and Circular polariscope

Isoclinic Fringe patterns – Compensation techniques – Calibration methods – Separation methods – Scaling Model to prototype Stresses – Materials for photo – Elasticity Properties of Photoelastic Materials.

Textbooks:

1. Experimental stress analysis by J.W.Dally and W.F.Riley, College House Enterprises2005
2. Experimental stress analysis by Dr.SadhuSingh.khanna Publishers 4th edition

Reference Books:

1. Experimental Stress analysis by U.C.Jindal, Pearson Pubilications 2012 edition
2. Experimental Stress Analysis by L.S.Srinath, MC.Graw Hill Company Publishers.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – I EEE
III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**ELECTRIC VEHICLE ENGINEERING (OE-I) EEE**		**L**	**T**	**P**	**C**
20A50205			**3**	**0**	**0**	**3**
Pre-requisite	AC & DC Machines	**Semester**	V			
Course Objectives: The student will be able to:						
• Understand latest trends in Electric Vehicles; parameters used in EV and types of EVs. • Analyze various energy sources available to run EV like batteries, fuels cells etc. • Analyze the dynamics and the propulsion system used in EVs, working of fuel cells, battery charging concept.						

- Design a electromechanical system using various control techniques.

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

CO1: Understand the difference between conventional and latest trends in Electric Vehicles; understand the various parameters used in EV, types of HEVs.
CO2: Analyze various energy sources available to run EV like batteries, fuels cells etc.
CO3: Analyze the propulsion system of EV, its dynamics and the concept of battery charging.
CO4: Design EV system with battery charger using various fundamental concepts.

UNIT - I	**INTRODUCTION TO EV SYSTEMS AND PARAMETERS**	**Lecture Hrs: 10**

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

UNIT - II	**EV AND ENERGY SOURCES**	**Lecture Hrs: 08**

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

UNIT - III	**EV PROPULSION AND DYNAMICS**	**Lecture Hrs: 10**

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

UNIT - IV	**FUEL CELLS**	**Lecture Hrs: 10**

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.
Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

UNIT - V	**BATTERY CHARGING AND VEHICLE CONTROL**	**Lecture Hrs: 10**

Battery charging: Battery Chemistry, Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.
Battery Management System: Introduction and BMS functionality, Battery pack topology, Voltage, Temperature and Current Sensing.
Control: Introduction, modelling of electro mechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Textbooks:C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.
3. Tom Denton, “Electric and Hybrid Vehicles”, TAYLOR & FRANCIS; 2nd edition, CBS PUBLISHERS, 2nd Edition, 2020.
4. MehrdadEhsani, Yimin Gao, Ali Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell

Vehicles: Fundamentals", CRC Press, 2010. 5. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002.
Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – I Mechanical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
2050305	**OPTIMIZATION TECHNIQUES**	3	0	0	3

Course Objectives:

To introduce various optimization techniques i.e classical, linear programming,

Transportation problem, simplex algorithm, dynamic programming Constrained and unconstrained optimization techniques for solving and optimizing.

Electrical and electronic engineering circuits design problems in real world situations.

To explain the concept of Dynamic programming and its applications to project

Learn the knowledge to formulate optimization problems

UNIT - I

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

UNIT - II

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

UNIT - III

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

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

UNIT – IV

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

UNIT V

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

Course Outcomes:

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

understand optimization of electrical and electronics engineering problems

apply classical optimization techniques, linear programming, simplex algorithm,

- transportation problem apply unconstrained optimization and constrained non-linear programming anddynamic programming Formulate optimization problems.

TEXT BOOKS:

Optimal design – Jasbir Arora, Mc Graw Hill (International) Publishers

Optimization for Engineering Design – Kalyanmoy Deb, PHI Publishers

Engineering Optimization – S.S.Rao, New Age Publishers

REFERENCES:

1.Genetic algorithms in Search, Optimization, and Machine learning – D.E.Goldberg, Addison-Wesley Publishers

Genetic Programming- Koza

Multi objective Genetic algorithms - Kalyanmoy Deb, PHI Publishers

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I ECE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code 20A50405	BASICS OF ELECTRONICS AND COMMUNICATION ENGINEERING	L	T	P	C
		3	0	0	3
	Semester	V			

Pre-requisite

Applied Physics

Course Objectives:

- To study the basic principle, construction and operation of semiconductor devices.
- To learn the real time applications of semiconductor devices.
- To introduce binary number systems, logic gates and digital logic circuits.
- To get an idea about the basic principles of communication systems and their applications.
- To learn the measurement of physical parameters using Sensors and Transducers.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic principle, construction and operation of semiconductor devices.
- Learn the real time applications of semiconductor devices.
- Comprehend the binary number systems, logic gates and digital logic circuits.
- Understand the basic principles of communication systems and their applications.

- Measure the physical parameters using Sensors and Transducers.

UNIT - I

Introduction to Electronics Engineering: Overview, scope and objective of studying Electronics Engineering. Introduction to semiconductor devices: Bond structure of semiconductors, intrinsic and extrinsic semiconductors; Basic principle and operation of semiconductor devices – diode, bipolar junction transistor, field effect transistors; Introduction to VLSI.

UNIT - II

Applications of semiconductor devices: Basic concepts of rectifiers, voltage regulators, amplifiers and oscillators; Basic concepts of operational amplifier and their applications.

UNIT - III

Introduction to digital systems: Binary number system, Boolean algebra, Logic gates, adders, one-bit memory, flip-flops (SR, JK), shift registers, Asynchronous counter.

UNIT - IV

Introduction to Communication Systems: Elements of a communication system – transmitter and receiver; Signal types in communication; FDM and TDM; Processing of signals for transmission – basic concepts of amplitude and frequency modulation; Examples of telecommunication systems – telephone, radio, television, mobile communication and satellite communication.

UNIT - V

Sensors and Transducers - Active and passive transducers: Measurement of displacement (Resistance, capacitance, inductance; LVDT) Force (strain gauges) Pressure (piezoelectric transducers) Temperature (resistance thermometers, thermocouples and thermistors), Velocity, Acceleration, Vibration, pH measurement Signal Conditioning Circuits.

Textbooks:

1. Millman J, Halkias C.C and Jit S, “Electronic Devices and Circuits”, Tata McGraw-Hill, 2nd 2007 Edition.
2. Mano M.M., “Digital Design”, Prentice-Hall, 3rd Edition. 2002
3. A.K. Sawhney, “A course in Electrical and Electronics Measurements and Instrumentation”, DhanpatRai& Co. 3rd edition Delhi, 2010.
4. Kennedy G. and Davis B., “Electronic Communication Systems”, Tata McGraw-Hill, 4th 2008 Edition.

Reference Books:

1. Tomasi W., “Advanced Electronic Communication Systems”, Pearson/Prentice-Hall, 6th 2004 Edition.
2. Boylstead R.L. and Nashelsky L., “Electronic Devices and Circuit Theory”, Pearson, 10th 2009 Edition.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I CSE

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

INTRODUCTION TO JAVA PROGRAMMING

Course Code:20A50505 **Semester V(R20)** **L T P C : 3 0 0 3**

Course Objectives:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

Course Outcomes:

CO1: Solve real-world problems using OOP techniques.
CO2: Apply code reusability through inheritance, packages and interfaces
CO3: Solve problems using java collection framework and I/O classes.
CO4: Develop applications by using parallel streams for better performance and develop applets for web applications.
CO5: Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

UNIT – I: **Introduction**

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods.

UNIT – II: **Inheritance, Packages, Interfaces**

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,

Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT – III: **Exception handling, Stream based I/O**
Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.
Stream based I/O (java.io) – The Stream classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.
UNIT – IV: **Multithreading, The Collections Framework**
Multithreading: The Java thread model, Creating threads, Thread priorities, Synchronizing threads, Interthread communication.
The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses- Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.
UNIT – V: **Applet, GUI Programming with Swings, Accessing Databases with JDBC**
Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets
GUI Programming with Swings – The origin and design philosophy of swing, components and containers, layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.
Accessing Databases with JDBC:
Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Textbooks:
1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

Reference Books:
1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, KarthikandGajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Chemical

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code		L	T	P	C
20A50805	**ENERGY CONVERSION AND STORAGE DEVICES**	**3**	**0**	**0**	**3**

Pre-requisite

Course Objectives:

1. Understand the fundamentals of fossil energy sources, solar, biomass and electrochemical energy etc
2. Understand the basics of photosynthetic, photocatalytic and photoelectrochemical systems and devices for the efficient energy and fuels production.
3. Learn the principles and operations of electrochemical energy storage devices,

Course Outcomes (CO):

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

CO1 Understand the need of energyconversion and the various methods of energy storage

CO2 Identify Winds energy as alternateform of energy and to know how itcan be tapped

CO3 Understand the nuclear and bio energy, its mechanism of production and its applications

CO4 Analyse chemical, electrochemical energy storage devices and interpret the conversion efficiencies

CO5 Explain bio gas generation and itsimpact on environment

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Outline of the course. Introduction and scope of energy conversion. World Energy Production and Balance. Motivations for studying future energy systems (e.g. pollution, climate change, energy security).

UNIT - II

Fossil Energy: Overview of fossil fuel resources and energy contents. Cycle analysis (Rankine, Brayton, combined cycles, cogeneration)

Nuclear Energy: nuclear reaction and energy conversion physics (fission and fusion), nuclear power systems

UNIT - III

Solar-thermal energy: solar thermal radiation physics, Active and passive solar-thermal energy collection and conversion systems

Photoelectric energy: Photoelectric physics. Solar photovoltaic cell materials and technology

Wind Energy: Wind interaction with objects fluid dynamics. Wind harvesting devices and systems

UNIT - IV

Biomass and Waste to Energy: Potential and resources of biomass and waste energy. Thermal-chemical and bio-chemical conversion methods

Overview of Climate Control, CO_2 Sequestration and Energy Sustainability

UNIT - V

Basic of Electrochemical energy conversion and storage, Fundamentals of Fuel Cells, Basics of Fusion power, Energy Storage Technologies, Mechanical storage, Chemical storage, Electrical storage

Textbooks:

Energy Systems Engineering, F.M. Vanek, L.D Albright, and LargusAngenent, Second Edition, McGraw-Hill, Inc., 2012,

Reference Books:

- AngèleReinders, Pierre Verlinden, Wilfried van Sark, Alexandre Freundlich, Photovoltaic

Solar Energy:From Fundamentals to Applications, JOHN WILEY.

- Alexander P. Kirk, Solar Photovoltaic Cells: Photons to Electricity, ELSEVIER
- Francesco Dalena, Angelo Basile, Claudio Rossi, Bioenergy Systems For The Future: Prospects ForBiofuels And Biohydrogen, 1st Edition, ELSEVIER
- Jean-Marie Tarascon, Patrice Simon, ELECTROCHEMICAL ENERGY STORAGE,
- Electrochemistry by Carl H. Hamann, Andrew Hamnett and Wolf Vielstich, Wiley VCH, 1998.
- Modern Electrochemistry 1. Volume 1 and 2, by J. O'M. Bockris and A. K. N. Reddy, Kluwer Academic,2000.
- Electrochemical Methods, by A. J. Bard and L. R. Faulkner, John Willey, 1980
- John Love and John A. Bryant, Biofuels and Bioenergy, John Wiley
- Anju Dahiya, Bioenergy: Biomass to Biofuels, Elsevier

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – I Mathematics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="1">Optimization Methods</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A55101</td><td colspan="2">B.Tech III Year
(Common for all)
Open elective course -1</td><td>0</td><td>3</td><td>0</td><td>3</td></tr>
<tr><td>Pre-requisite</td><td>--</td><td>Semester</td><td colspan="4">I</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">• formulate a linear programming problem and solve it by various methods.
• give an optimal solution in assignment jobs, give transportation of items from sources to destinations.</td></tr>
</table>

- identify strategies in a game for optimal profit.
- implement project planning.

UNIT - I		8 Hrs

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

UNIT - II		8 Hrs

Transportation problems- assignment problems-Game theory.

UNIT - III		9 Hrs

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

UNIT - IV		8 Hrs

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs-Group replacement .

UNIT - V		9 Hrs

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

Textbooks:

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, HardikSoni, PHI publishers

Reference Books:

1. Problems on Operations Research, Er. Premkumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

Online Learning Resources:

https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf
https://slideplayer.com/slide/7790901/
https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I Physics

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A55201	**MATERIALS CHARACTERIZATION TECHNIQUES**	3		-	3

COURSE OBJECTIVES	
1	To provide an exposure to different characterization techniques.
2	To explain the basic principles and analysis of different spectroscopic techniques.
3	To elucidate the basic principle of Scanning electron microscope along with its limitations and applications.
4	To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
5	To educate the uses of advanced electric and magnetic instruments for characterization.
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To explain the structural analysis by X-ray diffraction.
CO2	To understand the morphology of different materials using SEM and TEM.
CO3	To recognize basic principles of various spectroscopic techniques.
CO4	To apprehend the electric and magnetic properties of the materials.
CO5	To make out which technique has to be used to analyse a material

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

Credit: 3 **Hours of teaching: - 45 H**

UNIT-I **9H**

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure,Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT-II **9H**

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (SecondaryElectron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT-III **9H**

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy,Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

UNIT-IV **9H**

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy(ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT-V **9H**

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method,Vibrating sample Magnetometer (VSM) and SQUID.

TEXT BOOKS:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008

2. Hand book of Materials Characterization -by **Sharma** S. K. - S**pringer**

REFERENCES:

1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville BanwellandElaine M. McCash, Tata McGraw-Hill, 2008.

2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, PrenticeHall, 2001 – Science

3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-Yang Leng- John Wiley & Sons

4. Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley(Bp)

5. Microstructural Characterization of Materials - David Brandon, Wayne D Kalpan,John Wiley & Sons Ltd., 2008.

NPTEL courses

https://nptel.ac.in/courses/115/103/115103030/

https://nptel.ac.in/content/syllabus_pdf/113106034.pdf https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-mm08/

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I H & SS

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF HUMANITIES & SOCIAL SCIENCES

Course Code	E-Business	L	T	P	C
20A55401		3	0	0	3
Pre-requisite					

Course Objectives:

1.	To provide knowledge on emerging concept on E-Business related aspect.
2.	To understand various electronic markets models which are trending in India
3.	To give detailed information about electronic payment systems net banking.
4.	To exact awareness on internet advertising, market research strategies and supply chain management.
5.	To understand about various internet protocols-security related concept.

Course Outcomes (CO):

1	They will be able to identify the priority of E-Commerce in the present globalised world.
2	Will be able to understand E-market-Models which are practicing by the organization
3.	Will be able to recognize various E-payment systems & importance of net banking.
4.	By knowing E-advertisement, market research strategies, they can identify the importance of customer role.
5.	By understanding about E-security, they can ensure better access control to secure the information
6	Develop a personal synthesis and approach towards E-Business

UNIT – I **Electronic Business**

Definition of Electronic Business - Functions of Electronic Commerce (EC) - Advantages of E-Commerce – E-Commerce and E-Business Internet Services Online Shopping-Commerce

Opportunities for Industries.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of E-Business
- Contrast and compare E-Commerce E-Business
- Analyze Advantages of E-Commerce
- Evaluate opportunities of E-commerce for industry

UNIT - II **Electronic Markets and Business Models**

E-Shops-E-Malls E-Groceries - Portals - Vertical Portals-Horizontal Portals - Advantages of Portals - Business Models-Business to Business(B2B)-Business to Customers(B2C)-Business to Government(B2G)-Auctions-B2B Portals in India

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of business models
- Contrast and compare Vertical portal and Horizontal portals
- Analyze Advantages of portals
- Explain the B2B,B2C and B2G model

UNIT - III **III Electronic Payment Systems**

Digital Payment Requirements-Designing E-payment System- Electronic Fund Transfer (EFT)-Electronic Data Interchange (EDT)-Credit Cards-Debit Cards-E-Cash-Electronic Cheques -Smart Cards-Net Banking-Digital Signature.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the Electronic payment system
- Contrast and compare EFT and EDT
- Analyze debit card and credit card
- Explain the on Digital signature

UNIT - IV **E-Security**

Internet Protocols - Security on the Internet –Network and Website Security – Firewalls – Encryption – Access Control – Secure Electronic transactions.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand E-Security

- Contrast and compare security and network
- Analyze Encryption
- Evaluate electronic transitions

UNIT - V **E-Marketing**

Online Marketing – Advantages of Online Marketing – Internet Advertisement – Advertisement Methods – Conducting Online Online Market Research– Data mining and Marketing Research Marketing Strategy On the Web – E-Customer Relationship Management(e-CRM) –E- Supply Chain Management.(e-SCM) –New Trends in Supply Chain Management.

LEARNING OUTCOMES:- After completion of this unit student will

- Understand the concept of online marketing
- Analyze advantages of online marketing
- Compare the e-CRM and e-SCM
- Explain the New trends in supply chain management

Textbooks:

1. **E-Commerce by C.S.V Murthy** Himalaya publication house, 2002.
2. **E-Commerce by** P.T.S Joseph, Fourth Edition, Prentice Hall of India 2011

Reference Books:

1. **E-Commerce: by** KamaleshKBajaj,DebjaniNa, Second Edition TataMcGrwHills 2005
2. **E-Commerce E-Management: by Dave Chaffey** – Second Edition, Pearson, 2012.
3. **E-Commerce Fundamentals and Application; by** Henry Chan, Raymond Lee,Tharm Wiley India 2007
4. **E-Commerce: by** S. Jaiswall Galgotia Publication Pvt Ltd 2003.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – I

III B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
20A55301	**CHEMISTRY OF ENERGY MATERIALS**	2	1	-	3

COURSE OBJECTIVES	
1	To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
2	To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
3	To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
4	Necessasity of harnessing alternate energy resources such as solar energy and its basic concepts.
5	To understand and apply the basics of calculations related to material and energy flow in the processes.

COURSE OUTCOMES	
CO1	Solve the problems based on electrode potential,Describe the Galvanic Cell Differentiate between Lead acid and Lithium ion batteries, Illustrate the electrical double layer
CO2	Describe the working Principle of Fuel cell,Explain the efficiency of the fuel cell Discuss about the Basic design of fuel cells,Classify the fuel cell
CO3	Differentiate Chemical and Physical methods of hydrogen storage,Discuss the metal organic frame work, Illustrate the carbon and metal oxide porous structures

	Describe the liquification methods
CO4	Apply the photo voltaic technology,Demonstrate about solar energy and prospects Illustrate the Solar cells,Discuss about concentrated solar power
CO5	Differentiate between Photo and Photo electrochemical Conversions,Illustrate the photochemical cells, Identify the applications of photochemical reactions, Interpret advantages of photoelectron catalytic conversion

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

UNIT-1: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batterie**s.-**
UNIT-2: Fuel Cells: Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell,
UNIT-3: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.
UNIT-4: Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells .
UNIT-5: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

References :

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical

services and corporation)

5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Civil

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Disaster Management	L	T	P	C
20A60105		**3**	**0**	**0**	**3**

Course Objectives:

1. To give knowledge types of disasters and stages in disaster rehabilitation process.
2. To make awareness on change in climates and their impacts on occurrence of environmental disasters.
3. To impart knowledge on Consideration of wind and water effects as per codal provisions to withstand disasters.
4. To familiarize the student with the Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. To illustrate the methodology in Planning and design considerations of various structures constructing in disaster prone areas.

Course Outcomes (CO):

1. About various types of disasters and stages in disaster rehabilitation process.
2. Impact of change in climates and their impacts on occurrence of environmental disasters.
3. Adopting suitable codal provisions to study the effect of wind and water effects on various structures constructed at disaster prone areas.
4. Causes of earthquake and their effects and remedial methods to be adopted for buildings.
5. Adopt suitable Planning and design considerations of various structures constructing in

disaster prone areas.

UNIT - I

Brief introduction to different types of natural disaster, Occurrence of disaster in different climatic and geographical regions, hazard (earthquake and cyclone) map of the world and India, Regulations for disaster risk reduction, Post disaster recovery and rehabilitation (socioeconomic consequences)

UNIT - II

Climate change and its impact on tropical cyclone, Nature of cyclonic wind, velocities and pressure, Cyclone effects, Storm surge, Floods, Landslides. Behavior of structures in past cyclones and wind storms, case studies. Cyclonic retrofitting, strengthening of structures and adaptive sustainable reconstruction. Life–line structures such as temporary cyclone shelter.

UNIT - III

Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated unsteadiness along and across wind forces. Lab: Wind tunnel testing, its salient features. Introduction to Computational fluid dynamics. General planning/design considerations under wind storms & cyclones; Wind effects on buildings, towers, glass panels etc, & wind resistant features in design. Codal Provisions, design wind speed, pressure coefficients; Coastal zoning regulation for construction & reconstruction phase in the coastal areas, innovative construction material & techniques, traditional construction techniques in coastal areas.

UNIT - IV

Causes of earthquake, plate tectonics, faults, seismic waves; magnitude, intensity, epicenter, energy release and ground motions. Earthquake effects – On ground, soil rupture, liquefaction, landslides. Performance of ground and building in past earthquakes: Behavior of various types of buildings, structures, and collapse patterns; Behavior of Non-structural elements like services, fixtures, mountings- case studies. Seismic retrofitting-Weakness in existing buildings, aging, concepts in repair, restoration and seismic strengthening.

UNIT - V

General Planning and design consideration; Building forms, horizontal and vertical eccentricities, mass and stiffness distribution, soft storey etc.; Seismic effects related to building configuration. Plan and vertical irregularities, redundancy and setbacks. Various Types and Construction details of: Foundations, soil stabilization, retaining walls, plinth fill, flooring, walls, openings, roofs, terraces, parapets, boundary walls, under-ground – overhead tanks, staircases and isolation of structures; innovative construction material and techniques; Local practices: traditional regional responses; Computational investigation techniques.

Textbooks:

1. Disaster Management by Rajib Shah, Universities Press, India, 2003
2. Disaster Management by R.B. Singh (Ed) Rawat Publication, New Delhi, 2000

Reference Books:

1. Natural disasters. By Abbott, L. P. (2013) 9th Ed. McGraw-Hill.
2. Earthquake Resistant Design of Structures. By Agarwal, P. and Shrikhande, M.

(2009). New Delhi : PHI Learning.

3. Mapping Vulnerability: Disasters, Development and People. byBankoff, G., Frerks, G. and Hilhorst, D. (2004). London :Earthscan.
4. Improving Earthquakes and Cyclone Resistance of Structures:Guidelines for the Indian Subcontinent. TERI
5. Disaster Mitigation, preparedness, recovery and Response. By Sinha, P. C. (2006). New Delhi : SBS Publishers.
6. World Bank. (2009). Handbook for Reconstructingafter Natural Disasters.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II EEE
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	RENEWABLE ENERGY SYSTEMS (OE-II)		L	T	P	C
20A60205			3	0	0	3
Pre-requisite		Semester	VI			

Course Objectives: To make the students learn about:

- Various sources of Energy and the need of Renewable Energy Systems.
- The concepts of Solar Radiation, Wind energy and its applications.
- Operation of Solar thermal and solar PV systems
- The concept of geo thermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

Course Outcomes (CO): At the end of the course the student will be able to:

CO 1 Understand various alternate sources of energy for different suitable application requirements.
CO 2 Analyze the concepts of solar energy generation strategies and wind energy system
CO 3 Design Solar and Wind energy systems.
CO 4 Apply the concepts of Geo Thermal Energy, Ocean Energy, Bio mass and Fuel Cells for generation of power.

UNIT - I	**SOLAR ENERGY**	Lecture Hrs: 10

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT - II	**PV ENERGY SYSTEMS**	Lecture Hrs: 10

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

UNIT - III	**WIND ENERGY**	Lecture Hrs: 10

Principle of wind energy conversion; Basic components of wind energy conversion systems; wind mill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT - IV	**GEOTHERMAL ENERGY**	Lecture Hrs: 8

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT - V	**MISCELLANEOUS ENERGY TECHNOLOGIES**	Lecture Hrs: 10

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.
Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration
Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Text books:

1. Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.
2. G. D. Rai, “Non-Conventional Energy Sources”, 4th Edition, Khanna Publishers, 2000.

Reference Books:

1. S. P. Sukhatme, “Solar Energy”,3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma,“Non-Conventional Energy Resources”,3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.

Online Learning Resources:

1. https://nptel.ac.in/courses/103103206 2. https://nptel.ac.in/courses/108108078

https://www.slideshare.net/fatimahAlkreem/e-businessppt-67935771
https://www.slideshare.net/VikramNani/e-commerce-business-models
https://www.slideshare.net/RiteshGoyal/electronic-payment-system
https://www.slideshare.net/WelingkarDLP/electronic-security
https://www.slideshare.net/Ankitha2404/emarketing-ppt

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II Mechanical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Subject Code	Title of the Subject	L	T	P	C
20A60305	**SOLAR ENERGY SYSTEMS**	3	0	0	3

Course objectives

Learning the fundamental principles of solar radiation and geographic distribution of solar radiation.

Study of various solar energy technologies with different types of concentrating collectors.

Comparative study of different solar cells with respect to properties and applications of solar cells in nano technology.

Understanding the basics of economics involves in the solar system.

Learning the concepts and designing aspects in thermal power. 6. Study of solar pond and solar stills and their applications.

UNIT – I

SOLAR RADIATION:

Sources of radiation –sun earth relationship, Solar Time and angles, day length, angle of incidence on tilted surface; Sun path diagram, Solar Radiation: Extraterrestrial Radiation; Effect of earth atmosphere; Estimation of solar radiation on horizontal and tilted surfaces. Geographic Distribution of solar radiation, Phyrellio, pyranometer, equation of time-estimation of average radiation falling on tilled.

UNIT-II

SOLAR ENERGY TECHNOLOGIES:

Performance analysis of a liquid Flat-plate collector, Total loss coefficient and heat losses: Top loss coefficient, Bottom loss coefficient, Side loss coefficient. Solar concentrating collectors, types of concentrating collectors, Parabolic Dish System, The central power tower system, The Parabolic Trough System, Tracking CPC and Solar Swing, Performance analysis of cylindrical parabolic collector, Compound parabolic concentrator (CPC).

UNIT-III

SOLAR CELLS:

Solar cell fundamentals, solar cell classification, solar cell, module, panel array construction, maximum power pint trackers(MPPT), solar PV applications, The Recent developments in Solar cells, Role of Nano-Technology in Solar cells.

UNIT – IV

ECONOMICS:

Discounted Cash Flow-light cycle, coasting of solar system, production function and optimization

UNIT – V

THERMAL POWER:

The power concepts- design aspects, thermo-chemical reactor.

SOLAR POND AND SOLAR STILLS:

Working Principle-Construction-operating difficulties and remedies, Agriculture and Domestic applications: Still, timber drying, crop drying, cooker.

Course Outcomes :

Illustrate the fundamental principles of solar radiation and geographic distribution of solar radiation.

Obtaining the performance analysis of liquid flat plate collector and cylindrical parabolic collector.

Developing solar cells in the field of nano technology.

Calculating the cash flow and costs involves in the solar energy systems.

Designing and developing of thermo chemical reactor with respect to thermal power.

<u>**Reference Books:**</u>

Solar Energy Thermal Process Diffice and Beckman
Solar Heating and Cooling by Kreith and Kreider
Solar Energy Utilization by G.D.Rai
Solar Energy Utilization by G.D.Rai , Khanna Publishers.
Renewable Energy Sources and Emerging Technologies- By D.P. Kothari, PHI Pub.,
Applied Solar Energy by Meinel and Meinel
Non-Conventional Energy Resources by B.H . Khan, Tata McGraw Hill
Energy Resources Utilization and Technologies ByAnjaneyulu, BS Pub.

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II ECE
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	BASICS OF INTEGRATED CIRCUITS APPLICATIONS	L	T	P	C
20A60405		3	0	0	3

\Pre-requisite
Basics of Electronics and Communication Engineering
Course Objectives:

- To introduce the basic building blocks of linear & digital integrated circuits.
- To learn the linear and non - linear applications of operational amplifiers.
- To introduce the theory and applications of 555 and PLL.
- To learn the theory of ADC and DAC
- To understand different families of digital integrated circuits and their characteristics.

Course Outcomes (CO): At the end of this course, the students will be able to

- Understand the basic concepts of Op -AMPs, characteristics and specifications.
- Design circuits using operational amplifiers for various applications.
- Develop, apply and analyze circuits for advanced applications using Op-Amps, PLL, VCO and Analog multipliers.
- Understand different families of digital integrated circuits and their characteristics
- Design various and sequential circuits using digital ICs.

UNIT - I

Operational Amplifier: Ideal and Practical Op-Amp, Op-Amp Characteristics, DC and AC Characteristics, Features of 741 Op-Amp, Modes of Operation - Inverting, Non-Inverting, Differential, Instrumentation Amplifier, AC Amplifier, Differentiators and Integrators, Comparators, Schmitt Trigger, Introduction to Voltage Regulators, Features of 723 Regulator, Three Terminal Voltage Regulators.

UNIT - II

Op-Amp, IC-555 & IC 565 Applications: Introduction to Active Filters, Characteristics of Band pass, Band reject and All Pass Filters, Analysis of 1st order LPF & HPF Butterworth Filters, Waveform Generators – Triangular, Sawtooth, Square Wave, IC555 Timer - Functional Diagram, Monostable and Astable Operations, Applications, IC565 PLL - Block Schematic, Description of Individual Blocks, Applications.

UNIT - III

Data Converters: Introduction, Basic DAC techniques, Different types of DACs-Weighted resistor DAC, R-2R ladder DAC, Inverted R-2R DAC, Different Types of ADCs - Parallel Comparator Type ADC, Counter Type ADC, Successive Approximation ADC and Dual Slope ADC, DAC and ADC Specifications.

UNIT - IV

Digital Integrated Circuits: Classification of Integrated Circuits, Comparison of Various Logic Families, CMOS Transmission Gate, IC interfacing- TTL Driving CMOS & CMOS Driving TTL

Combinational Logic ICs – Specifications and Applications of TTL-74XX & CMOS 40XX Series ICs - Code Converters, Decoders, Demultiplexers, LED & LCD Decoders with Drivers, Encoders, Priority Encoders, Multiplexers, Demultiplexers, Priority Generators/Checkers, Parallel Binary Adder/Subtractor, Magnitude Comparators.

UNIT - V

Sequential Logic ICs and Memories: Familiarity with commonly available 74XX & CMOS 40XX Series ICs – All Types of Flip-flops, Synchronous Counters, Decade Counters, Shift Registers. Memories - ROM Architecture, Types of ROMS & Applications, RAM Architecture, Static & Dynamic RAMs.

Textbooks:

1. Ramakanth A. Gayakwad, "Op-Amps & Linear ICs", PHI, 2003.
2. Floyd and Jain, "Digital Fundamentals", Pearson Education, 8th Edition, 2005.

Reference Books:

1. D. Roy Chowdhury, "Linear Integrated Circuits", New Age International (p) Ltd, Second Edition, 2003.
2. James M. Fiore, "Op Amps and Linear Integrated Circuits-Concepts and Applications", Cengage Learning/ Jaico, 2009.
3. K.Lal Kishore, "Operational Amplifiers with Linear Integrated Circuits", Pearson, 2009.
4. John. F. Wakerly, "Digital Design Principles and Practices", Pearson, Third Edition, 2005.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II CSE

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Introduction to Linux Programming

Course Code:20A60505 **L T P C : 3 0 0 3**

Course Objectives:

- To study the commands according to user requirements.

- To utilize Shell scripts to perform the given task.
- To enable writing own programs in UNIX.
- To know AWK programs.

Course Outcomes:

CO1: Develop text data processing applications using Unix commands and filters.
CO2: Design and develop text based user interface components
CO3: Understand user management, network management and backup utilities
CO4: Use the system calls for file management
CO5: Understands the Concept of Process Threads and File Structure.

UNIT-I: Introduction,Unix File System,Unix Commands

Operating System, History of UNIX, Overview and Features of Unix System,Structure of Unix System, Unix Environment. **Unix File System**: Introduction of Files, Organization of File Systems, Accessing File Systems, Structure of File Systems. **Unix Commands**: Basic Commands, Advanced Unix Commands: File Access Permissions, Pipe Operator, cut, paste, wc, sort, head, tail, diff, cmp, uniq, comm, time, Conversions between DOS and Unix, man.

UNIT-II: File management and Compression Techniques,Manipulating Processes and Signals

Managing and Compressing Files, Computer Devices, Disk related Commands, Compression and Uncompressing Files, Important Unix System Files, Shell Variables, Export of Local and Global Shell Variables.

Manipulating Processes and Signals: Process Basics, Processes States and Transitions, Zombie Process, Context switching, Threads, ps-status of Process.

UNIT-III: System calls

Introduction, File-related System calls (open, create, read, write, lseek), File-related System calls (close, mknod, link and unlink, access, and chown, chmod), Directory Handling System calls (mkdir, rmdir, chdir, opendir, readdir, telldir, closedir), Process related System calls (exec, fork, wait,exit).

Editors in Unix: introduction, Stream editor, Emacs Editor.

UNIT-IV: AWK Script,Burne Shell

AWK Command, print, printf, Displaying Content of Specified Patterns, Comparison Operators, Compound Expressions, Arithmetic Operators, Begin and end Sections, User-defined Variables, if else Statement, Built-in Variables, Changing Input Filed Separator, Functions, Loops, Getting Input from User, Search and Substitute Functions, Copying results into Another file.

Bourne Shell: Introduction, beginning Bourne Shell Scripting, Writing Shell Scripts, Command Line Parameters, read, for Loop, While Loop, if Statement, Bourne Shell Commands.

UNIT-V: InterprocessCommunicaation, Unix System Administration and Networking

Interprocess Communication, Synchronization, Filters.

Unix System Administration and Networking: Unix Booting Procedure,Mounting Unix File System, Unmounting Unix File System, Managing User Accounts, Networking Tools, mail Command, Distributed File System, Firewalls, Backup and Restore.

TEXT BOOKS

1. "UNIX and SHELL Programming", B.M. HARWANI, OXFORD UNIVERSITY PRESS.

REFERENCES

1. "UNIX and Linux System Administration Handbook", Evi Nemeth, Garth Snyder, Trent R. Hein and Ben Whaley, PHI

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II Chemical

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	OE2. GREEN TECHNOLOGY	L	T	P	C
20A60805		3	0	0	3

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

CO1 Understand the basic knowledge of environmental issues and estimate the risk
CO2 Evaluate the exposures
CO3 To discuss the type of wastes and emissions that drive the environmental impacts
CO4 Estimation of the environmental properties, persistence, ecosystem risk,
CO5 To present approaches and methodologies for evaluating and improving the environmental performance of chemical processes and chemical products.

Course Articulation Matrix

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

UNIT - I

An introduction to environmental issues: Role of chemical processes and chemical products, Global environmental issues, Air and water quality issues, Ecology.

Risk concept: Description of risk, Risk assessment concept, Dose-response, Exposure assessment.

UNIT - II

Evaluating exposures: Occupational exposures: recognition, evaluation, control, Exposure assessment for chemicals in the ambient environment, Designing safer chemicals.

Green chemistry:Green chemistry methodologies, Optimization based frameworks for the design of green chemical synthesis pathway.

UNIT - III

Evaluating environmental fate: Chemical and physical property estimation, estimating environmental persistence, estimating ecosystem risk, classifying environmental risk based on chemical structure.

UNIT - IV

Life-cycle concepts: Life-cycle assessment, Life-cycle impact assessment

UNIT - V

Material flows in chemical manufacturing, Assessing opportunities for waste exchanges and by-product synergies.

Textbooks:

SHONNARD, DALLEN, D. Green Engineering: Environmentally Conscious Design of Chemical Processes.

Reference Books:

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	**Mathematical Modelling & Simulation (Common for CIVIL,MECH&CHEM)**		**L**	**T**	**P**	**C**
20A65101			**0**	**3**	**0**	**3**
Pre-requisite		**Semester**	**II**			
Course Objectives:						
This course focuses on what is needed to build simulation software environments, and not just building simulations using preexisting packages.						
Course Outcomes (CO): Student will be able to						
• understand basic Model Forms. • understand basic Simulation Approaches. • evaluate handling Stepped and Event-based Time in Simulations. • distinguish Discrete versus Continuous Modeling. • apply Numerical Techniques.						

• calculate Sources and Propagation of Error.		
UNIT - I		8 Hrs
Simulation Basics-Handling Stepped and Event-based Time in Simulations-Discrete versus Continuous Modelling-Numerical Techniques-Sources and Propagation of Error		
UNIT - II		9 Hrs
Dynamical, Finite State, and Complex Model Simulations-Graph or Network Transitions Based Simulations-Actor Based Simulations-Mesh Based Simulations-Hybrid Simulations		
UNIT - III		8 Hrs
Converting to Parallel and Distributed Simulations-Partitioning the Data-Partitioning the Algorithms-Handling Inter-partition Dependencies		
UNIT - IV		8 Hrs
Probability and Statistics for Simulations and Analysis-Introduction to Queues and Random Noise-Random Variates Generation-Sensitivity Analysis		
UNIT - V		9 Hrs
Simulations Results Analysis and Viewing Tools-Display Forms: Tables, Graphs, and Multidimensional Visualization-Terminals, X and MS Windows, and Web Interfaces-Validation of Model Results.		
Textbooks:		
1. Mathematical modeling, JN Kapur, Newage publishers 2. Mathematical Modeling and Simulation: Introduction for Scientists and Engineers by Kai Velten, Wiley Publishers		
Reference Books:		
1. Introduction to Mathematical Modeling and Computer Simulations By Vladimir Mityushev,WojciechNawalaniecNataliaRylko Published by Chapman and Hall/CRC.		
Online Learning Resources:		
http://www.cse.chalmers.se/~dag/docs/matmodReport6.pdf https://www.slideshare.net/arupparia/introduction-to-mathematical-modelling-42588379 https://www.slideshare.net/mailrenuka/simulation-for-queuing-problems-using-random-numbers		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	**Wavelet transforms and its Applications (Common for EEE&ECE)**		**L**	**T**	**P**	**C**
20A65102			**0**	**3**	**0**	**3**
Pre-requisite	Fourier Series	**Semester**	**II**			

Course Objectives:

This course provides the students to understand Wavelet transforms and its applications.

Course Outcomes (CO): Student will be able to

- understand wavelets and wavelet expansion systems.
- illustrate the multi resolution analysis ad scaling functions.
- form fine scale to coarse scale analysis.
- find the lattices and lifting.
- perform numerical complexity of discrete wavelet transforms.
- find the frames and tight frames using Fourier series.

UNIT - I	Wavelets	9 Hrs

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems - Haar Scaling Functions and Wavelets -effectiveness of Wavelet Analysis -The Discrete Wavelet Transform The Discrete-Time and Continuous Wavelet Transforms.

UNIT - II	A Multiresolution Formulation of Wavelet Systems	8 Hrs
Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.		
UNIT - III	Filter Banks and the Discrete Wavelet Transform	9 Hrs
Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.		
UNIT - IV	Time-Frequency and Complexity	9 Hrs
Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.		
UNIT - V	Bases and Matrix Examples	8 Hrs
Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.		
Textbooks:		
1. C. Sidney Burrus, Ramesh A. Gopinath, “Introduction to Wavelets and Wavelets Transforms”,Prentice Hall, (1997). 2. James S. Walker, “A Primer on Wavelets and their Scientific Applications”, CRC Press, (1999).		
Reference Books:		
1. Raghuveer Rao, “Wavelet Transforms”, Pearson Education, Asia.		
Online Learning Resources:		
https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

<table>
<tr><td>Course Code</td><td colspan="2" rowspan="2">Statistical Methods for Data Science
CSE (Data Science)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>20A65103</td><td></td><td>3</td><td></td><td>3</td></tr>
<tr><td>Pre-requisite</td><td></td><td>Semester</td><td colspan="4">II</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td colspan="7">Course Objectives:</td></tr>
<tr><td colspan="7">This course aims at providing knowledge on basic concepts of Statistics, Estimation and testing of hypotheses for large and small samples.</td></tr>
<tr><td colspan="7">Course Outcomes (CO): Student will be able to</td></tr>
<tr><td colspan="7">• Understand the basic concepts of Statistics
• Analyze data and draw conclusion about collection of data under study using Point estimation
• Analyze data and draw conclusion about collection of data under study using Interval estimation
• Analyzing the tests and types of errors for large samples
• Apply testing of hypothesis for small samples.</td></tr>
<tr><td>UNIT - I</td><td colspan="2">Basic Concepts</td><td colspan="4">9 Hrs</td></tr>
<tr><td colspan="7">Population, sample, parameter and statistic; characteristics of a good estimator; Consistency – Invariance property of Consistent estimator, Sufficient condition for consistency; Unbiasedness; Sufficiency – Factorization Theorem – Minimal sufficiency; Efficiency – Most efficient estimator, likelihood equivalence, Uniformly minimum variance unbiased estimator,applications of Lehmann-Scheffe’s Theorem, Rao - Blackwell Theorem and applications</td></tr>
<tr><td>UNIT - II</td><td colspan="2">Point Estimation</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Point Estimation- Estimator, Estimate, Methods of point estimation – Maximum likelihood method (the asymptotic properties of ML estimators are not included), Large sample properties of ML estimator(without proof)- applications , Method of moments, method of least squares, method of minimum chi-square and modified minimum chi-square-Asymptotic Maximum Likelihood Estimation and applications.</td></tr>
<tr><td>UNIT - III</td><td colspan="2">Interval Estimation</td><td colspan="4">8 Hrs</td></tr>
<tr><td colspan="7">Confidence limits and confidence coefficient; Duality between acceptance region of a test and a confidence interval; Construction of confidence intervals for population proportion (small and large samples) and between two population proportions(large samples); Confidence intervals for mean and variance of a normal population; Difference between the mean and ratio of two normal populations.</td></tr>
</table>

UNIT - IV	Testing of hypotheses	9 Hrs
Types of errors, power of a test, most powerful tests; Neyman-Pearson Fundamental Lemma and its applications; Notion of Uniformly most powerful tests; Likelihood Ratio tests: Description and property of LR tests - Application to standard distributions.		

UNIT - V	Small sample tests	9 Hrs
Student's t-test, test for a population mean, equality of two population means, paired t-test, F-test for equality of two population variances,CRD,RBD,LSD; Chi-square test for goodness of fit and test for independence of attributes, $\chi 2$ test for testing variance of a normal distribution Sign test, Signed rank test, Median test, Mann-Whitney test, Run test and One sample Kolmogorov –Smirnov test ,Kruskal – Wallis H test(Description, properties and applications only).		

Textbooks:

1. Manoj Kumar Srivastava and Namita Srivastava, Statistical Inference – Testing of
   Hypotheses, Prentice Hall of India, 2014.
2. Robert V Hogg, Elliot A Tannis and Dale L.Zimmerman, Probability and Statistical Inference,9th edition,Pearson publishers,2013.

Reference Books:

1. S.P.Gupta, Statistical Methods, 33rd Edition, Sultan Chand & Sons.
2. Miller and John E Freund, Probability and Statistics for Engineers, 5th Edition.

Online Learning Resources:

1. https://www.statstutor.ac.uk/resources/uploaded/1introduction3.pdf
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2996198/

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

PHYSICS OF ELECTRONIC MATERIALS AND DEVICES

COURSE OBJECTIVES

1 To impart the fundamental knowledge on various materials, their properties and **Applications.**

2 To provide insight into various semiconducting materials and their properties.
3 To elucidate the characteristic behavior of various semiconductor devices.
4 To provide the basics of dielectric and piezoelectric materials and their properties.
5 To explain different categories of magnetic materials, mechanism and their advanced applications.

COURSE OUTCOMES

At the end of the course the student will be able
CO1 To understand the fundamentals of various materials.
CO2 To exploit the physics of semiconducting materials
CO3 To familiarize with the working principles of semiconductor-based devices.
CO4 To understand the behavior of dielectric and piezoelectric materials.
CO5 To make use of the magnetic materials for advanced applications.

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS **Credit: 3 Hours of teaching: - 45 H**

UNIT-1 Fundamentals of Materials Science: 9H

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects.Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RF and glow discharge).

UNIT-2: Semiconductors: 9H

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT-3: Physics of Semiconductor Devices: 9H

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium.and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

UNIT-4: Dielectric Materials and their Applications: 9H

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties- Ferroelectricity-Applications.

UNIT-5: Magnetic Materials and their Applications: 9H

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

Text Books

1. Principles of Electronic Materials and Devices-S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd.,3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, DhanpatRai and Co.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning,6th edition
2. Electronic Materials Science- Eugene A. Irene, , Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., , 2nd Edition,2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R.Askeland,Chapman& Hall Pub.
6. Electrical Engineering Materials-by A.J. Dekker, PHI Pub

NPTEL courses links
https://nptel.ac.in/courses/113/106/113106062/
https://onlinecourses.nptel.ac.in/noc20_mm02/preview
https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – II H& SS
III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**Academic Writing and Public Speaking**		**L**	**T**	**P**	**C**
20A65501			**3**	**0**	**0**	**3**
Pre-requisite						

Course Objectives:

- To encourage all round development of the students by focusing on writing skills
- To make the students aware of non-verbal skills
- To develop analytical skills
- To deliver effective public speeches

Course Outcomes (CO):

By the end of the program students will be able to

- Define various elements of Academic Writing
- Understand how to paraphrase sources and avoid plagiarism
- Demonstrate the knowledge in writing a Research paper
- Analyse different types of essays
- Assess the speeches of others and know the positive strengths of speakers
- Build confidence in giving an impactful presentation to the audience

UNIT - I	Introduction to Academic Writing	Lecture Hrs

Introduction to Academic Writing – Essential Features of Academic Writing – Courtesy – Clarity – Conciseness – Correctness – Coherence – Completeness – Types – Descriptive, Analytical, Persuasive, Critical writing

UNIT - II	**Academic Journal Article**	Lecture Hrs

Art of condensation- summarizing and paraphrasing - Abstract Writing, writing Project Proposal, writing application for internship, Technical/Research/Journal Paper Writing – Conference Paper writing - Editing, Proof Reading - Plagiarism

UNIT - III	**Essay & Writing Reviews**	Lecture Hrs
Compare and Contrast – Argumentative Essay – Exploratory Essay – Features and Analysis of Sample Essays – Writing Book Report, Summarizing, Book/film Review-		
UNIT - IV	Public Speaking	Lecture Hrs
Introduction, Nature, characteristics, significance of Public Speaking – Presentation – 4 Ps of Presentation – Stage Dynamics – Answering Strategies –Analysis of Impactful Speeches- Speeches for Academic events		
UNIT - V	Public Speaking and Non-Verbal Delivery	Lecture Hrs
Body Language – Kinesics – Oculesics – Proxemics – Haptics – Paralanguage		
Textbooks:		
3. Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010 Pearson Education; First edition (1 January 2010) **4. A Course In Academic Writing Paperback – 1 January 2017Publisher : The Orient Blackswan; Second edition (1 January 2017)**		
Reference Books: 1. **A Handbook For Academic Writing and Composition Paperback – 1 January 2014** by Nzanmongi Jasmine PattonPublisher : Pinnacle Learning; 1st edition (1 January 2014) 2. Critical Thinking, Academic Writing and Presentation Skills: Mg University Edition Paperback – 1 January 2010Publisher : Pearson Education; First edition (1 January 2010) by Marilyn Anderson (Author) 3. Effective Academic Writing Second Edition: 1: Student Book: The Paragraph Paperback – Student Edition, 9 June 2014 by Alice Savage (Author), MasoudShafiei (Author)Publisher : Oxford University Press; Student, Workbook edition (9 June 2014) 4. A Course In Academic Writing Paperback – 1 January 2017 by Renu Gupta (Author) Publisher : The Orient Blackswan; Second edition (1 January 2017)		
Online Learning Resources:		
1. https://youtu.be/NNhTIT81nH8 2. phttps://www.youtube.com/watch?v=478ccrWKY-A 3. https://www.youtube.com/watch?v=nzGo5ZC1gMw		

4. https://www.youtube.com/watch?v=Qve0ZBmJMh4

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – II

III B.TECH – II SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF CHEMISTRY

Subject Code	Title of the Subject	L	T	P	C
	CHEMISTRY OF POLYMERS AND ITS APPLICATIONS	2	1	-	3

COURSE OBJECTIVES	
1	To understand the basic principles of polymers
2	To synthesize the different polymeric materials and their characterization by various instrumental methods.
3	To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
4	To enumerate the applications of polymers in engineering

COURSE OUTCOMES	
CO1	Classify the polymers, Explain polymerization mechanism, Differentiate addition, condensation polymerizations, Describe measurement of molecular weight of polymer
CO2	Differentiate Bulk, solution, Suspension and emulsion polymerization, Describe fibers and elastomers, Identify the thermosetting and thermo polymers, Characterize the properties of polymers by IR, NMR, XRD etc.
CO3	Describe the properties and applications of polymers, Interpret the properties of cellulose, lignin, starch, rosin, latex etc., Discuss the special plastics of PES, PAES, PEEK etc., Explain modified cellulosics
CO4	Identify types of polymer networks, Describe methods involve in hydrogel preparation, Explain applications of hydrogels in drug delivery, Demonstrate the advanced drug delivery systems and controlled release
CO5	Demonstrate electrical phenomena at interfaces including electrokinetics, miselles, reverse micelles etc., Explain photoelectron spectroscopy, Discuss ESCA and Auger

	spectroscopy to the study of surfaces, Differentiate micelles and reverse micelles

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

Unit – I: Polymers-Basics and Characterization :-

Basic concepts: monomers, repeating units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: addition, condensation, co polymerization and coordination. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution. Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit – II: Synthetic Polymers

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization. Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications. Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol – formaldehyde. Melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD

Unit – III : Natural Polymers & Modified cellulosics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins. Modified cellulosics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEA.

Unit-IV: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

Unit – V: Surface phenomena

Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

References :

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III CIVIL

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	Building Technology for Engineers	L	T	P	C
20A70104		3	0	0	3

Course Objectives :

1. To make the student familiar with varioustypes of Buildings and its components
2. To teach the students about general requirements of building regarding safety and transportation
3. To impart knowledge on various special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. To make the student familiar with the concepts of various Prefabrication systems.
5. To Teach the students about various construction equipments used in building.

Course Outcomes:

By the end of this course the student will be able to

1. Classify various types of buildings and its components.
2. Understand the general requirements of building regarding safety and transportation.
3. Understand the Special requirements of buildings regarding ventilation, insulation acoustics, etc,.
4. Familiarize with the concepts of various Prefabrication systems.
5. Understand various construction equipments used in building.

UNIT-1

Building planning: Types of Buildings — components, definitions, economy and design, Principles and aspects of building planning, Definitions and importance of Grouping and circulation; Lighting and ventilation; Sustainability and Green Buildings.

UNIT-II

General requirements: Requirements for safety against fire, termite, damping, earthquakes, Vertical transportation in building — planning of vertical transportation, Stairs, different forms of stairs, Other modes of vertical transportation.

UNIT-III

Special Requirements: Air conditioning — process and classification of air conditioning, Dehumidification. Systems of air-conditioning, ventilation, functional requirements of ventilation. Thermal insulation. Acoustics, effect of noise, properties of noise and its measurements, Principles of acoustics of building. Sound insulation.

UNIT-IV

Prefabrication systems: Prefabricated walls, openings, cupboards, shelves etc., planning and modules and sizes of components in prefabrication. Plumbing services — water supply system, maintenance of building pipe line, Sanitary fittings, Design of building drainage.

UNIT-V

Construction Equipment: Introduction and Planning for construction Equipment, Earthmoving and Excavating equipment, Pile driving equipment, Lifting and Concreting Equipment.

<u>Learning Resources:</u>

Text Books:

1. Building Construction, Punmia B. C., Jain A.J., and Jain A.J., Laxmi Publication, 2016, Eleventh Edition.

2. The Text book for Building Construction, Arora S. P., and Bindra S. P., Dhanpat Rai Pubications, 2010.

Reference Books:

1. Building Construction, Varghese P.C., PHI Learning Pvt. Ltd., 2017, 2nd Edition.
2. Construction Planning, Equipment and Methods, Robert P., Clifford J. S., and Aviad S., McGrawHiII Education, 2010

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III EEE
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

Course Code	**BATTERY MANAGEMENT SYSTEMS (OE-III)**		**L**	**T**	**P**	**C**
20A70204			**3**	**1**	**0**	**4**
Pre-requisite	**Basic Electrical Engineering**	**Semester**	**VI**			

Course Objectives: To make the students learn about:

- Understand the role of battery management system and the requirements of BMS.
- Interpret the concept associated with battery charging / discharging process
- Analyze various parameters of battery and battery pack
- Design the model of battery pack

Course Outcomes (CO): After completion of this course, student will be able to

CO1: Understand and remember the basic concepts and terminologies of Cells and Batteries, charging, discharging methods, concept of cell balancing.

CO2: Analyze BMS functionality, various sensors used, control techniques, Sate of Charge estimation, cell total energy and cell total power.

CO3: Apply the equivalent circuits, physical models, empirical modelling of BMS.

CO4: Design of Battery management system considering various parameters and through simulation.

UNIT - I	**INTRODUCTION**	Lecture Hrs: 14

Introduction to Battery Management System, Cells & Batteries, Nominal voltage and capacity, C rate, Energy and power, Cells connected in series, Cells connected in parallel, Electrochemical and lithium-ion cells, Rechargeable cell, Charging and Discharging Process, Overcharge and Undercharge, Modes

of Charging		
UNIT - II	**BATTERY MANAGEMENT SYSTEM**	Lecture Hrs: 14
Introduction and BMS functionality, Battery pack topology, BMS Functionality, Voltage Sensing, Temperature Sensing, Current Sensing, BMS Functionality, High-voltage contactor control, Isolation sensing, Thermal control, Protection, Communication Interface, Range estimation, State-of charge estimation, Cell total energy and cell total power		
UNIT - III	**BATTERY STATE OF CHARGE AND STATE OF HEALTH ESTIMATION**	Lecture Hrs: 12
Battery state of charge estimation (SOC), voltage-based methods to estimate SOC, Model-based state estimation, Battery Health Estimation, Lithium-ion aging: Negative electrode, Lithium ion aging: Positive electrode, Cell Balancing, Causes of imbalance, Circuits for balancing		
UNIT - IV	**MODELLING AND SIMULATION**	Lecture Hrs: 12
Equivalent-circuit models (ECMs), Physics-based models (PBMs), Empirical modelling approach, Physics-based modelling approach, Simulating an electric vehicle, Vehicle range calculations, Simulating constant power and voltage, Simulating battery packs		
UNIT - V	**DESIGN OF BATTERY MANAGEMENT SYSTEMS**	Lecture Hrs: 12
Design principles of battery BMS, Effect of distance, load, and force on battery life and BMS, energy balancing with multi-battery system		
Textbooks:		
1. Plett, Gregory L. Battery management systems, Volume I: Battery modelling. Artech House, 2015. 2. Plett, Gregory L. Battery management systems, Volume II: Equivalent-circuit methods. Artech House, 2015.		
Reference Books:		
1. Bergveld, H.J., Kruijt, W.S., Notten, P.H.L "Battery Management Systems -Design by Modelling" Philips Research Book Series 2002. 2. Davide Andrea," Battery Management Systems for Large Lithium-ion Battery Packs" Artech House, 2010 3. Pop, Valer, et al. Battery management systems: Accurate state-of-charge indication for battery-powered applications. Vol. 9. Springer Science & Business Media, 2008. 4. RuiXiong, "Battery management Algorithm for Electric Vehicles", China Machine Press, Springer,2020. 5. Bergveid, Krujit, Notten, " Battery Management Systems: Design by Modelling", Philips Research Book Series, Kluwer Academic Publishers.		
Online Learning Resources:		
1. https://www.coursera.org/learn/battery-management-systems		

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MECHANICAL ENGINEERING

Subject Code	Title of the Subject	L	T	P	C
20A70304	**MODERN MANUFACTURING METHODS**	3	0	0	3

Course Objectives:

- To learn the importance and basics of unconventional machining.
- To understand the rapid prototyping processes.
- To have the knowledge of different micro machining methods
- To understand the working principles of various Non-traditional machining methods.
- To learn about Non-traditional forming processes.

UNIT-I

Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications.

Introduction to rapid prototyping - Classification of rapid prototyping methods - sterolithography, fused deposition methods - materials, principle of prototyping and various applications.

UNIT-II

Ultrasonic machining – Elements of the process, mechanics of material removal, process parameters, applications and limitations, Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT-III

Electro –Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM.

Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT-IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations.

Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT-V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations.

Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Course Outcomes:

At the end of this course the student should be able to understand

Technical aspects of precision machining.
Applications of rapid prototyping technologies.
Tool selection for non traditional processes.
Knowledge of economic aspects of Non traditional processes.
Fabrication of microelectronic devices.

TEXT BOOKS:

Manufacturing processes for engineering materials by SeropeKalpakjian and Steven R Schmid, 5edn, Pearson Pub.
Advanced machining processes, VK Jain, Allied publishers.

REFERENCE:

New Technology , Bhattacharya A, The Institution of Engineers, India 1984
Manufacturing Technology, Kalpakzian, Pearson
Modern Machining Process, Pandey P.C. and Shah H.S., TMH.

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronic & Communication Engineering

Course Code	DIGITAL ELECTRONICS		L	T	P	C
20A70404			3	0	0	3
Pre-requisite		**Semester**	**VII**			

Basics of Electronics and Communication Engineering

Course Objectives:

- To learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- To understand and design various combinational logic circuits like adders and code converters.
- To know the design of various combinational circuits useful to implement logic functions.
- To study the design of sequential logic circuits in synchronous and asynchronous modes.
- To introduce programmable logic devices.

Course Outcomes (CO): At the end of this course, the students will be able to

- Learn simplification methods for minimizing Boolean functions and their realization using logic gates.
- Understand and design various combinational logic circuits like adders and code converters.
- Know the design of various combinational circuits useful to implement logic functions.

- Gain knowledge on the design of sequential logic circuits in synchronous and asynchronous modes.
- Understand the operation and uses of programmable logic devices.

UNIT - I

Logic Simplification and Combinational Logic Design: Review of Boolean Algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Introduction to Logic Gates, Ex-OR, Ex-NOR operations, Minimization of Switching Functions: Karnaugh map method, Quine – McCluskey Tabular Minimization Method. Logic function realization: AND-OR, OR-AND and NAND/NOR realizations.

UNIT - II

Introduction to Combinational Design 1: Binary Adders, Subtractors and BCD adder, Code converters - Binary to Gray, Gray to Binary, BCD to excess3, BCD to Seven Segment display.

UNIT - III

Combinational Logic Design 2: Decoders (3 to 8, octal to decimal), Encoders, Priority Encoders, Multiplexers, Demultiplexers, Comparators, Implementations of Logic Functions using Decoders and Multiplexers.

UNIT - IV

Sequential Logic Design: Latches, Flipflops, S-R, D, T, JK and Master-Slave JK FF, Edge triggered FF, flipflop conversions, set up and hold times, Ripple and Synchronous counters, Shift registers.

UNIT - V

Programmable Logic Devices:ROM, Programmable Logic Devices (PLDs), Introduction to logic families and their comparisons.

Textbooks:

1. Digital Design, M. Morris Mano & Michel D. Ciletti, 5th Edition, Pearson Education, 1999.
2. Switching theory and Finite Automata Theory, ZviKohavi and Nirah K. Jha, 2nd Edition, Tata McGraw Hill, 2005.

Reference Books:

1. Fundamentals of Logic Design, Charles H Roth, Jr., 5th Edition, Brooks/coleCengage Learning, 2004.
2. Digital & State Machine Design, Comer, 3rd Edition, OXFORD.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Compute Science & Engineering

Cyber Security

Course Code:20A70504 **L T P C : 3 0 0 3**

Course Objectives:

- To introduce the concepts of Java.
- To Practice object-oriented programs and build java applications.
- To implement java programs for establishing interfaces.
- To implement sample programs for developing reusable software components.
- To establish database connectivity in java and implement GUI applications.

Course Outcomes:

CO1: Recognize the Java programming environment.
CO2: Select appropriate programming constructs to solve a problem.
CO3: Develop efficient programs using multithreading.
CO4: Design reliable programs using Java exception handling features.
CO5: Extend the programming functionality supported by Java.

UNIT-I: Cybercrime

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-II: Cyber Offenses

Cybercrime and information security, Cybercriminals, Classifications of cybercrimes, Need for Cyberlaws in Indian context, Legal perspectives of cybercrime, Indian perspective of cybercrimes, Cybercrime and the Indian ITA 2000, Positive aspects and weak areas of ITA 2000, Amendments made in Indian ITA 2000 for admissibility of e- records, Amendments to the Indian IT Act, Global perspective on cybercrimes, Intellectual property in cyberspace, Ethical dimension of cybercrimes.

UNIT-III: Cybercrime in Mobile and Wireless Devices

Proliferation of mobile and wireless devices, Trends in mobility, Credit card frauds in mobile and wireless computing era, Security challenges posed by mobile devices, Registry settings for mobile devices, Authentication service security, Attacks on mobile/cell phones, Security implications of mobile devices for organizations, Organizational measures for handling mobile devices related security issues.

UNIT-VI: Tools and Methods Used in Cybercrime

Proxy servers and anonymizers, Password cracking, Keyloggers and spywares, Virus and worms, Trojan horses and backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow, Attacks on wireless networks

UNIT-V: Cyber Forensics, Cybercrime in Real-World

Forensics of Computer and Handheld Devices: Cyber forensics, Cyber forensics and digital evidence, Forensics analysis of e-mail, Forensics and social networking sites, Forensics of handheld devices – Smartphone forensics, EnCase, Device Seizure, MOBIL edit.

Cybercrime examples, mini-cases, online scams: Real-life examples - Official website of Maharashtra Government hacked, Indian banks lose millions of rupees, Game source code stolen; Mini-cases - Indian Case of online gambling, Indian case of intellectual property crime; Online scams - Cheque cashing scam, Charity scams.

References:

1. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
2. Cyril Prasanna Raj P., “CMOS digital circuit design manual”, Volume 1, MSEC E-publication, Edition 2016

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Chemical Engineering

Course Code	INDUSTRIAL POLLUTION CONTROL	L	T	P	C
20A70804	ENGINEERING	3	0	0	3

Pre-requisite

Course Objectives:

Course Outcomes (CO):

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

CO1 Understand the different types of wastes generated in an industry, their effects on living and non-living things & environmental regulatory legislations and standards and climate changes.

CO2 Quantify, analyse and treat wastewater

CO3 Apply the different unit operations and unit processes involved in conversion of highly polluted water to potable standards

CO4 Apply the operating principles, design calculations of particulate control devices.

CO5 Estimate the different waste generated from the industries

Course Articulation Matrix

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1												
CO2												
CO3												
CO4												
CO5												
CO6												

UNIT - I

Types of emissions from chemical industries and effects of environment, environment legislation, Type of pollution, sources of wastewater, Effluent guidelines and standards. Characterization of effluent streams, oxygen demands and their determination (BOD, COD, and TOC), Oxygen sag curve, BOD curve mathematical, controlling of BOD curve, self purification of running streams, sources and characteristics of pollutants in fertilizer, paper and pulp industry, petroleum and petroleum industry.

UNIT - II

General methods of control and removal of sulfur dioxide, oxides of nitrogen and organic vapors from gaseous effluent, treatment of liquid and gaseous effluent in fertilizer industry. Air pollution sampling and measurement: Types of pollutant and sampling and measurement,ambient air sampling: collection of gaseous air pollutants, collection of particulate air pollutants. Stack sampling: sampling system, particulate sampling, and gaseous sampling. Analysis of air pollutants: Sulphur dioxide, nitrogen oxides, carbon monoxide, oxidants and ozones, hydrocarbons, particulate matter

UNIT - III

Air pollution control methods and equipments: Source collection methods: raw material changes, process changes, and equipment modification. Cleaning of gaseous equipments particulate emission control: collection efficiency, control equipment like gravitational settling chambers, Cyclone separators, fabric filters, ESP and their constructional details and design aspects. Scrubbers: wet scrubbers, spray towers, centrifugal scrubbers, packed beds and plate columns, venturi scrubbers, their design aspects. Control of gaseous emissions: absorption by liquids, absorption equipments, adsorption by solids, equipment and the design aspects

UNIT - IV

Introduction to waste water treatment, biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, attached growth processes, trickling filters, rotary drum filters, anaerobic processes.

UNIT - V

Methods of primary treatments: screening, sedimentation, flotation, neutralization, and methods of tertiary treatment. A brief study of carbon absorption, ion exchange, reverse osmosis, ultra-filtration, chlorination, ozonation, treatment and disposal. Hazardous waste management: nuclear wastes: health and environment effects, sources and disposal methods. Chemical wastes: health and environmental effects, treatment and disposal: treatment and disposal by industry, off site treatment and disposal, treatment practices in various countries. Biomedical wastes: types of wastes and their control.

Textbooks:

1. Environmental Pollution and Control Engineering, C. S. Rao – Wiley Eastern Limited, India, New Delhi, 1993.
2. Pollution Control in Process Industries, S.P. Mahajan, Tata McGraw-Hill, New Delhi, 1985.

Reference Books:

1. Wastewater Treatment, M. Narayana Rao and A.K.Datta, Oxford and IHB publ. New Delhi.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Numerical Methods for Engineers (Common for all Branches)	L	T	P	C
20A75101		**0**	**3**	**0**	**3**
Pre-requisite	**---**				

Course Objectives:		
This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.		
Course Outcomes (CO): Student will be able to		
• apply numerical methods to solve algebraic and transcendental equations. • understand fitting of several kinds of curves. • derive interpolating polynomials using interpolation formulae. • Solve differential and integral equations numerically.		
UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs
Introduction-Bisection method-Iterative method-Regula falsi method-Newton Raphson method. System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.		
UNIT - II	**Curve Fitting**	8 Hrs
Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.		
UNIT - III	**Interpolation**	9 Hrs
Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae. Gauss forward and backward formula, Stirling's formula, Bessel's formula		
UNIT - IV	**Numerical Integration**	8 Hrs
Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule		
UNIT - V	**Solution of Initial value problems to Ordinary differential equations**	9 Hrs

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.
Textbooks:
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
https://slideplayer.com/slide/8588078/

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75201	**SMART MATERIALS AND DEVICES**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to smart materials and their engineering applications.

2	To impart knowledge on the basics and phenomenon behind the working of smart materials
3	To explain theproperties exhibited by smart materials
4	To educate various techniques used to synthesize and characterize smart materials
5	To identify the required smart material for distinct applications/devices
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of smart materials
CO2	To understand the working principles of smart materials
CO3	To know different techniques used to synthesize and characterize smart materials
CO4	To exploit the properties of smart materials
CO5	To make use of smart materials for different applications

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

Credit: 3 **Hours of teaching: - 45 H**

UNITI : Introduction to Smart Materials: 9H

Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

UNIT II: Properties of Smart Materials: 9H

Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials.

UNIT III: Synthesis of Smart materials: 9H

Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method,Co-precipitaiton.Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Spray pyrolysis.

UNIT IV: Characterization Techniques: 9H

X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

UNIT V:Smart Materials and Devices: 9H

Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials. Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

Text Books:

1.Encyclopaediaof Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Champman and Hall, 1992

Texts/References:

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, , Elsevier, 2005.

2. Characterization and Application of smart Materials -R. Rai, Synthesis, , Nova Science, 2011.

3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, , 2nd

Edn., John Wiley & Sons, 2003.

4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1.

Emission Sensors, Materials and Amplifiers,G.Gautschi, Springer, 2002.

5. Optical Metamaterials: Fundamentals and Applications-W. Cai and V. Shalaev,

,springer,2010.

6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

NPTEL courses links

https://nptel.ac.in/courses/112/104/112104173/
https://nptel.ac.in/courses/112/104/112104251/
https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat_lec_1.pdf

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H &SS

Course Code	Employability Skills		L	T	P	C
20A75501			**3**	**0**	**0**	**3**
Pre-requisite		**Semester-VII**				

Course Objectives:

- To encourage all round development of the students by focusing on productive skills
- To make the students aware of Goal setting and writing skills
- To enable them to know the importance of presentation skills in achieving desired goals.
- To help them develop organizational skills through group activities

To function effectively with heterogeneous teams

Course Outcomes (CO):

CO1: Define goals and try to achieve them
CO2: Understand the significance of self-management
CO3: Apply the knowledge of writing skills in preparing eye-catchy resumes
CO4: Analyse various forms of Presentation skills
CO5: Judge the group behaviour
CO6: Develop skills required for employability.

UNIT - I	Goal Setting and Self-Management	Lecture Hrs

Definition, importance, types of Goal Setting – SMART Goal Setting – Motivation – Intrinsic and Extrinsic Motivation – Self-Management - Knowing about self – SWOT Analysis

UNIT - II	Writing Skills	Lecture Hrs

Definition, significance, types of writing skills – Resume writing, E-Mail writing, Cover Letters, - E-Mail Etiquettes

UNIT - III	Technical Presentation Skills	Lecture Hrs

Nature, meaning & significance of Presentation Skills – Planning, Preparation, Presentation, Stage Dynamics – PPT & Poster Presentation

UNIT - IV	Group Presentation Skills	Lecture Hrs

Body Language – Group Behaviour - Team Dynamics – Leadership Skills – Personality Manifestation- Group Discussion

UNIT - V	Job Cracking Skills	Lecture Hrs

Nature, characteristics, importance & types of Interviews – Job Interviews – Skills for success - Answering Strategies – Mock Interviews

Textbooks:

- 1. Soft Skills & Employability Skills (English, Paperback, SABINA PILLAI, AGNA FERNANDEZ)Publisher: Cambridge

2.Personality Development and Soft Skills (English, Paperback, MitraBarun K.)

Reference Books:

1. Learning How To Fly - Life Lessons for the Youth (English, Paperback, Kalam Abdul A. P. J.), Rupa& Co

2. Personality Development and Soft Skills - Preparing for Tomorrow 1 Edition (English, Paperback, Shikha Kapoor)Publisher: Dreamtech Press

3. Skills for Employability - Skills for Employability with 0 Disc (English, Paperback, Dr. M. Sen Gupta)Publisher: Innovative Publication
Online Learning Resources:
7. https://youtu.be/gkLsn4ddmTs 8. https://youtu.be/2bf9K2rRWwo 9. https://youtu.be/FchfE3c2jzc 10. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KlJ

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – III

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75301	**GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT**	2	1	-	3

COURSE OBJECTIVES	
1	Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
2	Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

COURSE OUTCOMES

CO1	Apply the Green chemistry Principles for day to day life as well as synthesis, Describe the sustainable development and green chemistry, Explain economic and un-economic reactions, Demonstrate Polymer recycling.
CO2	Explain Heterogeneous catalyst and its applications in Chemical and Pharmaceutical Industries, Differentiate Homogeneous and Heterogeneous catalysis, Identify the importance of Bio and Photo Catalysis, Discuss Transition metal and Phase transfer Catalysis
CO3	Demonstrate Organic solvents and importance of solvent free systems, Discuss Super critical carbondioxide, Explain Super critical water and water as a reaction solvent, Interpret Ionic Liquids as Catalyst and Solvent
CO4	Describe importance of Biomass and Solar Power, Illustrate Sonochemistry and Green Chemistry, Apply Green Chemistry for Sustainable Development , Discuss the importance of Renewable resources
CO5	Discuss green Chemistry Principles for practicing Green nano synthesis, Illustrate Microwave Assisted Synthesis, Differentiate Hydrothermal and Reflux synthesis, Demonstrate Green Chemistry applications of Inorganic nanomaterials

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

UNIT 1: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT 2: CATALYSIS AND GREEN CHEMISTRY

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogeneous and Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C–C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples,

UNIT 3: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbondioxide, super critical water and water as a reaction solvent: water based coatings, Ionic liquids as catalyst and solvent.

UNIT 4: EMERGING GREENER TECHNOLOGIES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable Feedstocks, Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency, Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions)

UNIT 5: ALTERNATIVE ENERGY SOURCES

Photo redox catalysis, single electron transfer reactions (SET), Advantages and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis.

Text Books :

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA

References :

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and Ackmez Mudhoo, CRC Press, 2010.
2. Edited by Alvise Perosa and Maurizio Selva , Hand Book of Green chemistry Volume 8: Green Nanoscience, wiley-VCH, 2013.

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV
IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch
DEPARTMENT OF Civil Engineering

		L	T	P	C
20A70105	**Environmental Impact Assessment**	**3**	**0**	**0**	**3**

Course Objectives:
1. To impart knowledge on different concepts of Environmental Impact Assessment.
2. To teach procedures of risk assessment.
3. To teach the EIA methodologies and the criterion for selection of EIA methods.
4. To teach the procedures for environmental clearances and audit.
5. To know the impact quantification of various projects on the environment.

Course Outcomes (CO):
1. To prepare EMP, EIS, and EIA report.
2. To identify the risks and impacts of a project.
3. To choose an appropriate EIA methodology.
4. To evaluation the EIA report.
5. To Estimate the cost benefit ratio of a project.

UNIT - I

Concepts and methodologies of EIA :Initial environmental Examination, Elements of EIA, -Factors affecting E-I-A Impact evaluation and analysis, preparation of Environmental Base map, Classification of environmental parameters- Criteria for the selection of EIA Methodology, E I A methods, Ad-hoc methods, matrix methods, Network method Environmental Media Quality Index method, overlay methods and cost/benefit Analysis.

UNIT - II

Impact of Developmental Activities and Land Use :Introduction and Methodology for the assessment of soil and ground water, Delineation of study area, Identification of actives. Procurement of relevant soil quality, Impact prediction, Assessment of Impact significance, Identification and Incorporation of mitigation measures. E I A in surface water, Air and Biological environment: Methodology for the assessment of Impacts on surface water environment, Air pollution sources, Generalized approach for assessment of Air pollution Impact.

UNIT - III

Assessment of Impact on Vegetation, Wildlife and Risk Assessment :Introduction - Assessment of Impact of development Activities on Vegetation and wildlife, environmental Impact of Deforestation – Causes and effects of deforestation - Risk assessment and treatment of uncertainty-key stages in performing an Environmental Risk Assessment-Advantages of Environmental Risk Assessment

UNIT - IV Environmental audit

Introduction - Environmental Audit & Environmental legislation objectives of Environmental Audit, Types of environmental Audit, Audit protocol, stages of Environmental Audit, onsite activities, evaluation of Audit data and preparation of Audit report.

UNIT - V Environmental Acts and Notifications

The Environmental protection Act, The water preservation Act, The Air (Prevention &Control of pollution Act), Wild life Act - Provisions in the EIA notification, procedure for environmental clearance, procedure for conducting environmental impact assessment report- Evaluation of EIA report. Environmental legislation objectives, evaluation of Audit data and preparation of Audit report. Post Audit activities, Concept of ISO and ISO 14000.

Textbooks:

1. Environmental Impact Assessment, by Canter Larry W., McGraw-Hill education Edi (1996)
2. Environmental Impact Assessment Methodologies, by Y. Anjaneyulu, B. S. Publication, Hyderabad 2nd edition 2011

Reference Books:

1. Environmental Engineering, by Peavy, H. S, Rowe, D. R, Tchobanoglous, G.Mc-Graw Hill International Editions, New York 1985
2. Environmental Science and Engineering, by J. Glynn and Gary W. Hein Ke, Prentice Hall Publishers
3. Environmental Science and Engineering, by Suresh K. Dhaneja, S.K., Katania& Sons Publication, New Delhi.
4. Environmental Pollution and Control, by H. S. Bhatia, Galgotia Publication (P) Ltd, Delhi.

Online Learning Resources:

https://nptel.ac.in/courses/124107160

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electrical & Electronic & Engineering

Course Code	**IoT APPLICATIONS IN ELECTRICAL ENGINEERING (OE-IV)**	**L**	**T**	**P**	**C**
20A70205		**3**	**0**	**0**	**3**
Pre-requisite					

Course Objectives: To make the students learn about:

- Basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process.
- The concept of motion less and motion detectors in IoT applications.
- Applications of IoT in smart grid.
- The concept of Internet of Energy for various applications.

Course Outcomes (CO): After completing the course, the student should be able to do the following:

CO 1 Understand the concept of IoT in Electrical Engineering.
CO 2 Analyze various types of motionless sensors and various types of motion detectors
CO 3 Apply various applications of IoT in smart grid.
CO 4 Design future working environment with Energy internet.

UNIT - I	**SENSORS**	Lecture Hrs: 10

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

UNIT - II	**OCCUPANCY AND MOTION DETECTORS**	Lecture Hrs: 10

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

UNIT - III	**MEMS**	Lecture Hrs: 10

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

UNIT - IV	**IoT FOR SMART GRID**	Lecture Hrs: 8

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

UNIT - V	**INTERNET of ENERGY (IoE)**	Lecture Hrs: 10

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid .

Textbooks:

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1^{st} Edition, Mc Grawhill Education, 2017
3. ErsanKabalci and YasinKabalci, From Smart grid to Internet of Energy, 1^{st} Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir VahidDastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1^{st} Edition, CRC Press, 2019
3. RMD SundaramShriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview
2. https://nptel.ac.in/courses/108108123
3. https://nptel.ac.in/courses/108108179

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Mechanical Engineering

Subject Code	Title of the Subject	L	T	P	C
20A70305	**MATERIAL HANDLING EQUIPMENTS**	3	0	0	3

Course Objectives:

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

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

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

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

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

UNIT-I

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

UNIT-II

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

UNIT-II

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

UNIT-IV

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

UNIT-V

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

Course Outcomes :

The students will be able to select appropriate location for establishing industrial plants by applying the concepts of location selection.

The students will be able to plan and design plant and production layouts through basic strategies and with computer applications.

The students will be able to identify and analyse the problems in the existing layout/ material handling system and shall be able to the optimize the layout/ material handling system

The students will be able to develop algorithms for new planning layouts for typical applications in the industries and Suggesting appropriate material handling strategies in the industries.

The students will be able to design of fork lift trucks.

REFERENCES

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

Spivakovsy, A.O. and Dyachkov, V.K., Conveying Machines, Volumes I and II, MIR Publishers, 1985.

Alexandrov, M., Materials Handling Equipments, MIR Publishers, 1981.

Boltzharol, A., Materials Handling Handbook, The Ronald Press Company, 1958.

P.S.G. Tech., “Design Data Book”, KalaikathirAchchagam, Coimbatore, 2003.

Lingaiah. K. and Narayana Iyengar, “Machine Design Data Hand Book”, Vol. 1 & 2, Suma Publishers, Bangalore, 1983

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Electronics & Communication Engineering

Course Code	PRINCIPLES OF DIGITAL SIGNAL PROCESSING	L	T	P	C
20A70405		3	0	0	3

Pre-requisite

Basics of Electronics and Communication Engineering

Course Objectives:

- To understand the frequency domain analysis of discrete time signals.
- To learn the properties of discrete Fourier series and Fourier transforms.
- To design &analyzeIIR digital filters from analog filters.
- To know various structures used in implementation of FIR digital filters.

- To grasp the importance and applications of Multirate Digital signal processing.

Course Outcomes (CO): At the end of this course, the students will be able to

- Articulate the frequency domain analysis of discrete time signals.
- Understand the properties of discrete Fourier series and Fourier transforms.
- Design &analyzeIIR digital filters from analog filters.
- Design various structures used in implementation of FIR digital filters.
- Summarize the importance and applications of Multirate Digital signal processing.

UNIT - I

Introduction to Digital Signal Processing: Discrete time signals & sequences, Classification of Discrete time systems, stability of LTI systems, LTI system Properties. Solution of Linear constant coefficient difference equations, frequency domain representation of discrete time signals and systems. Review of Z-transforms.

UNIT - II

Discrete Fourier Series and Fourier Transforms: Properties of discrete Fourier series, DFS representation of periodic sequences, Discrete Fourier transforms: Properties of DFT, linear filtering methods based on DFT, Fast Fourier transforms (FFT) - Radix-2 decimation in time and decimation in frequency FFT Algorithms, Inverse FFT.

UNIT - III

Design of IIR Digital Filters and Realizations: Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters, Design Examples, Analog and Digital frequency transformations. Basic structures of IIR systems, Transposed forms.

UNIT - IV

Design of FIR Digital Filters and Realizations: Characteristics of FIR Digital Filters, frequency response. Design of FIR digital filters using window techniques and frequency sampling techniques, comparison of IIR & FIR filters, basic structures of FIR systems.

UNIT - V

DSP Applications: Introduction to programmable DSPs, Multirate signal processing: Decimation, Interpolation, Sampling rate conversion by a rational factor; Adaptive filters: Introduction, Basic principles of Forward Linear Predictive filter and applications such as system identification, echo cancellation, equalization of channels, and beam forming using block diagram representation study only.

Textbooks:

1. John G. Proakis and Dimitris G. Manolakis, “Digital Signal Processing, Principles, Algorithmsand Applications”, Pearson Education, 2007.
2. A.V. Oppenheim and R.W. Schaffer, “Discrete Time Signal Processing”, PHI.

Reference Books:

1. Andreas Antoniou, “Digital Signal Processing”, TATA McGraw Hill, 2006
2. MH Hayes, “Digital Signal Processing”, Schaum’s Outline series, TATA Mc-Graw Hill, 2007.
3. Robert J. Schilling and Sandra L. Harris, “Fundamentals of Digital Signal Processing using MATLAB”, Thomson, 2007.
4. B. Venkataramani and M. Bhaskar, “Digital Signal Processors – Architecture, Programming and Applications”, TATA McGraw Hill, 2002.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Computer Science & Engineering

Introduction to Database Management Systems

Course Code:20A70505 **L T P C : 3 0 0 3**

Course Objectives:

- To introduce the concept of Internet of Things.
- To Practice programs and build real time applications.
- Students will be explored to the interconnection and integration of the physical world.
- Students will gain practical experience in the development of Cloud-based IoT systems.
- To get knowledge on cloud platforms

Course Outcomes (CO):

CO1: Design reliable real time applications using microcontrollers and microprocessors .
CO2: Extend the programming functionality and design new modules.
CO3: Able to design & develop IOT Devices.

UNIT-I: Introduction

Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database

system, approaches to building a database, data models, database management system, Data Independence, DBMS
system architecture, challenges in building a DBMS, various components of a DBMS
Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database
system, approaches to building a database, data models, database management system, Data Independence, DBMS
system architecture, challenges in building a DBMS, various components of a DBMS
Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database
system, approaches to building a database, data models, database management system, Data Independence, DBMSsystem architecture, challenges in building a DBMS, various components of a DBMS
Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database
system, approaches to building a database, data models, database management system, Data Independence, DBMS
system architecture, challenges in building a DBMS, various components of a DBMS.
Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database
system, approaches to building a database, data models, database management system, Data Independence,DBMS system architecture, challenges in building a DBMS, various components of a DBMS.
Introduction to database systems; Characteristics of databases, File system V/s Database system, Users of Database system, approaches to building a database, data models, database management system, Data Independence, DBMSsystem architecture, challenges in building a DBMS, various components of a DBMS.
Introduction to database systems, Characteristics of databases, File system V/s Database system, Users of Database system, approaches to building a database, data models, database management system, Data Independence, DBMS system architecture, challenges in building a DBMS, various components of a DBMS.

UNIT-II: E/R Model

Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship
types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples
Conceptual Data Modeling – motivation, entities, entity types, various types of attributes, relationships, relationship
types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples
Conceptual Data Modeling - motivation, entities, entity types, various types of attributes, relationships, relationship types, Entity set types, Participation constraints, E/R diagram notation, Extended E/R Model, Examples.

UNIT-III: Relational Data Model

Concepts of relations, schema-instance distinction, keys, referential integrity & foreign keys, converting the database specification in ER notation to the relational schema, Relational algebra operators: selection, projection, cross product, various types of joins, division, set operations, example queries, tuple relational calculus, domain relational calculus, Fundamentals of SQL.

UNIT-VI: Relational Database Design

Importance of a good schema design, problems encountered with bad schema designs, motivation for normal forms, dependency theory - functional dependencies, Armstrong's axioms for FD's, closure of a set of FD's, minimal covers, Normalization, Normal Forms - INF, 2NF, 3NF and BCNF, decompositions and desirable properties of them, multi valued dependencies and 4NF, join dependencies and 5NF, Concept of Denormalization.

UNIT-V: Transaction Processing,Data Storage & Indexing

Transaction processing and Error recovery-Concepts of transaction processing, ACID properties, concurrency control, Serializability, locking based protocols, Timestamp based protocols, recovery and logging methods.

Data Storage and Indexes - File organizations, primary, secondary index structures, various index structures - hasb based, dynamic hashing techniques, multi-level indexes, B and B-trees.

References:

3. K. A. Navas, “Electronics Lab Manual”, Volume I, PHI, 5th Edition, 2015, ISBN:9788120351424
4. Cyril Prasanna Raj P., “CMOS digital circuit design manual”, Volume 1, MSEC E-publication, Edition 2016

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemical Engineering

Course Code	**SOLID WASTE MANAGEMENT**	**L**	**T**	**P**	**C**
20A70805		**3**	**0**	**0**	**3**
Pre-requisite					

Course Objectives:

- Material flow in society and generation of solid waste source
- Clarification of solid waste on characterization of the same
- Understand the sense of onsite handling storage and collection systems including transportation
- Understand processing technologies with mechanical volume reduction and thermal volume reduction corporate land filling, deep well injections.
- Learn to estimate material recovery energy recovery from a given waste data using case

standing

Course Outcomes (CO):

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

CO1 Identify sources and relationship between various functional elements of solid waste management and methods of storage and collection and transport of solid wastes.

CO2 Know the importance of transfer station and suggest suitable methods of solid waste disposal based on the composition of solid waste.

CO3 Suggest suitable methods for the management of plastic and E-wastes

CO4 Identify hazardous wastes and suggest suitable management techniques for radioactive wastes and Bio-medical wastes.

CO5 Adopt the suitable management method for a given industry

Course Articulation Matrix

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

UNIT - I

Introduction: Definition, characteristics and perspectives of solid waste. Types of solid waste. Physical and chemical characteristics. Variation of composition and characteristics. Municipal, industrial, special and hazardous wastes.

General aspects Overview of material flow in society. Reduction in raw material usage. Reduction in solid waste generation. Reuse and material recovery. General effects on health and environment. Legislations

UNIT - II

Engineered systems: Typical generation rates. Estimation and factors effecting generation rates. On site handling. Storage and processing. Collection systems and devices. Transfer and transport.

UNIT - III

Processing Techniques: Mechanical volume reduction. Thermal volume reduction. Component separation. Land filling and land forming. Deep well injection.

UNIT - IV

Material recovery: Mechanical size alteration. Electromagnetic separation. Drying and dewatering. Other material recovery systems. Recovery of biological conversion products. Recovery of thermal conversion products.

Energy recovery: Energy recovery systems and efficiency factors. Determination of output and efficiency. Details of energy recovery systems. Combustion incineration and heat recovery. Gasification and pyrolysis. Refuse derived fuels (RDF).

UNIT - V

Case studies: Major industries and management methods used in typical industries – Coal fired power stations, textile industry, oil refinery, distillery, sugar industry, and radioactive waste generation units.

Textbooks:

1. Howard S. Peavy, Environmental Engineering, McGraw Hill International Edition, 1986.
2. Dutta, Industrial Solid Water Management and Land Filling Practice, Narose Publishing House, 1999.

Reference Books:

1. Sastry C.A., Waste Treatment Plants, Narose Publishing House, 1995.
2. Lagrega, Hazardous Waste Management, McGraw Hill, 1994.

Online Learning Resources:

JNTUA College of Engineering (Autonomous), Ananthapuramu
Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF MATHEMATICS

Course Code	Number theory and its Applications		L	T	P	C
20A75102			0	3	0	3
Pre-requisite	-----	Semester	I			

Course Objectives:		
This course enables the students to learn the concepts of number theory and its applications to information security.		
Course Outcomes (CO): Student will be able to		
• understand number theory and its properties. • understand principles on congruences • develop the knowledge to apply various applications • develop various encryption methods and its applications.		
UNIT - I	**Integers, Greatest common divisors and prime Factorization**	8 Hrs
The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations		
UNIT - II	**Congruences**	8 Hrs
Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences		
UNIT - III	**Applications of Congruences**	9 Hrs
Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem-Pseudo primes- Euler's theorem- Euler's p hi-function- The sum and number of divisors- Perfect numbers and Mersenne primes.		
UNIT - IV	**Finite fields & Primality, factoring**	8 Hrs
Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.		
UNIT - V	**Cryptology**	9 Hrs
Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers- Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.		

Textbooks:
1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories. 2. A course in Number theory & Cryptography, Neal Koblitz, Springer.
Reference Books:
1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers 2. Introduction to Analytic number theory-Tom M Apostol, springer 3. Elementary number theory, VK Krishnan, Universities press
Online Learning Resources:
https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Physics

Subject Code	Title of the Subject	L	T	P	C
20A75202	**SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS**	3		-	3

COURSE OBJECTIVES	
1	To provide exposure to various kinds of sensors and actuators and their engineering

	applications.
2	To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
3	To explain the operating principles of various sensors and actuators
4	To educate the fabrication of sensors
5	To explain the required sensor and actuator for interdisciplinary application
COURSE OUTCOMES	
At the end of the course the student will be able	
CO1	To recognize the need of sensors and actuators
CO2	To understand working principles of various sensors and actuators
CO3	To identify different type of sensors and actuators used in real life applications
CO4	To exploit basics in common methods for converting a physical parameter into an electrical quantity
CO5	To make use of sensors and actuators for different applications

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

Credits: 3 **Hours of teaching:- 45 H**

UNIT – I: Introduction to Sensors and Actuators 9H

Sensors: Types of sensors:temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition:ChemicalVapor Deposition, Pattern: photolithography and Etching: Dry and WetEtching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, Piezo-electric and Piezo-resistive actuators, Applications of Actuators.

UNIT –II: Temperature and Mechanical Sensors 9H

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: Strain gauges, Tactile sensors, Pressure sensors: Semiconductor, Piezoresistive, capacitive, Variable Reluctance Sensor (VRP).

UNIT –III: Optical and Acoustic Sensors 9H

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors:thermal, Passive Infra Red, Fiber based sensors and Thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

UNIT –IV: Magnetic, Electromagnetic Sensors and Actuators 9H

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

UNIT –V: Chemical and Radiation Sensors 9H

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Muller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)

Text Books:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1.Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003

2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999

3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.

4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.

5. Principles of Industrial Instrumentation By D. Patranabhis

NPTEL courses links

https://onlinecourses.nptel.ac.in/noc21_ee32/preview

JNTUA College of Engineering (Autonomous), Ananthapuramu

Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF H & SS

Subject Code	Title of the Subject	L	T	P	C
20A79102	English Literary Spectrum	3		0	3

COURSE OBJECTIVES	
1	To develop aesthetic sense to appreciate the beauty of life
2	To introduce to Elizabethan drama and be able to appreciate the nuances of humour
3	To familiarize with Victorian novel and industrialization
4	To expose to the historical significance of ideas of different periods
5	To give exposure to the vicissitudes of life through short stories

COURSE OUTCOMES	
CO1	Awareness to lead a life of quality than quantity
CO2	Able to understand humour and Elizabethan culture
CO3	Enable to appreciate human relations in this mechanized world
CO4	Tolerant and receptive to different ideas
CO5	Be imaginative and understanding of human aspirations

Mapping between Course Outcomes and Programme Outcomes

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

SYLLABUS

UNIT I: Poetry

1. Ode to a Grecian Urn- John Keats
2. To a Skylark- P.B.Shelley
3. Satan's Speech from Paradise Lost Book I- 140-170 lines- John Milton
4. My Last Duchess- Robert Browning

UNIT II: Drama

1. Twelfth Night- William Shakespeare
    a) Elizabethan theatre
    b) Shakespearean tragedy
    c) Shakespearean Comedy
    d) Themes of Shakespearean Dramas

UNIT III: Novel

1. Hard Times- Charles Dickens

a) Rise of the English Novel
b) Victorian Novel
c) Utilitarianism
d) Humanism

UNIT IV: Prose

1. Of Studies – Francis Bacon
2. On Seeing People Off- A.G.Gardiner
3. Sweetness and Light- Mathew Arnold
4. I too have a Dream- Martin Luther King Junior

UNIT V: Short Stories

1. The Last Leaf- O.Henry
2. Useless Beauty- Guy de Maupassant
3. After the Dance – Leo Tolstoy
4. The Selfish Giant- Oscar Wilde

Text Books:

The Oxford Book of English Verse by Christopher Ricks (Editor)
Twelfth Night (2010 edition): Oxford School Shakespeare (Oxford School Shakespeare Series)
Dickens Charles, Hard Times (Penguin Classics)
The Art of the Personal Essay: An Anthology from the Classical Era to the Present, Anchor Books Publication

References:

Legois and Cazamian, *A History of English Literature*

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Open Elective Course – IV

IV B.TECH – I SEMESTER (R20) (common to all branches) - 2020 Admitted Batch

DEPARTMENT OF Chemistry

Subject Code	Title of the Subject	L	T	P	C
20A75302	**CHEMISTRY OF NANOMATERIALS AND APPLICATIONS**	2	1	-	3

COURSE OBJECTIVES	
1	'o understand synthetic principles of Nanomaterials by various methods
2	ınd also characterisae the synthetic nanomaterials by various instrumental methods
3	'o enumerate the applications of nanomaterials in engineering

COURSE OUTCOMES	
CO1	Classify the nanostructure materials, Describe scope of nano science and technology, Explain different synthetic methods of nano materials, Identify the synthetic methods of nanomaterial which is suitable for preparation of particular material
CO2	Describe the top down approach, Explain aerosol synthesis and plasma arc technique, Differentiate chemical vapour deposition method and electrodeposition method, Discuss about high energy ball milling.
CO3	Discuss different technique for characterization of nanomaterial, Explain electron microscopy techniques for characterization of nanomaterial, Describe BET method for surface area analysis, Apply different spectroscopic techniques for characterization
CO4	Explain synthesis and properties and applications of nanaomaterials, Discuss about fullerenes and carbon nanotubes, Differentiate nanomagnetic materials and thermoelectric materials, Describe liquid crystals
CO5	Illustrate applications of nanaomaterials, Discuss the magnetic applications of nanomaterials, list the applications of non-linear optical materials, Describe the applications fullerenes, carbon nanotubes

Mapping between Course Outcomes and Programme Outcomes

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

CO3												
CO4												
CO5												

SYLLABUS

Unit – I

Basics and Characterization of Nanomaterials : Introduction**,** Scope of nanoscience and nanotecnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Unit – II

Synthesis of nanomaterials : Top-Down approach**,** Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling method.
Synthetic Methods**:** Bottom-Up approach**:-** Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT-III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterilas, BET method for surface area analysis, dynamic light scattering for particle size determination-

UNIT-IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self- assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials and liquid crystals.

UNIT-V

Engineering Applications of Nanomaterials : Applications of Nano Particle, nano rods of nano wires, Fullerenes, carbon nano tubes, Graphines nanoparticles and other applications of nonmaterials and uses.

TEXT BOOKS:

1. **NANO: The Essentials:** T Pradeep, MaGraw-Hill, 2007.
2. **Textbook of Nanoscience and nanotechnology:** B S Murty, P Shankar, Baldev Rai, BB Rath and James Murday, Univ. Press, 2012.

REFERENCE BOOKS:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. **Nanostructures & Nanomaterials; Synthesis, Properties & Applications:** Guozhong Cao, Imperial College Press, 2007.

3. **Nanomaterials Chemistry**, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.