Scheme and Syllabi of Courses

B.Tech. Second Year-2019 batch

National Institute of Technology Srinagar

DEPARTMENT OF CHEMICAL ENGINEERING

3rd Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	CET201	Introduction to Chemical Engineering	4	3	1	0	4
2	CET202	Material and Energy Balance	4	3	1	0	4
3	CET203	Process Fluid Mechanics	4	3	1	0	4
4	CET204	Thermodynamics and Chemical Kinetics	4	3	1	0	4
5	ECT205	Basic Electronics Engineering	3	2	1	0	3
6	HST201	Ethics & Self Awareness	2	2	0	0	2
7	MAT201	Chemical Engineering Mathematics-I	4	3	1	0	4
Total			**25**	**19**	**6**	**0**	**25**

4th Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	CET250	Chemical Engineering Thermodynamics	3	2	1	0	3
2	CET251	Heat Transfer	4	3	1	0	4
3	CET252	Mechanical Operations	4	3	1	0	4
4	CET253	Material Science &Technology	4	3	1	0	4
5	CET254	Process Instrumentation	3	3	0	0	3
6	MAT250	Chemical Engineering Mathematics –II	4	3	1	0	4
7	CEL255	Fluid Mechanics & Mechanical Operations Lab.	2	0	0	4	4
8	ECL256	Basic Electronics Engineering Lab.	1	0	0	2	2
Total			**25**	**17**	**5**	**6**	**28**

DEPARTMENT OF CIVIL ENGINEERING

3rd Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	CVT201	Structural Analysis- I	4	2	2	0	4
2	CVT202	Fluid Mechanics	3	2	1	0	3
3	CVT203	Surveying-I	3	2	1	0	3
4	CVT204	Building Materials and Construction	4	3	1	0	4
5	MAT202	Mathematics-I	4	3	1	0	4
6	HST202	Basics of Industrial Economics and Management	3	2	1	0	3
7	CVL205	Fluid Mechanics Lab-I	1	0	0	2	2
8	CVL206	Surveying Lab-I	2	0	0	4	4
9	CVL207	Structural Engineering Lab- I	1	0	0	2	2
Total			**25**	**14**	**7**	**8**	**29**

4th Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	CVT250	Structural Analysis- II	3	2	1	0	3
2	CVT251	Fluid Flow in Pipes and Channels	3	2	1	0	3
3	CVT252	Surveying-II	3	2	1	0	3
4	CVT253	Surveying Camp	2	0	0	4	4
5	CVT254	Engineering Geology	3	2	1	0	3
6	CVT255	Civil Engineering Drawing	4	3	1	0	4
7	MAT251	Mathematics-II	4	3	1	0	4
8	CVL256	Fluid Mechanics Lab-II	1	0	0	2	2
9	CVL257	Surveying Lab-II	1	0	0	2	2
10	CVL258	Geology Lab.	1	0	0	2	2
Total			**25**	**14**	**6**	**10**	**30**

DEPARTMENT OF COMPUTER SCIENCE & ENGINEERING

Semester: 3rd

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	CST201	Object Oriented Programming	4	3	1	0	4
2	CST202	Database Management Systems	4	3	1	0	4
3	MAT203	Discrete Mathematics	4	3	1	0	4
4	ECT203	Signals & Systems	4	3	1	0	4
5	ECT207	Electronics	4	3	1	0	4
6	ECL208	Electronics Lab	1	0	0	2	2
7	CSL203	Object Oriented Programming - Lab	1	0	0	2	2
8	CSL204	Database Management Systems - Lab	1	0	0	2	2
9	ITL206	Internet & Web Technologies	2	0	0	4	4
Total			**25**	**15**	**5**	**10**	**30**

Semester: 4th

S.No.	Course Code	Course Title	Credits	Contact Hours			
				L	T	P	Total
1	CST250	Data Structures	4	3	1	0	4
2	MAT252	Introduction to Probability Theory & Statistics	3	3	0	0	3
3	ECT251	Digital Electronics & Logic Design	4	3	1	0	4
4	ITT255	Software Engineering	4	3	1	0	4
5	ECT253	Communication Systems	4	3	1	0	4
6	EET254	Control Systems	3	3	0	0	3
7	ECL254	Digital Electronics & Logic Design Lab	1	0	0	2	2
8	ECL255	Communication Systems – Lab	1	0	0	2	2
9	CSL251	Data Structures –Lab	1	0	0	2	2
Total			**25**	**18**	**4**	**6**	**28**

DEPARTMENT OF ELECTRICAL ENGINEERING

3rd Semester

S. No.	Course Code	Course Title	Credits	Contact Hours			
				L	T	P	Total
1	EET201	Electrical Measurement & Instrumentation.	4	3	1	0	4
2	ECT201	Electronics-I	4	3	1	0	4
3	ECT202	Network Analysis	4	3	1	0	4
4	PHT201	EMF & Waves	4	3	1	0	4
5	MMT209	Electrical Engg. Materials	4	3	1	0	4
6	MAT204	Mathematics-III	4	3	1	0	4
7	ECL204	Electronics – I Lab	1	0	0	2	2
Total			**25**	**18**	**6**	**2**	**26**

4th Semester

S. No	Course Code	Course Title	Credits	Contact Hours			
				L	T	P	Total
1.	EET250	Electrical Machines-I	4	3	1	0	4
2.	EET251	Control Systems-I	4	3	1	0	4
3.	MET257	Thermal Engineering	4	3	1	0	4
4.	ECT250	Electronics-II	4	3	1	0	4
5.	CVT259	Hydraulics & Hydraulic Machines	3	2	1	0	3
6.	MAT253	Mathematics-IV	3	2	1	0	3
7.	EEL252	Electrical Machines – I Lab.	1	0	0	2	2
8.	EEL253	Electrical Measurement & Instrumentation-Lab	1	0	0	2	1
9.	ECL253	Electronics-II Lab	1	0	0	2	3
		Total	**25**	**16**	**6**	**6**	**28**

DEPARTMENT OF ELECTRONICS & COMMUNICATION

3rd Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	ECT201	Electronics I	4	3	1	0	4
2	ECT202	Network Analysis	4	3	1	0	4
3	ECT203	Signals and Systems	4	3	1	0	4
4	CST205	Data Structures	3	2	1	0	3
5	MAT204	Mathematics-III	4	3	1	0	4
6	MMT210	Electronics Engineering Materials	4	3	1	0	4
7	CSL206	Data Structures Laboratory	1	0	0	2	2
8	ECL204	Electronics-I Laboratory	1	0	0	2	2
		Total	25	17	6	4	27

4th Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	ECT250	Electronics II	4	3	1	0	4
2	ECT251	Digital Electronics and Logic Design	3	2	1	0	3
3	ECT252	Communications Systems-I	3	2	1	0	3
4	EET255	Electrical Machines	3	2	1	0	3
5	EET256	Control System	4	3	1	0	4
6	MAT254	Mathematics-IV	4	3	1	0	4
7	ECL253	Electronic II Laboratory	1	0	0	2	2
8	ECL254	Digital Electronics and Logic Design Lab	1	0	0	2	2
9	ECL257	Communications Systems I Laboratory	1	0	0	2	2
10	EEL257	Electrical Machines Laboratory	1	0	0	2	2
Total			**25**	**15**	**6**	**8**	**29**

DEPARTMENT OF INFORMATION TECHNOLOGY

3rd Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	ITT201	Data Structures	4	3	1	0	4
2	ITT202	Signal and Systems	3	3	1	0	4
3	ITT203	Software Engineering	3	2	1	0	3
4	ITT204	Discrete Mathematics and Graph Theory	4	3	1	0	4
5	CST201	Object Oriented Programming I	4	3	1	0	4
6	ECT207	Electronics	4	3	1	0	4
7	CSL203	Object Oriented Programming Lab I	1	0	0	2	2
8	ECL208	Electronics Lab	1	0	0	2	2
9	ITL205	Data Structures Lab	1	0	0	2	2
Total			**25**	**17**	**6**	**6**	**29**

4th Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	ITT250	Operating Systems	4	3	1	0	4
2	ITT251	Database Management System	4	3	1	0	4
3	ECT251	Digital Electronics & Logic Design	4	3	1	0	4
4	ECT253	Communication System	4	3	1	0	4
5	EET258	Control System	3	3	0	0	3
6	ECL254	Digital Electronics & Logic Design Lab	1	0	0	2	2
7	ECL255	Communication System Lab	1	0	0	2	2
8	ITL252	Operating Systems Lab	1	0	0	2	2
9	ITL253	Database Management System Lab	1	0	0	2	2
10	ITL254	Web Programming	2	0	0	4	4
Total			**25**	**15**	**4**	**12**	**31**

DEPARTMENT OF MECHANICAL ENGINEERING

3rd Semester

S. No	Course Code	Course Title	Credits	Contact Hours			
				L	T	P	Total
1.	MET201	Manufacturing Processes	4	3	1	0	4
2.	MET202	Mechanics of Solids	3	3	0	0	3
3.	MET203	Fundamentals of Dynamics	3	3	0	0	3
4.	MET204	Engineering Thermodynamics	4	3	1	0	4
5.	MET205	Fluid Mechanics - I	4	3	1	0	4
6.	MET206	Machine Drawing & Solid Modelling	2	0	0	4	4
7.	MAT205	Applied Mathematics for Engineers	3	3	0	0	3
8.	MEL207	Mechanics of Solids Lab	1	0	0	2	2
9.	MEL208	Manufacturing Processes Lab	1	0	0	2	2
Total			**25**	**18**	**3**	**8**	**29**

4th Semester

S. No	Course Code	Course Title	Credits	Contact Hours			
				L	T	P	Total
1.	MET250	Applied Thermodynamics	4	3	1	0	4
2.	MET251	Mechanics of Materials	4	3	1	0	4
3.	MET252	Theory of Mechanisms and Machines	4	3	1	0	4
4.	MET253	Materials Science and Engineering	4	3	1	0	4
5.	MET254	Non-Traditional Machining and Automation	4	3	1	0	4
6.	ECT254	Basic Electronics	3	3	0	0	3
7.	MEL255	Thermo-Fluids Lab	1	0	0	2	2
8.	MEL256	Non-Traditional Machining and Automation Lab	1	0	0	2	2
Total			**25**	**18**	**5**	**4**	**27**

DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

3rd Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	MMT201	Electronic, Magnetic and Di Electric Materials	4	3	1	0	4
2	MMT202	Thermodynamics of Materials	4	3	1	0	4
3	MMT203	Physical Metallurgy	4	3	1	0	4
4	MMT204	Principles of Process Metallurgy	4	3	1	0	4
5	MMT205	Metallurgical and Instrumental Analysis	3	2	1	0	3
6	MAT206	Numerical Techniques and Computer Programming	3	2	1	0	3
7	MML206	Laboratory Practice in Physical Metallurgy	1	0	0	2	2
8	MML207	Laboratory Practice in Thermodynamics	1	0	0	2	2
9	MML208	Laboratory Practice in Metallurgical and Instrumental Analysis-Lab	1	0	0	2	2
Total			**25**	**16**	**6**	**6**	**28**

4th Semester

S. No.	Course Code	Course Title	Credit	Contact Hours			
				L	T	P	Total
1	MMT250	Phase Transformation and Heat Treatment	4	3	1	0	4
2	MMT251	Kinetics of Metallurgical Processes	4	3	1	0	4
3	MMT252	Mechanical Behaviour of Materials	4	3	1	0	4
4	MMT253	Non-Ferrous Metal Extraction	3	3	0	0	3
5	MMT254	Powder Metallurgy	3	2	1	0	3
6	MMT255	Mineral Dressing	3	2	1	0	3
7	MML256	Laboratory Practice in Heat Treatment	1	0	0	2	2
8	MML257	Laboratory Practice in Mechanical Behaviour of Materials	1	0	0	2	2
9	MML258	Laboratory Practice in Powder Metallurgy	1	0	0	2	2
10	MML259	Laboratory Practice in Mineral Dressing	1	0	0	2	2
11	HSA250	Vocabulary and Group Discussion (Compulsory Audit)	0	0	0	2	2
Total			**25**	**16**	**5**	**10**	**31**

CHEMICAL ENGINEERING DEPARTMENT

Subject: Introduction to Chemical Engineering (Code:CET201)	Year & Semester: B. Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To acquaint the students with the fundamentals of Chemical Engineering principles, their application and to build their broader perspective in a wholesome manner.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1. Understand basics of chemical engineering education along with the origin and growth of chemical process industries and chemical engineering
CO2. Acquaint the fundamental knowledge of unit operations and unit processes with the basic understanding of process flow sheeting, mass and energy balance, and chemical kinetics
CO3. Gain an insight into the areas of concerns for chemical engineers, such as energy, environment, materials, health, safety and sustainability.
CO4. Know the significance of computers, dimensional analysis, modeling and simulation, and scale up in chemical engineering

Details of the Syllabus:

Unit I	Chemical engineering and chemical technology. Chemical engineering: definition, origin and growth. Chemical process industries: definition, origin, growth and the present scenario. Problems associated with industrial expansion. Chemical engineers, the diversity of employment opportunities for them. A successful chemical engineer. Professional ethics.
Unit II	Concepts of unit processes and unit operations. Intimate connections with physico-chemical sciences, biological and biomedical sciences and other engineering streams: case study, if any. Process flow sheeting and symbols. Basic concepts of material and energy balances, and kinetics of chemical reactions.
Unit III	Concerns of chemical engineering traditional areas: environment, energy, new materials, biotechnology, food, health and safety
Unit IV	Different system of units. Dimensional analysis. Concepts of scale-up. Modeling and Simulation. Computers in chemical engineering.

Books Recommended:

Text Books	1. Anderson, L.B., Wenzel, L.A., "*Introduction to Chemical Engineering*", McGraw-Hill Book Company, Inc., New York (1961). 2. Ghosal, S.K., Sanyal, S.K., Datta, S., "*Introduction to Chemical Engineering*", Tata McGraw-Hill Publishing Company Ltd., New Delhi (1997). 3. Pushpavanam, S., "*Introduction to Chemical Engineering*", PHI Learning Pvt. Ltd. (2012).
Reference Books	1. Rao, M.G., Sittig, M., "*Dryden's Outlines of Chemical Technology*", East-West Press (1997). 2. Perry, R.H., Green, D.W., "*Perry's Chemical Engineers' Handbook*", McGraw-Hill Book Company (2008). 3. Pushpavanam, S., "*Introduction to Chemical Engineering*", PHI Learning Pvt. Ltd. (2012).

Subject: Material and Energy Balance (Code:CET202)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To formulate and solve Material and Energy balances for Chemical process systems.

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

CO1. Understand the basic concepts involved in material and energy balances of chemical processes.
CO2. Understand the ideal and real behavior of gases, vapors and liquids.
CO3. Perform material balances on chemical processes and non-conventional separation processes without and with reactions.
CO4. Perform energy balances on chemical processes and non-conventional separation processes without and with reactions.

Details of the Syllabus:

Unit-I	**Mole concept and mole fraction, weight fraction and volume fraction, concentration of liquid solutions, molarity, molality, normality, ppm, density and specific gravity, composition relationships, stoichiometric principles.Ideal and real gas laws, critical properties, properties of mixtures and solutions, and phase equilibria.**
Unit-II	**Mass Balance:** **Concepts of limiting and excess reactants, tie element, recycle, purging, bypass etc., in batch, stage-wise and continuous operations in systems with and without chemical reactions, and in unit operations**
Unit-III	**Mass balance of some prominent Unit Operations;** **Mass balance calculations of *single and multistage* unit operations like; Evaporation, Distillation, Crystallization etc.**
Unit-IV	**Energy Balance:** **Concepts, calculation of enthalpy changes for systems with and without reactions. Energy balance, heat capacity, estimation of heat capacities, calculation of enthalpy changes (without phase change), enthalpy change for phase transitions, general energy balance, thermochemistry, Hess's law of Summation- heat of formation, reaction, combustion, solution and mixing, theoretical flame temperature and effects of pressure and temperature on them.**
Unit-V	**Material and energy balance for nuclear, electrochemical, photochemical, biochemical and non-conventional separation processes.**

Books Recommended

Text Books	**1. Himmelblau, D.M., "*Basic Principles and Calculations in Chemical Engineering*", 8th Edn.,Prentice-Hall of India Ltd. (2012).** **2. Felder, R.M., Rousseau, R.W., "*Elementary Principles of Chemical Processes*" Wiley, 3rd Edn., 2000.** **3. Hougen, D.A., Watson, K.M., Ragatz, R.A., "*Chemical Process Principles, Part-I* ", 2nd Edn., John Wiley & Sons (1995).** **4. Bhatt, B.I., Vora, S.M., "*Stoichiometry*", 5th Edn., Tata McGraw-Hill (2010).**
Reference Books	**1. Narayanan, K. V., Lakshmikutty, B., "*Stoichiometry and Process Calculations*", Prentice Hall of India (2006).** **2. Venkataramani, V., Anantharaman, N., Begum, K.M.M.S., "*Process Calculations*", PHI Learning Pvt. Ltd. 2nd Edition.** 3. Gavhane, K. A.,"*Introduction to Process Calculations Stoichiometry*", NiraliPrakashan, 2012. **4. Williams, E.T., Johnson, R.C., "*Stoichiometry for Chemical Engineers*", McGraw-Hill Book Company Ltd. (1958).**

Subject: Process Fluid Mechanics(Code:CET203)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To understand the fundamental aspects & basic principles of fluid mechanics and its application to chemical process industries.

Course Outcomes (COs):

CO1. Understand the fundamentals & basics concepts of fluid mechanics & able to describe fluid pressure and its measurement.
CO2. Analyze fluid flow problems with the application of conservation laws & ability to evaluate energy losses and pressure drop in fluid flow system.
CO3. Able to describe function of flow measuring devices and apply Bernoulli equation to determine the performance of flow measuring devices.
CO4. Determine and analyze the performance aspects &characteristics of fluid machinery.

Details of the Syllabus:

Unit-I	Introduction: Introduction to fluids and the concept of viscosity, Newtonian and non-Newtonian fluids. Fluid Statistics: Fluid forces and pressure measurement. Kinematics: Eulerian and Lagrangian description of fluid motion, concept of local and convective accelerations, steady and unsteady flows.
Unit-II	Integral analysis: Control volume analysis for mass, momentum and energy. Differential analysis: Differential equations of mass and momentum for incompressible flows: inviscid - Euler equation and viscous flows - Navier-Stokes equations, concept of fluid rotation, vorticity, stream function, Exact solutions of Navier-Stokes equation for Couette flow and Poiseuille flow.
Unit-III	Invicid flows: Bernoulli's equation - assumptions and applications, potential function. Dimensional analysis and similitude. Internal flows: Fully developed pipe flow, empirical relations for laminar and turbulent flows: friction factor and Darcy-Weisbach relation.
Unit-IV	Boundary layer theory: Concept and assumptions, qualitative idea of boundary layer and separation, boundary layer equations, Blasius solution for laminar boundary layer, momentum-integral equation of boundary layer.
Unit-V	Flow measurements: Basic ideas of flow measurement using venturimeter, pitot-static tube and orifice plate. Pumps, blowers and compressors. Characteristics and applications of pumps, blowers and compressors.

Books Recommended

Text & Reference Books	1. Shames, J.H., "*Mechanics of Fluid*", McGraw-Hill (1992). 2. Darby, R., "*Chemical Engineering Fluid Mechanics*", Marcel Dekker (1996). 3. Wilkes, J.O., "*Fluid Mechanics for Chemical Engineers*", Prentice-Hall International Series (1998). 4. Streeter, V.L., Wylie E.B., Bedford, K.W. "*Fluid Mechanics*" McGraw-Hill Book Company, New York (1998). 5. Mc Cabe, W.L., Smith, J.C., Harriott, P., "*Unit Operation of Chemical Engineering*", McGraw-Hill (2004).

Subject: Thermodynamics & Chemical Kinetics (Code:CET204)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To understand basic concepts of thermodynamics and chemical kinetics and their applications in solving engineering problems.

Course outcomes (COs):

CO1. Understanding and application of laws of thermodynamics.
CO2. Ability of application of thermodynamics to phase equilibrium and reaction equilibrium.
CO3. Basic Idea of Reactors.
CO4. ¡Basic insight into the interpretation of kinetic data and reactor design.

Details of the Syllabus:

Unit I	**Introduction:** Thermodynamic system, surroundings, state, process, properties, equilibrium, heat and work. Properties of Pure Simple Compressible Substance: P-V-T surface, P-V, T-V and T-P diagrams. Equations of state for ideal and real gases. Virial equation of state, van der Waals and Redlich-Kwong equations of state; Use of Thermodynamic tables.
Unit II	**First Law of Thermodynamics:** Energy balance for closed systems. Various forms of energy balance. Specific heat, internal energy, enthalpy, and specific heat of ideal gases. Application of first law to non-flow isochoric, isobaric, isothermal, and adiabatic and polytropic processes. Conservation of mass for a control volume, mass and volume flow rates, mass balance for steady flow processes, flow work, steady flow energy equation. Application to various practical systems viz. nozzles, diffusers, etc. Transient Analysis.
Unit III	**Second Law of Thermodynamics:** Second law, reversible and irreversible processes, Clausius and Kelvin Planck statements. Carnot cycle, Clausius inequality, entropy as a property, principle of increase of entropy. Calculation of entropy change. Thermodynamic Cycles: Otto, Diesel, Rankine cycles and their applications.
Unit IV	**Rate Expression and Reaction Mechanism:** Use of pseudo steady state approximation to get rate expression from mechanism, temperature-dependence of reaction rate-collision theory, transition state theory, thermodynamics and Arrhenius law. Interpretation of Kinetic Data of Batch Reactors: Constant volume and variable volume batch reactions, Integral and differential methods of analysis of data of uni, bi and tri-molecular irreversible reactions. Reversible reactions, homogeneously catalysed, auto-catalysed, series and parallel reactions. Estimation of rate constants and its temperature-dependence.
Unit V	**Solid-Catalysed Fluid Reactions:** Characterization of catalyst, Physical and chemical adsorption, various reaction steps, Langmuir-Hinshelwood kinetics. Kinetics of Biochemical Reactions: Microbial and enzymatic reactions. Substrate and product inhibition.

Books Recommended

Text Books	1. Narayanan, K.V., "*Chemical Engineering Thermodynamics*", Prentice Hall (2007). 2. Smith, J.M., Van Ness, H.C., Abbott, M.M., "*Introduction to Chemical Engineering Thermodynamics*", 7th Edn. McGraw-Hill (2005). 3. Fogler, H.S., "*Elements of Chemical Reaction Eng*.", Prentice Hall of India (2005). 4. Levenspiel, O., "*Chemical Reaction Engineering*", John Wiley & Sons (1998).
Reference Books	1. Koretsky, M.D., "*Engineering and Chemical Thermodynamics*", John Wiley (2004). 2. Kyle, B.G., "*Chemical and Process Thermodynamics*", 3rdEdn, Prentice Hall (1999). 3. Sandler, S.I., "*Chemical, Biochemical and Engineering Thermodynamics*", 4th Edn, John Wiley (2006). 4. Borgnakke, C., Sonntag R.E., "*Fundamentals of Thermodynamics*", John Wiley & Sons (2009). 5. Çengel, Y.A., Boles, M.A., "*Thermodynamics: An Engineering Approach*", 6thEdn., McGraw-Hill (2008).

Subject: Basic Electronics Engineering (Code:ECT205)	Year & Semester: B. Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives: Familiarize with the basic semiconductor devices and to know about the working and performance of semiconductor devices like diodes, BJTs and FETs. To understand different applications of Electronic circuits and instrumentation.

Course Outcomes (COs):

CO1. Familiarization with basic semiconductors
CO2. Understanding the behavior of different types of diodes, transistors at circuit level and behavior of operational amplifiers, & its applications
CO3. Analyze and study the measurement and Instrumentation techniques and devices
CO4. Understanding and applications of Digital Logic gates and blocks

Details of the Syllabus:

Unit I	**Introduction to Semiconductors**: Intrinsic and extrinsic semi-conductors, transport mechanism of charge carriers, electric properties, Temperature Dependence
Unit II	**P-N Junction Diode: Current components in P-N junction,** Characteristics-piece wise linear approximation, and diode circuits half wave, full wave rectifiers, Photodiodes.
Unit III	**BJT: Operation and Characteristics:** CE,CB and CC configuration input, output characteristics Biasing and Bias stability, Low frequency, h-parameter model, Analysis and Design of transist or amplifier circuits using h-parameters. Multistage amplifiers, Transistor as a switch. Introduction to Feedback and Sinusoidal Oscillators
Unit IV	**Operational Amplifier:** Operational amplifiers stages, Differential amplifier, CMRR, Cascade amplifier, Ideal and practical operational amplifier characteristics and properties OP amp applications, inverting and non-inverting amplifiers, Difference amplifier, summer differentiator and integrator, rectifiers etc. Instrumentation Amplifier
Unit V	**Measurement and Instrumentation**: Sensors and Actuators; Measurement of physical parameters like displacement, pressure, force, velocity, humidity, and temperature. LVDT, Strain Gauge, Pyrometer, Thermistor, etc. Digital Multi meter. Data acquisition system and processing.
Unit VI	**Digital Logic:** Introduction to Boolean theorems and codes, code conversion; Logic gates, Combinatorial and Sequential blocks

Books Recommended

S. No.	Name of the Book	Author
1.	Fundamentals of Microelectronics	Behzad Razavi
2.	Analysis and Design of Analog Integrated Circuits	Gray, Hurst, Lewis, Meyar
3.	Electronic Devices and Circuits	Millman, Halkias, and SatyabrataJit
4.	Electronic Devices & Circuits	Allan Mottershed
5.	Digital System Design An Integrated Approach	Uyemura
6.	Digital Logic & Computer Design	M Morris Mano
7.	Measurement and Instrumentation	Cooper

Subject: Ethics and Self-Awareness (Code:HST201)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 2		
			L	T	P
			2	0	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To explain human behavior in situational, social and cultural context**.** To define culture, ethics, morality and values. To help develop an ability to think critically and evaluate theories, concepts and perspectives related to psychology, human behavior, and current societal advances related to career.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1. Explain human experience and behavior in a social and cultural context.
CO2. Develop an appreciation for one's own culture, ethics and values as well as that of others.
CO3. Apply critical thinking and evaluate theories, concepts and perspectives related to psychology, human mind and human behavior as well as current societal advances related to career
CO4. Explicate the importance of self-awareness, self-reflection and self-regulation.

Details of the Syllabus:

Unit I	**Introduction to Ethics** Definition of Ethics; Approaches to Ethics: Psychological, Philosophical, Social; Kohlberg's View: Morality and Ideology, Culture and Morality, Morality in everyday context; Ethical concerns: work ethics and work values; Business ethics; Human Values in Organizations
Unit II	**Self-Awareness** Concept of Self: Johari Window; Character strengths and virtues; Emotional Intelligence; Social Intelligence; Positive Cognitive States and Processes: Self Efficacy; Transactional Analysis

Books Recommended:

Text Books	**1.**	John B. Campbell, Hall, Calvin S., Lindzey, Gardner. "*Theories of Personality".* Wiley, Student Edition, 4th Edition, 2007.
	2.	Manuel E. G. Velasquez, "*Business Ethics: Concepts & Cases*", 6th Edn. Prentice Hall of India, 2006.
	3.	A. C. Fernando, K. P. Muralidheeran, and E. K. Satheesh, "*Business Ethics: An Indian Perspective*". Pearson Education, 3rd Edition, 2019.
	4.	Daniel Albuquerque, "*Business Ethics: Principles and Practices*". Oxford University Press, 2010
Reference Books	1.	Carr, Alan. "*Positive Psychology: The Science of happiness and human strengths".* New York, Brunner-Routledge, 2nd Edition, 2011.
	2.	Leary, Mark R. "*The Curse of the Self: Self-Awareness, Egotism and the Quality of Human Life".* New York, Oxford University Press.
	3.	Louis P. Pojman and Lewis Vaughn. "*The moral life: An introductory reader in ethics and literature".* New York, Oxford University Press. 5th Edition, 2013.
	4.	Corey, G., M. Schneider Corey, Callanan, P. "*Issues and ethics in the helping professions".* CA: Brooks/Cole. 8th Edition, 2010.
	5.	Snyder, C.R. Lopez, Shane, J., & Pedrotti, J.T. "*Positive Psychology: The Scientific and Practical Explorations of Human Strength* (2nd Edn). New Delhi: Sage

Subject: Chemical Engineering Mathematics-I (Code:MAT201	Year & Semester: B.Tech Chemical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs): At the end of the course, a student should be able to:

CO1. Solve problems related to Differentiation of complex functions, Analytic functions, harmonic functions and conformal mapping.
CO2. Solve problems related to Integration of complex functions.
CO3. Expand Complex functions in terms of Taylor series, Laurant series and classify singularities of a complex function and calculation of residues.
CO4. Apply the concepts of Complex Analysis in Boundary value problems and potential theory.
CO5. Solve problems related to Legendre and Bessel functions.

Details of the Syllabus:

Unit-I	**Analytic Functions (10 hours)** Function of a Complex variable, Limit, Continuity and Differentiablity of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Construction of Analytic function whose real or imaginary part is given, Elementary function, Reflection Principle, Conformal Mapping, Angle of Rotation, Mapping by Elementary functions. Bilinear Transformation.
Unit-II	**Complex Integration (10 Hours)** Derivatives of functions w(t), Definite Integrals of functions w(t), Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Antiderivatives and Definite Integrals, Cauchy Integral Formula, Cauchy Integral formula for Derivatives, Evaluation of Improper Definite Integrals by Contour Integration, Liouville's Theorem and its consequences.
Unit-III	Taylor and Laurant Series- Residue Theorem and Applications Taylor Series, Laurant Series, Classification of Singularities, Residues, Cauchy's Residue Theorem and its Applications, Zeros of Analytic functions, Rouche's Theorem and its consequences, Gauss Lucas Theorem.
Unit-IV	**Boundary Value Problems and Potential Theory (6 Hours)** Laplace's Equation and Conformal Mappings, Standard Solution of Laplace equation, Steady –State Temperature Distribution, Steady Two Dimensional Fluid Flow.
Unit-V	**Special Functions (10 Hours)** Legendre's functions, Rodrigue's formula, generating functions for Legendre's Polynomials and recurrence formulae. Bessel's functions, Recurrence formulae and Bessel's functions of integral order.

Books Recommended

Text Books	1. Brown,J. W., Churchill, R. V.,*Complex Variables and Applications*, 8thEdn., 2009, Mc-Graw- Hill International Edition. 2. Jain, R.K.,Iyengar, S.R.K., *Advanced Engineering Mathematics*, 3rdEdn., Narosa Pub. House, 2008
Reference Books	1. Alan J., *Complex Analysis and Applications*, 2nd Edn.,2005, CRC Press. 2. Needham, T.,*Visual Complex Analysis*, Oxford University Press.

Subject: Chemical Engineering Thermodynamics (Code: CET250)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To understand the theory and applications of thermodynamic properties, equations of state, methods used to describe and predict phase equilibria.

Course outcomes (COs):

CO1. Basic understanding of the thermodynamic properties of fluid, mixture and solutions.
CO2. Apply thermodynamic principles to understand fugacity, partial molar properties, chemical potential, and activity coefficients for non-ideal fluid systems.
CO3. Investigate binary phase equilibria; perform vapour-liquid equilibrium (VLE) calculations.
CO4. Apply thermodynamic principles to reaction equilibrium between phases and reactions.

Details of the Syllabus:

Unit I	**Thermodynamic Properties of Homogeneous Fluids:** Fundamental property relations, Maxwell's relations, Residual properties and their estimation, two phase systems, thermodynamic diagrams and tables, generalized property correlation for gases.
Unit II	**Thermodynamic Properties of Mixtures or Solutions:** Property relationships for systems of variable composition; chemical potential, partial molar properties, fugacity and fugacity coefficients – pure species and species in a mixture, fugacity in ideal solutions, activity coefficients, excess properties.
Unit III	**Applications of Solution Thermodynamics:** VLE-qualitative behavior, Duhem's theorem, simple models for VLE (Raoult's law, modified Raoult's law, etc.). Liquid properties from VLE.Activity coefficients from experimental data – Margules, Van-Laar, and Wilson equations. Property changes of mixing, heat effects in mixing processes.
Unit IV	**Phase Equilibria:** Importance of phase equilibria in process industries, equilibrium and stability, vapour-liquid equilibria (VLE) for miscible, partially miscible and immiscible systems, their phase diagrams, azeotropes. VLE calculations at low and high pressures, analysis of multi- component systems.
Unit V	**Chemical Reaction Equilibria:** Reaction coordinate, application of equilibrium criteria to chemical reactions, standard Gibbs energy change and the equilibrium constant, effect of temperature on equilibrium constant, evaluation of equilibrium constant and composition. Calculation of equilibrium compositions for single reactions; Phase rule and Duhem"s theorem for reacting systems. Thermodynamic Analysis of Processes: Work and free energy, availability, analysis of mixing, separation processes, heat exchange, lost work calculations.

Books Recommended:

Text Books	1. Narayanan, K.V., "*Chemical Engineering Thermodynamics*", Prentice Hall (2007). 2. Smith, J.M., Van Ness, H.C., Abbott, M.M., "*Introduction to Chemical Engineering Thermodynamics*", 7th Edn. McGraw-Hill (2005).
Reference Books	1. Koretsky, M.D., "Engineering and Chemical Thermodynamics", John Wiley (2004). 2. Kyle, B.G., "*Chemical and Process Thermodynamics*", 3rd Edn, Prentice Hall (1999). 3. Sandler, S.I., "*Chemical, Biochemical and Engineering Thermodynamics*", 4th Edn, John Wiley (2006).

Subject: Heat Transfer (Code: CET251)	Year & Semester: B. Tech Chemical Engineering2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To understand the fundamentals & basic principles of heat transfer mechanisms in solids and fluids and their applications in various heat transfer equipment in process industries.

Course outcomes (COs): At the end of the course, student will be able to:

CO1. Identify, formulate, analyse & solve problems involving steady state heat conduction in simple geometries..
CO2. Understand the fundamentals and basic principles of convection heat transfer and evaluate heat transfer coefficients for natural and forced convection.
CO3. Calculate radiation heat transfer between black body surfaces & grey body surfaces.
CO4. Able to perform the thermal analysis and sizing of heat exchangers & evaporators.

Details of the Syllabus:

Unit-I	Introduction: Modes of heat transfer. Thermal conductivity of material. Effect of temperature on thermal conductivity of different solids, liquids and gases. Derivation of generalized heat conduction equation in Cartesian, cylindrical and spherical coordinates and its reduction to specific cases, general laws of heat transfer.
Unit-II	Conduction: Fourier's law, steady state conduction through flat wall, multi-layer wall, cylinders and hollow spheres. Lagging of pipes and optimum lagging thickness. Heat transfer from extended surface: Types of fin, heat flow through rectangular fin, infinitely long fin, fin insulated at the tip and fin losing heat at the tip, efficiency and effectiveness of fin.
Unit-III	Convection: Natural and forced convection, Newton's law of cooling, dimensional analysis applied to forced and free convection, dimensionless numbers and their physical significance, empirical correlations for free and forced convection, continuity, momentum and energy equations, thermal and hydrodynamic boundary layer.
Unit-IV	Heat transfer with phase change: Boiling of liquids, Pool boiling curve, different types of pool boiling, condensation of vapor. Film wise & drop wise condensation. Radiation: Emissivity, absorptivity, black body and grey body radiation, view factors, radiation between various types of surfaces.
Unit-V	Heat exchanger: Classification, heat exchanger analysis, LMTD for parallel and counter flow exchanger, condenser and evaporator, overall heat transfer coefficient, fouling factor, correction factors for multi pass arrangement, effectiveness and number of transfer unit for parallel and counter flow heat exchanger, introduction of heat pipe and compact heat exchanger.

Books Recommended

Text Books& Reference Books	1. McCabe, W.L., Smith, J.C., "*Unit Operation of Chemical Engineering*",7th Edn., McGraw-Hill (2011). 2. Holman, J.P., " *Heat Transfer*", 10th Edn., McGraw-Hill (2009) 3. Bergman, T.L., Lavine, A.S., Incropera, F.P., DeWitt, D.P., "*Introduction to Heat Transfer*", 6th Edn., Wiley (2011). 4. Kreith, F., Manglik, R.M., Bohn, M., "*Principles of Heat Transfer*", 7th Edn., Cengage Learning (2010). 5. Hewitt, G.F., Shires, G.L., Bott, T.R., "*Process Heat Transfer*", Begell House (1995). 6. Kern, D.Q., "*Process Heat Transfer*", McGraw- Hill (2001).

Subject: Mechanical Operations (Code: CET252)	Year & Semester: B. Tech Chemical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course description:

Understand properties and characterization of particulate solids and mechanical solids separation methods such as screening, filtration, sedimentation, transportation of solids, agitation etc and associated equipments used for achieving these methods.

Course Objectives:

1. To impart the basic concepts of mechanical operations
2. To develop an understanding of size analysis, size reduction, and solid handling
3. To understand mechanical separation methods such as filtration, sedimentation, transportation of solids etc and associated equipment used for achieving these methods

Course outcomes (COs): Upon successful completion of the course, students will be able to:

CO1. Understand the characterization, classification, conveying and storage of solids
CO2. Calculate the power requirements and crushing efficiencies of size reduction equipment using laws of communition and understand the working of different size reduction equipment
CO3. Analyze the screening results to estimate the screen effectiveness and acquire knowledge of screening mechanism and separation of solids from solids and gases
CO4. Apply the knowledge of filtration theory to estimate the filtration time, specific cake and medium resistance of filtration processes and understand the settling characteristics
CO5. Acquire the knowledge of agitation and different types of agitated vessels

Details of the Syllabus:

Unit-I	**Introduction:** Properties of particulate solids, characterization of solid particles and mixed particle size. Storage and transportation of bulk solids (types of conveyers, their selection), Pneumatic and hydraulic conveying of solids, general characteristics and flow relations, mechanical conveyers.
Unit-II	**Crushing and Grinding**: Theory of Crushing. Laws of crushing-Rittingers‟ law, Kick‟s law, Classification of crushing and grinding machinery, Coarse Crushers (jaw crusher, gyratory crusher), intermediate crushers (roll, disc or cone crusher, edge runners, squired cage disintegrator, hammer mill), fine grinders-burhstones, roller mills, ball and tube mills.
Unit-III	**Solid-Solid and Gas-Solid Separation:** Principle of screening, screen analysis, types of screening equipment (grizzlies, trommels, shaking and vibrating screens), effectiveness of a screen, air separating method (cyclone separator, bag filters, electrostatic precipitator, scrubbers).
Unit-IV	**Solid-Liquid Separation: Settling:** Free and hindered settling, classification of classifiers (simple and mechanical), introduction to the design of continuous thickeners. **Filtration:** Classification of filters, effect of pressure on filtration, filter aids, constant pressure and constant rate filtration theory, membrane filtration.
Unit-V	**Agitation and Mixing:** Theory of mixing, power consumption of mixer impellers, mixing liquids with liquids, mixing gas with liquid, mixing of viscous masses, mixing of solids with solids mixing of solid with liquid.

Books Recommended

Text Books	1. McCabe, W.I., Smith, J.C., "*Unit Operations in Chemical Engineering"*, 7th Edn., McGraw-Hill (2011). 2. Swain, A. K., Patra,H., Roy,G.K., " *Mechanical Operations*" 1st Edn., McGraw-Hill (2010).
Reference Books	1. Badger, L.W., Banchero, T.J., "*Introduction to Chemical Engineering"*, 3rd Edn., McGraw-Hill (1997). 2. Coulson, J.M., Richardson, J.F., "*Chem. Engineering, 2nd Vol.*", Butterworth-Heinemann. 3. Foust, A. S., Wenzel, L. A., Clump, C. W., Maus, L., Andersen, L. B., "*Principles of Unit Operations*", 2nd Ed., Wiley-India (2008). 4. Perry, R.H., Green, D.W., "*Perry's Chemical Engineers' Handbook"*, 7th Edn.", McGraw-Hill Book Company (2008).

Subject: Material Science and Technology (Code: CET253)	Year & Semester: B. Tech Chemical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: This course is aimed at providing students the information regarding availability of various types and classes of materials involved in engineering practices. This course will help the students in selection of suitable materials in construction of process equipment in particular.

Course outcomes (COs): Upon successful completion of the course, student should be able to:

- **CO1.** Analyze the micro structure of crystalline materials like lattice systems, unit cells and theoretical density
- **CO2.** Clear the concept of mechanical behavior of materials through calculations and appropriate equations along with their failure mechanics including corrosion.
- **CO3.** Understand the concept of phase diagrams and their construction, usage and applications.
- **CO4.** Understand and analyze the heat treatment processes and their types involving solid state diffusion processes

Details of the Syllabus:

Unit-I	**Introduction:** Properties of materials of importance to chemical equipment. Materials of construction for chemical industries (metallic and non-metallic). Principles of usage of materials. FCC, BCC, HCP crystal planes. Microscopic and macroscopic structure of metallic crystals. **Imperfection in crystals:** Point imperfection, line imperfection and surface imperfection. Single phase metals, properties of single phase metals. Plastic deformation, re-crystallization. Plastic deformation of metal crystals, properties of plastically deformed metals, mechanism of slip.
Unit-II	**Failure of Metals:** Creep, mechanized creep, ductile fracture, cleavage fracture, fracture in glass and theory of fracture, fatigue and mechanism of fatigue.
Unit-III	**Iron-Carbon Alloys:** Definition of alloys, Substitution and interstitial solid solutions, eutectic and eutectoid reactions, peritectic transformation, peritectic and pertectoid reaction, constituent diagram for iron-carbon system, time-temperature-transformation curves.
Unit-IV	**Inorganic Materials:** Ceramic, example of ceramic phases. Structure of silicates. Dielectric ceramic semiconductors. Mechanical behavior of ceramic materials. Introduction to Composite Materials **Corrosion:** Corrosion by solution, electrochemical oxidation. Electrode potential, galvanic couples. Types of galvanic cells. Corrosion prevention. Protective surfaces avoidance of galvanic couples, use of galvanic protection. Use of organic, inorganic and metallic linings.
Unit-V	**Polymers:** Structure, deformation, plastic deformation. **Composite Materials:** Introduction, Particle Reinforced composites, Fiber Reinforced composites, Structural Composites

Books Recommended

Text Books	1. William D. Callister, Jr. *"Material Science and Engineering, An introduction"* 8th Edn., (2010), John Wiley and Sons Inc. 2. Raghavan, V., *" Materials Science and Engineering- A First Course"*, 5th Edn., Prentice-Hall India (2009).
Reference Books	1. Van Vlack, L.H., "*Elements of Material Science and Engineering*", 6th Edn., Pearson Education (1989). 2. Fisher, T.,*" Material Science for Engineering students",* Academic Press, Elsevier-Edition (2009). 3. D. R. Askaland, P.P Fulay, "*Essentials of Material Science & Engineering*" 2nd Edn., Cengage Learning (2009).

Subject: Process Instrumentation (CET254)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 4th Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: This course enables the students to know about the process principles and make the students knowledgeable in various types of measuring instruments used in chemical process industries.

Course outcomes (COs): At the end of the course, student will be able to:

CO1.	Understand basic concept of instrumentation, principles and applications
CO2.	Understand the measurement techniques for Temperature
CO3.	Understand the measurement techniques for Pressure
CO4.	Understand the measurement techniques for Flow and Level

Details of the Syllabus:

Unit-I	**Introduction**: Measuring instruments and their function, elements of measurement, important characteristics of industrial measurement. Classification of Instruments: Recording and measuring types.
Unit-II	**Temperature measurement**: Classification of thermometers, and pyrometers, response of thermometers, protecting wells. Fluid filled expansion thermometers. Thermocouples: Resistance thermometers. Radiation and optical pyrometers.
Unit-III	**Pressure and vacuum measurement**: Classification. Manometers- Inverted well pressure gauges. Bourdon tube pressure gauges, diagram of pressure gauges. Special measuring devices: Pressure and vacuum, McLeod gauge. Thermal conductivity and ionization gauges.
Unit-IV	**Flow and Liquid Level Measurement:** Head and area flow meters-flow measuring devices, Visual indicators float motivation, liquid level instruments. Pressure differential type level gauge, Electrical contact type liquid level indicators.

Books Recommended

Text Books	1. Dunn, W.C., "Fundamentals of Industrial Instrumentation and Process Control", Tata McGraw-Hill (2009). 2. Nakra B. C., Chaudhry K. K., "Instrumentation, Measurement and Analysis" Tata McGraw-Hill (2004). 3. Andrew, W. G., "Applied Instrumentation in the Process Industries, Vol. I.", Gulf Publishing Company (1993).
Reference Books	4. Liptek, B.G., "Instrument Engineers' Handbook: Process Control and Optimization, Volume II", Taylor and Francis, CRC press (2006).
	5. Johnson, C., "Process Control Instrumentation Technology", Prentice Hall (2005).

Subject: Chemical Engineering Mathematics-II (Code: MAT250)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course outcomes (COs): At the end of the course, a student should be able to:

- **CO1.** Evaluate Laplace and Inverse Laplace transforms of various functions and related problems.
- **CO2.** Evaluate Fourier and Inverse Fourier transforms of various functions and related problems.
- **CO3.** Apply the methods of Laplace and Fourier transforms in solving ODE, PDE and Integral equations.
- **CO4.** Solve the problems related to random variables, Probability density function, Mathematical expectation, Moments, Moment generating function, Inequalities of Markov and Chebyshev and their applications.
- **CO5.** Solve the problems related to Binomial, Poisson and normal Distributions, Beta and gamma Distribution, t-distribution, F-Distribution, Chi-square Distribution and their applications.

Details of the Syllabus:

Unit-I	**Laplace Transforms:** Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform.Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem and properties of Convolution, Evaluation of definite integrals by Laplace transforms, Use of Laplace transforms in the solution of linear differential equation.
Unit-II	**Fourier Transforms:** Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations.
Unit-III	**Probability:** Point function and Set function, Probability Set function, Random variable, Probability density function, Mode and median of distribution of a random variable, Probability distribution function and its properties, Mathematical expectation, Laws of expectation, Mean, Variance, Moments, Moment generating function, Inequalities of Markov and Chebyshev and their applications. Binomial, Poisson and normal Distributions, Beta and gamma Distribution, t-distribution, F-Distribution, Chi-square Distribution and their applications.

Books Recommended

Text Books

1. Debnath, L., Bhatta, D.,*Integral Transforms and their Applications*, 2nd Edn., CRC press, 2007.
2. Murray, R. S.,*Schaum's Outlines Laplace Transforms*, Tata Mc-Graw Hill Edition, 2005.
3. Robert V. H., Joseph W. M., Allen T. C., *Introduction to Mathematical Statistics*, 2nd Edn., LPE Pearson Prentice hall, 2007.

Reference Books

1. Jain, R. K., Iyengar, S. R. K.,*Advanced Engineering Mathematics*, 3rd Edn., Narosa Pub. House, 2008.
2. Rohatgi, V.K. Ehsanes Saleh, A. K. Md.,*An Introduction to Probability and Mathematical Statistics*, 2nd Edn., John Wiley and sons, 2008.

Subject: Fluid Mechanics & Mechanical Operations Lab. (Code: CEL255)	Year & Semester: B.Tech Chemical Engineering 2nd Year & 4thSemester	Total Course Credit: 2		
		L	T	P
		0	0	4
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objective: To understand basic concepts of thermodynamics and chemical kinetics and their applications in solving engineering problems.

Course outcomes (COs):

CO1. Make velocity measurements using flow meters and viscosity measurements by Stokes Apparatus

CO2. Understand the laminar and turbulent flow behaviour, verify Bernoulli's principleand pipe fittings

CO3. Understand the classification, conveying and communition of solids

CO4. Understand the theories of sedimentation and to study the settling characteristics of batch settling

List of Experiments and Equipments

S.No.	Name of the Experiment	Name of the Equipment
1	Measurement of liquid viscosity by Stokes Method	Stokes Apparatus
2	Reynolds Experiment to demonstrate laminar and turbulent flow	Reynolds Apparatus
3	Verification of Bernoulli's Principle	Bernoulli's Apparatus
4	Flow through Orificemeter	Orificemeter
5	Flow through Venturimeter	Venturimeter
6	Flow through Rotameter	Rotameter
7	Determine the Efficiency of a Ball Mill	Ball Mill
8	Determine the Efficiency of a Vibrating Screen	Vibrating Screen
9	Find out the discharge at different angles of elevation of Screw conveyor	Screw Conveyor
10	Study the settling Characteristics of Slurry	Sedimentation Apparatus
11	Demonstration of Trommel	Trommel Apparatus
12	Determine the Capacity of Belt Conveyor	Belt Conveyor
13	Pipe Fittings	---

Books Recommended

1. McCabe W. L., Jullian Smith C. and Peter Harriott - *Unit operations of Chemical Engineering*, 7thEdn., McGraw-Hill international edition, 2005.
2. Coulson J.M and Richardson. J.F, *Chemical Engineering Volume I and II*, 5thEdn., Elsevier India, 2006.

Subject: Basic Electronics Engineering Laboratory (Code: ECL256)	Year & Semester:B. Tech Chemical Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze diode circuits, BJT circuits, operational amplifiers, Digital Logic Gates, and Instrumentation systems.

Details of the Syllabus:

S. No.	Particulars
1	Study of CRO-Measurement of Voltage frequency and Phase of a given waveform
2	To obtain diode characteristics. Half wave and a full wave rectifier and to study their performance. Clipping and Clamping circuits
3	To obtain transistor characteristics in the following configurations. a) Common base b) Common emitter
4	To assemble a CE amplifier and observe its performance
5	To assemble a differential amplifier and obtain its CMRR.
6	To study different applications of OPAMPS. a. OP-AMP as an inverting amplifier. b. OPAMP as a non-inverting amplifier c. OPAMP as an integrator d. OPAMP as a differentiator
7	To measure the following parameters ofa typical OP-AMP. a. I/P Impedance b. O/P Impedance c. Slew rate d. CMRR
8	To verify the truth table of following logic gates: a. AND OR and NOT b. NAND, NOR, XOR and XNOR c. To realize any one of above gate using discrete active and passive components.
9	To implement XOR and XNOR using universal logic gates.
10	To study a Linear Variable Differential Transformer (LVDT) and use it in a simple experimental set up to measure a small displacement.
11	To study measurement of displacement using strain gauge.

CIVIL ENGINEERING DEPARTMENT

Subject: Structural Analysis - I (Code: CVT201)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			2	2	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: The objective of this course is elaborate on the knowledge of engineering mechanics (statics) and to teach the students the purpose of studying strength of materials with respect to civil engineering design and analysis. The course introduces the students to the concepts of engineering mechanics of materials and the behavior of the materials and structures under applied loads.

Course Outcomes:

CO1: Understand the concepts of stress and strain, principal stresses and principal planes.
CO2: Determine Shear force and bending moment in beams and understand concept of theory of simple bending.
CO3: Calculate the deflection of beams by different methods and selection of method for determining slope or deflection
CO4: Apply basic equation of torsion in design of circular shafts and helical springs
CO5: To understand the buckling behavior of columns subjected to axial loads.

S. No.	Contents
01.	**Review of Basic Concepts of Stress and Strain:** Hooke's law; Poisson's ratio; Stress-strain diagram of ductile and brittle materials; Elastic limit; Modulus of elasticity; Bulk Modulus: Beam Statics: Support reactions, concepts of redundancy, axial force, shear force and bending moment diagrams for concentrated, uniformly distributed, linearly varying load, concentrated moments in simply supported beams, cantilever and overhanging beams
02.	**Symmetric Beam Bending:** Simple theory of bending, Bending and shear stress for regular sections, shear centre
03.	**Two Dimensional Stress Problems**: Principal stresses, maximum shear stresses, Mohr's circle of stresses, construction of Mohr's circle, applications.
04.	**Deflection of statically determinate beams:** Slope and deflection of beams by integration, area-moment and conjugate beam methods
05.	**Introduction to thin cylindrical & spherical shells:** Hoop stress and meridonial - stress and volumetric changes. **Torsion:** Pure torsion, torsion of circular solid shaft and hollow shafts, torsional equation, torsional rigidity, closed coil helical; springs
06.	**Columns**: Fundamentals, column buckling theory, Euler's load for columns with different end conditions, limitations of Euler's theory – problems, eccentric load.

Books Recommended

Text Books	1. Hibbeler, R.C., “Mechanics of Materials”, 6th SI edition, Prentice Hall. 2. Junnarkar.S.B. and Shah.H.J, “Mechanics of Structures”, Vol I, Charotar Publishing House, New Delhi 2016. 3. Gambhir. M.L., "Fundamentals of Solid Mechanics", PHI Learning Private Limited., New Delhi, 2009.
References	1. Beer, P.F. and Johnston (Jr.) E.R. “Mechanics of Materials”, S.I. Version, Tata McGraw Hill, India, 2001. 2. Popov, E.P., Engineering Mechanics of Solids, Prentice-Hall, 1999. 3. Gere J.M. and Goodno, B. J., Strength of Materials, Cengage Learning. 4. Craig, R.R., “Mechanics of Materials”, 2nd edition, John Wiley and Sons.

Subject: Fluid Mechanics (Code: CVT202)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Midterm	Class Assessment	End Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: To develop the understanding of basic principles of mechanics of fluids at rest and in motion and their applications in solving the real engineering problems.

Course Outcomes:

CO1: Analyze Physical properties of fluids.

CO2: Analyze and perform calculations on Pressure Intensity pressure on plane and curved surfaces, centre of pressure;

CO3: Perform calculations for determination Steady and unsteady, uniform and non uniform, laminar and turbulent flows; one, two and three dimensional flows; Stream lines, Streak lines and path lines.

CO4: Determine Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation.

S. No.	Course Contents
01.	**Introduction:** Physical properties of fluids viz, mass density, viscosity, compressibility, vapour pressure, surface tension, capillarity, etc. Ideal Fluids and RealFluids; Newtonian and Non-Newtonian Fluids.
02.	**Fluid Statics:** Pressure Intensity, Pascal's law; Pressure- density- height relationships, manometers; pressure on plane and curved surfaces, centre of pressure; Buoyancy, Stability of immersed and floating bodies.
03.	**Kinematics Of Fluid Flow:** Steady and unsteady, uniform and non-uniform, laminar and turbulent flows; one, two and three dimensional flows; Streamlines, and pathlines; Continuity equation; Rotation and Elementary explanation of stream function and velocity Graphical and Experimental methods of drawing flow nets.
04.	**Dynamics Of Fluid Flow:** Euler's equation of motion along a streamline and its integration to yield Bernoulli's equation; Flow measurement, flow through orificemeter, Venturimeter, orifices, mouth pieces, pitot and Prandtl tubes, sluice gates under free and submerged conditions, Viscosity Notches and Weirs under free and submerged flow conditions, Aeration of nape.
05.	**Momemtum Equation:** Momentum equation and its application to stationary and moving vanes,pipe bends.
06.	**Dimensional Analysis And Hydraulic Similitude:** Dimensional analysis, Buckingham's theorem, Important dimensionless numbers and their significance, Geometric, Kinematic and dynamicsimilarity; Model analysis.

07.	**Boundary Layer Analysis:** Boundary layer thicknesses, Boundary layer over a boundary layer, Application of momentum boundary layer, Laminar sub-layer, smooth and rough boundaries, local and Average friction coefficients, separation.

Books Recommended:

References	1. Kumar, D.S. "Fluid Mechanics and Fluid Power Engineering". SeventhEd. S.K. Kataria& Sons Publishers, New Delhi,2008-2009. 2. Garde R.J "Engineering Fluid Mechanics",1988. 3. Kumar, K.L. "Engg. Fluid Mechanics", Eurasia Publishing House (P) Ltd.New Delhi, 1984. 4. Streter, V.L., Wylie, E.B. and Bedford, K.W. "Fluid Mechanics" McGrawHill, New York, 2001. 5. Asawa, GL, Fluid Flow in Pipes & Cannels 2008? CBS Publishers, newDelhi, 2000. 6. Mohanty "Fluid Mechanics"Printice Hall of India second Ed.,2010.

Subject: Surveying-I (Code: CVT203)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Midterm	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: To impart basic understanding of various aspects related to system of Geometrics and other physical measurements in the field of Civil Engg.

Course Outcomes:

CO1: To understand the importance of Engineering Surveys especially land surveying.

CO2: To know about the basic principles and types of land surveying.

CO3: To understand the mechanics concerned with the response of the rock to the force field of its physical environments.

CO4: To know the theory, working principles, and numerical aspects of various surveying method viz., chain, compass, plain table and levelling

Details of Course

Unit	Course Contents
Unit -1	**a. Introduction:** Importance, Principles of Surveying. Types of Surveying. **b. Chain Surveying:** Field Equipment, Methods of chaining, Offsets, corrections i n chaining, obstacles in chain surveying; plotting; Degree of accuracy. Tape and chain corrections
Unit - 2	**a. Prismatic compass surveying:** Instruments; Principle, Procedure and precautions. Closed traverse; corrections; local attraction; plotting. **b. Plane Table Surveying:** Field equipments, Methods of plane tabling, Two point and Three point problem, Precautions, Accuracy
Unit - 3	**a. Levelling: Instruments:** Field book recording, Bench mark & its types, methods of reduction of levels, va rious types of field works; contouring; Plotting. Testing and Permanent adjustments. Sensitivity of bubble tube. **b. Areas and Volumes:** Methods of determining areas and volumes viz Borrow - pits.

Books Recommended:

References	1. Surveying Vols. I & II by Dr. K.R. Arora 2. Surveying Vols. I & II, by Duggal, S.K. 3. Surveying & Levelling by Basak 4. Surveying & Levelling Vols. I & II by Kanetkar,T. P. and Kulkarni, S.V 5. Surveying & Levelling by P.B. Shahni 6. Surveying Vol. I & II, by Punmia, B. C

Subject: Building Materials and Construction (Code: CVT204)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: At the end of this course the students should have learnt about the various materials, both conventional and modern, that are commonly used in civil engineering construction. Further the students should be able to appreciate the criteria for choice of the appropriate materials and the various tests for quality control in the use of these materials.

Course Outcomes:

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

1. Develop knowledge of material science and behavior of various building materials used in construction.
2. Identify the construction materials required for the assigned work.
3. Provide procedural knowledge of the simple testing methods of cement, lime and concrete etc.
4. Adopt suitable repair and maintenance work to enhance durability of buildings.
5. Develop knowledge of various state-of-the-art materials used in construction in the modern times.

S. No.	Contents
01.	**Introduction**: Functions of buildings and structure in general. Loads on buildings as per IS 875, IS 1893 and NBC. Functional requirements of buildings and necessity of byelaws.
02.	**Stones – Bricks – Concrete Blocks:** Stone as building material; Criteria for selection; Tests on stones; Deterioration and Preservation of stone work; Bricks , Classification, Manufacture of clay bricks, Tests on bricks, Compressive Strength, Water Absorption, Efflorescence, Bricks for special use – Refractory bricks, Cement and Concrete hollow blocks, Light weight concrete blocks – Code Practices.
03	**Lime – Cement – Aggregates - Mortar:** Lime, Preparation of lime mortar, Cement – Ingredients, Manufacturing process, Types and Grades, Properties of cement and Cement mortar, Hydration, Compressive strength, Tensile strength, Soundness and consistency, Setting time, Aggregates – Natural stone aggregates, Industrial byproducts (EAF Slag, Steel Slag), Crushing strength, Impact strength, Flakiness, Abrasion Resistance, Grading, Sand – Bulking – Code Practices
04.	**Concrete:** Concrete, Ingredients, Manufacture, Batching plants, RMC – Properties of fresh concrete - Slump Flow and compaction. Properties of hardened concrete – Compressive, Tensile and shear strength, Modulus of rupture Tests.

	Mix specification – Mix proportioning: IS method. High Strength Concrete and HPC – Other types of Concrete – Code Practices
05.	**Metals:** Composition and properties of ferrous and non ferrous metals used in civil engineering. Effect of various heat treatments on the properties of steel and its alloys. Corrosion and methods of corrosion control.
06.	**Modern Materials:** Glass – Ceramics, Fibre glass reinforced plastic, Clay products – Refractories, Composite materials, Applications of laminar composites, Fibre textiles – Geosynthetics for Civil Engineering applications. Thermocol – Panels of laminates, Properties and uses of asphalt, bitumen, rubber and asbestos.
07	**Timber**: Characteristics of good timber, defects in timber, seasoning of timber, tests on timber. Market forms, Industrial timber, Plywood, Veneers.
08.	**Paints and Varnishes:** Composition, preparation, properties, test and uses of paints, varnishes and distempers

Books Recommended:

Text Books	1. Building Materials and Construction – Arora & Bindra, Dhanpat Rai Publications. 2. Building Construction by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi. 3. R. K. Rajput, Engineering Materials, S. Chand & Company Ltd., 2000.
References	1. Building Materials by Duggal, New Age International. 2. Alternate Building Materials and Technology, Jagadish, Venkatarama Reddy and others; New Age Publications. 3. M. S. Shetty, Concrete Technology (Theory and Practice), S. Chand & Company Ltd., 2003.

Subject: Mathematics -I (Code:MAT202)	Year & Semester: B. Tech. Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

CO1	Evaluate Laplace transform of the standard functions and learn properties of Laplace transformation.
CO2	Apply Laplace transform to solve Linear differential equations, Integral Equations.
CO3	Evaluate Fourier Integral, Fourier transformation for various function.
CO4	Apply Fourier transform to solve Ordinary and Partial differential equations.
CO5	Apply the concepts of random variables, probability distribution in fields.

Detailed Syllabus:

Unit-I Laplace Transforms: (15 Hours)

Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem and properties of Convolution, Evaluation of definite integrals by Laplace transforms, Use of Laplace transforms in the solution of linear differential equation.

Unit-II Fourier Transforms: (12 Hours)

Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations.

Unit-III Probability: (15 Hours)

Point function and Set function, Probability Set function, Random variable, Probability density function, Mode and median of distribution of a random variable, Probability distribution function and its properties, Mathematical expectation, Laws of expectation, Mean, Variance, Moments, Moment generating function, Inequalities of Markov and Chebyshev and their applications. Binomial, Poisson and normal Distributions, Beta and gamma Distribution, t-distribution, F-Distribution, Chi-square Distribution and their applications.

Text Books:

1. L. Debnath and D. Bhatta, *Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007).
2. M. R. Spiegel, *Schaum's Outlines Laplace Transforms*, Tata Mc-Graw Hill, (2005).
3. R. V. Hogg, J. W. McKean and A. T. Craig, *Introduction to Mathematical Statistics*, 2nd Edition, Prentice Hall, (2007).
4. R. A. Johnson, I. Miller and E. Freund, *Probability and Statistics for Engineers*, 8th Edition, Pearson Education, (2015).

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).
2. V.K. Rohatgi and A. K. Md. Ehsanes Saleh, *An Introduction to Probability and Mathematical Statistics*, 2nd Edition, John Wiley and Sons, (2008).

Basics of Industrial Economics and Management (Code: HST202)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

1. **Course Objectives:**
   - I. Describe the economic terms; concepts and explain the law of demand and Utility analysis.
   - II. Identify the various market structures and Analyse the various costs incurred by economic units.
   - III. Describe the process of management's four functions: planning, organizing, directing and controlling and make an appropriate staffing decision which includes recruitment and selection.
   - IV. Demonstrate organization's characteristics and how they might impact on management practices and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

Details of Course

S. No	Contents
1	**INDUSTRIAL ECONOMICS:** Managerial Economics, Nature, Scope and role of Managerial Economics. Basic Concepts Demand and Supply. Elasticity of demand and its Measurements, Indifference Curve analysis, Law of Diminishing Marginal Utility, MRTS, Utility Analysis.
2	**CONSUMPTION AND MARKET STRUCTURE:** Market Structure; Perfect and imperfect competition. Monopoly, Monopolistic Competition. Oligopoly. Duopoly. Cost Analysis and Types of Costs.
3	**MANAGEMENT- INTRODUCTION TO MANAGEMENT:** Nature, Meaning, and Significance of Management, Managerial functions, Principles of Management, Evolution of Management Thoughts-Traditional, Behavioral, Systems, Contingency and Quality viewpoints. Contemporary management practices, Managing in global environment
4	**PLANNING:** Nature & Elements of Planning, Planning types and Models, Planning in learning organizations; Decision making process–Approaches to decision making, Decision models, Pay off Matrices, Decision trees; Strategic Planning-an overview; Management by Objectives (MBO), SWOT Analysis.

5	**ORGANISING:** Nature of Organizing, Basic issues in organizing – Work Specialization, chain of common Delegation, Decentralization, Span of Management, Line-staff Authority and Decentralization, Staffing Decisions – Authority and Responsibility Relationships, Decision Making Process, Models of Decision Making.
6	**EVALUATION:** Nature of Evaluation, Design and Problems – Appraising Techniques– Developing Compensation Plans, Direction, Co-ordination, Quantitative and Qualitative measures of Control, Feedback Management; System and Process of Controlling, Control techniques and information technology; Social Corporate Responsibility of Business.

After the completion of course, students will be able,

CO1	Develop the ability to explain economic terms and concepts.
CO2	Understand and explain the function of market, its types and determination of price under various competencies.
CO3	Demonstrate the ability to employ the economic way of thinking like application of marginal analysis, use of benefit/cost analysis, utility and demand forecasting techniques.
CO4	Demonstrate the ability to recognize when change is needed, adapt to change as it occurs, and lead the change as effective managers.
CO5	Practice the process of management's four functions: planning, organizing, directing and controlling. make an appropriate staffing decision which includes recruitment and selection design, implement and evaluate training programmes.
CO6	Understand an organization's characteristics and how they might impact on management practices and analyze both qualitative and quantitative information to isolate issues and formulate best control methods.

Suggested Books

1. Robbins, S.P., Management Concepts, Pearson Education India, New Delhi.

2. Koontz,Weilhrich & Cannice, Management: A Global and Entrepreneurial Perspective, 13th Edition, McGraw Hill.

3. Jones and George, Contemporary Management, McGraw Hill.

4. Richard L. Draft, The New Era of Management, Cengage India

5. Stoner, Jetal, Management, Prentice Hall of India., New Delhi

6. Chandan, J.S., Management Concepts and Strategies, Vikas Publishing House.

7. Ahuja HL. Managerial Economics, S. Chand and Company Ltd. 2007.

Course Title: FLUID MECHANICS LAB-I (Code: CVL205)	Year & Semester: B. Tech Civil Engineering 2nd Year & 3rd Semester		Total Course Credit: 1		
			L	T	P
			0	0	2
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

CO1: To develop understanding about hydrostatic law, principle of buoyancy and stability of a floating body and application of mass, momentum and energy equation in fluid flow.

CO2: To imbibe basic laws and equations used for analysis of static and dynamic fluids.

CO3: To inculcate the importance of fluid flow measurement and its applications in Industries**.**

CO4: To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows.

List Of Experiments:

1	To determine experimentally the metacentric height of a ship model.
2	To verify the Bernoulli's equation experimentally.
3	To determine the coefficient of discharge, coefficient of velocity and coefficient of contraction of an orifice or a mouthpiece of a given shape.
4	To calibrate an orifice meter and to study the variation of coefficient of discharge with Reynold's number.
5	To calibrate a venturimeter and to study the variation of coefficient of discharge with Reynold's Number.
6	To calibrate sharp crested rectangular and triangular weir.
7	To verify momentum equation experimentally

Course Title: SURVEYING LAB-I (Code: CVL206)	**Syllabus for B.Tech. 3rd Semester (Civil Engineering)**	**Total Course Credit: 2**		
Mid Term/Class Assessment	End Term	L	T	P
40 Marks	60 Marks	0	0	4

CO1 To handle and use basic surveying equipment viz., chain/ Tape, compass. Prepare layout plans.

CO2 To measure angles and bearings.

CO3 To handle and use plain table, and level.

CO4 To handle and use level. Preparation of L –sections and X-sections showing relative levels of various points

Unit No.	**Course Contents**	**Lecture Hours**
Unit -1	Introduction: Importance, Principles of Surveying. Types of Surveying.	4
	Chain Surveying: Field Equipment, Methods of chaining, Offsets, Correction in chaining, Obstacles in chain-surveying; plotting Degree of accuracy. Tape and chain corrections	7
Unit -2	Prismatic compass surveying. Instruments; Principle, Procedure and precautions, Closed traverse; Corrections, Local attraction, Plotting	6
	Plane Table Surveying; Field equipment, Methods of plane tabling, Two point and Three-point problem, Precautions, Accuracy	6
Unit -3	Levelling; Instruments; Field book recording, Bench Mark and its types, Methods of reduction of levels, Various types of field works,	9
	Areas and Volumes: Methods of determining areas and volumes viz., Borrow - pits.	4

Course Title Structural Engg. Lab. -I (Code: CVL207)	**Syllabus for B.Tech. 3rd Semester (Civil Engineering)**	**Total Course Credit: 1**		
Mid Term/Class Assessment	End Term	L	T	P
40 Marks	60 Marks	0	0	2

CO1 To understand the behavior of structural members/elements under loading.

CO2 To understand the properties of structural members so that one can judge at a glance safety and usage of a given structure.

CO3 To determine crippling load of columns with different end conditions.

CO4 To measure the ultimate shear strength.

S No	**Name of experiment**	**Objective**
1	Tensile Test of Steel	To determine yield strength, ultimate tensile strength, percentage elongation and modulus of elasticity (Plot, stress strain curve).
2	Tensile and Compressive strength of Timber	i. Parallel to grains ii. Perpendicular to grains.
3	Shear test of steel/timber	To measure ultimate shear strength. Shear modulus. Plot shear stress strain Curve.
4	Torsion test of steel	To measure angle of twist. Ultimate Torsional strength stress strain Curve.
5	Buckling load of columns various end conditions.	To determine crippling load of columns with different end conditions and compare theoretical values.
6	Verification of Maxwell's Theorem.	To verify the Principle of Maxwell's theorem
7	Testing of Bricks and Stones as per IS Specifications.	
8	Verification of horizontal thrust in a three hinged arch	To evaluate experimentally horizontal thrust in a three hinged arch and draw influence line diagram for the horizontal thrust

Subject: Structural Analysis-II (Code: CVT250)	Year & Semester: B.Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To introduce the students to basic theory and concepts of classical methods of structural analysis.

Course Outcomes:

CO1: Identify the degree of indeterminacy of different types of structures

CO2: Determine the strain energy and compute the deflection of determinate beams, frames and trusses using energy principles.

CO3: Analyze statically indeterminate structures by force methods.

CO4: Analyze statically indeterminate structures by force methods.

CO5: Analyze building frames by approximate methods for horizontal and vertical loads.

S. No.	Contents
01.	**Indeterminate Structures:** Introduction to Indeterminate Structures; Stability; Static and Kinematic Indeterminacy of Structures viz. Beams, Frames, Trusses
02.	**Energy Methods of Analysis of structures:** Strain energy and strain energy density – strain energy due to axial load (gradual, sudden and impact loadings) , shear, flexure and torsion – Castigliano's theorems – Maxwell's reciprocal theorem - Principle of virtual work – unit load method - Application of energy theorems for computing deflections in determinate beams , plane frames and plane trusses – lack of fit and temperature effects - Williot Mohr's Diagram.
03.	**Force methods of Analysis of structures:** Method of least Work; Method of consistent deformation for analysis of indeterminate beams; continuous beams; Deflection of truss joints; Analysis of two hinged arches, Clepryon's Three- Moment Equation.
04.	**Displacement methods of Analysis of structures:** Analysis of Indeterminate Beams & Frames (with & without Sway) by Classical Displacement Methods viz; Slope Deflection Method, Kani's Method & Moment Distribution Method.
05.	**Approximate Methods for Indeterminate Structural Analysis:** Portal and Cantilever methods for the analysis of frames.

Textbooks:

4. Hibbeler, R. C. (2002). *Structural Analysis*, Pearson Education (Singapore) Pt. Ltd., Delhi
5. Leet, K. M. and Uang, C-M. (2003). *Fundamentals of Structural Analysis*, Tata McGraw-Hill Publishing Company Limited, New Delhi.

References:

5. C. S. Reddy, 'Basic Structural Analysis', Tata McGraw Hill, New Delhi.
6. C.K. Wang, 'Intermediate Structural Analysis', Tata McGraw Hill, New Delhi.
7. Junnarkar.S.B. and Shah.H.J, "Mechanics of Structures", Vol II, Charotar Publishing House, New Delhi 2016.

Subject: Fluid Flow in Pipes and Channels (Code: CVT251)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To develop the understanding of basic principles of fluid flow through pressure and gravity type conduit systems to ensure adequate water distribution to consumers and management of surface water resources.

Course Outcomes:

CO1: Analyze and perform calculations on open channel flows, compute water surface profiles and hydraulic jump characteristics.

CO2: Analyze and perform calculations on pipe flow problems involving turbulent flow, understand the concept of friction factor, head loss, and design of pipes and analysis of pipe-networks.

CO3: Perform calculations for determination of the drag and lift forces on submerged bodies.

CO4: Analyze water hammer phenomenon in closed conduits and design of surge tanks &Determine various hydraulic characteristics of turbines and pumps.

S. No.	Course Contents
01.	**Flow in Open Channels:** Uniform flow, Criticaldepth, Normal depth, Specific energy, Resistance formulae, Gradually varied flow equations, Classification of water surface profiles, Computation of water surface profiles, step by step method and graphical integration method. Hydraulic Jump, Momentum Principle for open channels, Evaluation of the jump elements. Venturi flumes.
02.	**Flow Through Pipes:** Nature of turbulent flow in pipes, Hydraulic and energy grade lines. Equation for velocity distribution over smooth and rough pipes, Resistance coefficient and its variation, Nikuradse experiments, Moody diagram, Flow in sudden expansion, Contraction, diffusers, Bends, Valves and Siphons; Concept of equivalent length, branched pipes, pipes in series and parallels, Simple networks, Transmission of power.
03.	**Fluid Flow Past Submerged Bodies:** Drag and lift, Drag on a sphere, cylinder and disc: Lift, Magnus effect and Circulation.

04.	**Water Hammer and Surge Tanks:** Sequence of events after sudden value closure, pressure diagrams, Gradual closure or opening of the valve, Instantaneous closure of valve in a rigid pipe, Instantaneous closure of valve in an Elastic pipe and Compressible fluid, Methods of Analysis; Surge Tanks, Location of Surge Tanks, Types, Design of surge Tanks.
05.	**Hydraulic Machines:** Types of Turbines, Description and principles of Impulse and reaction Turbines, Unit quantities and specific speed, Runaway speed, Turbine characteristics, Selection of Turbines, Cavitation; Draft Tube, Draft Tube dimensions, Types of draft tubes; Governing of Turbines; Centrifugal pumps, specific speed, power equirements, Reciprocating pumps.

References:

1. Kumar, D.S. "Fluid Mechanics and Fluid Power Engineering". Seventh Ed. S.K. Kataria& Sons Publishers, New Delhi,2008-2009.
2. K. Subramanaya "Open channel Flow"3rd.Tata McGraw Hill Pub. Co. New Delhi,1999.
3. RangaRaju, K.G., "Flow Through Open Channels", 2nd.Tata McGraw Hill Publishing Company Ltd., New Delhi,1986.
4. Nigam "Handbook of Hydroelectric Engg.", 2001.
5. Garde R.J "Engg. Engineering Fluid Mechanics", 1988.
6. Deshmukh ,M.M, " Water Power Engineering"Danpat Rai & Sons, NaiSarak New Delhi, 1978.
7. Asawa, GL "Fluid Flow in Pipes and Channels" CBS Publishing.

Subject: Surveying-II (Code: CVT252)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To impart basic understanding of various aspects related to system of Geometrics and other physical measurements in the field of Civil Engg.

Course Outcomes:

CO1 To understand traversing and numerical aspects of traversing.

CO2 To understand trigonometric leveling and geodetic surveying.

CO3 To understand curves and setting out works.

CO4 To understand tachometric surveying involving angular measurements.

S. No.	Course Contents
01.	**a. Theodolite:** Construction, Temporary and Permanent adjustment of transit Theodolite; angle measurements and errors, Theodolite Traversing-Traverse calculations; Traverse adjustments. **b. Tacheometry:** Stadia and its principal, analytic lens, Heights and distances from stadia intercepts; subtense method, tangential method; Accuracy, tacheometric alidade
02.	**a. Trigonometrical levelling:** Curvature and refraction, Axis-signal correction, method of trigonometrical levelling. **b. Curves:** Elements of simple curve; design and setting out of a simple curve, compound curve, transition curve, Vertical Curves.
03.	**a. Setting out works:** Setting out Buildings, Culverts and bridges, Tunnels. Transfer of alignment. Fixing of horizontal and vertical controls. **b. Geodetic surveying:** Triangulation-principles: choice of stations, Base line measurements- electronic methods of distance measurements, Triangulation adjustments-Heights-figure adjustments; Spherical excess, Computations of sides of spherical triangles.

References:

1. K. R. Arora., Surveying Vol. I& II, standard book; 16 edition2018
2. Duggal, S.K., Surveying Vols. I & II,McGraw Hill Education; Fourth edition 2017
3. Basak, Surveying & Levelling, McGraw Hill Education; 2 edition2017.
4. Kanetkar,T. P. and Kulkarni, S.V, Surveying & Levelling Vols. I & II, PuneVidyarthiGrihaPrakashan, 2014.
5. P.B. Shahani,Advance Surveying ,Vol I & II, Handbook, New Delhi Oxford and IBH
6. publication,1981.
7. Punmia, B. C., Surveying Vol. I & II,Laxmi Publications Pvt Ltd 2016.

Subject: Surveying-Camp (Code: CVT253)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 2		
			L	T	P
			0	0	4
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To impart the practical understanding of various aspects related to surveying and other physical measurements in the field of Civil Engg.

Course Outcomes:

CO1 To understand trigonometric leveling and geodetic surveying.

CO2 To understand traversing and numerical aspects of traversing.

CO3 To understand curves and setting out works.

Note: The Surveying Camp shall be of two week duration

S. No.	Course Contents
1	Triangulation: (i) Ordinary Methods (ii) On the basis of Global positioning system (GPS)
2	Shifting of Horizontal and Vertical Controls
3	Setting out of works
4	Setting out of Curves
5	Contouring: (i) Contouring of a Dam Reservoir/Railway line (ii) Preparing a contour plan by various methods (iii) Setting out of Contour lines of an appropriate site

Subject: Engineering Geology (Code: CVT254)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Outcomes:

CO1- Behavior of rocks at different scales, under loading conditions at ground surface and in the subsurface.

CO2- The link between rock mechanics, geology and hydrogeology.

CO3- The various engineering properties of earth's materials.

CO4- Geologically significant places to learn in-situ character of rocks in quarries/ outcrops, cuttings, dams, tunnels and underground excavations.

Details of Course:

S. No	Contents
1.	Physical Geology; geology and its relevance to civil engineering, geological work of wind, rivers, glaciers and seas.
2.	Petrology; formation of rocks, types/field classification, weathering of rocks, origin of soils.
3.	Structural Geology; folds, faults, joints, unconformities.
4.	Engineering Geology; geological considerations in tunnels, dams, bridges, building sites; landslides
5.	Earthquakes; basic definitions, types and causes, distribution in the world, seismic zones.
Part B: Materials	
1.	Stones; their engineering properties; bricks, classification and strength requirements; tiles and their uses
2.	Timber; properties, defects, seasoning, decay and prevention.
3.	Lime; types, properties and tests.
4.	Other materials

Books Recommended:

S.No.	Name of Books/ Authors/ Publishers
1.	Bangar, K.M, Principles of Engineering Geology Standard Publishers Distributors, New Delhi.
2.	Parbin Singh Engineering Geology, Katson Publishers New Delhi.
3.	Billings, M.P., Structural Geology, Prentice-Hall India, New Delhi.
4.	Blyth, F.G.H and de Freitas, M.H. Geology for Engineers, ELBS, London.
5.	Gokhale, KVG.K and Rao, D.M., Experiments in Engineering Geology, Tata- McGraw Hill, New Delhi.
6.	Kesavulu, C. Textbook of Engineering Geology, Macmillan, India Ltd. New Delhi.
7.	Geology for Civil Engineers by McLean and Gribble, Spon Press, Taylor &Francis Group, London.
8.	Building Materials by Parbin Singh, Katson Publishers New Delhi.
9.	Civil Engineering Material by Gurbachan Singh, Standard Publishers New Delhi.
10.	Building Material by Dutta.
11.	Building Materials by Duggal S. K., New Age International (P) Ltd. Publishers, New Delhi.

Subject: Civil Engineering Drawing (Code: CVT255)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To impart understanding & knowledge of various aspects of Building Drawing and Construction.

Course Outcomes:

CO1: Identify the factors to be considered in planning and construction of buildings and execute construction activities in building projects

CO2: Knowledge about various types of foundations and their constructional aspects

CO3: Able to draw different types of drawings required for construction of buildings

CO4: Drawing of building plan, elevation and sections including slabs

S. No.	Course Contents
01.	Standard Conventions in Drawing: Basic principles of planning and design in buildings.
02.	Foundations: Principles of foundations, types and suitability of foundations including strip, pad, raft, pile and pier foundation, timbering for excavation of foundation.
03.	Damp proofing: Causes, effects, parts of building likely to be affected of methods of damp-proofing , materials of damp proofing.
04.	Masonry: Principles and significance of brick masonry; terms used and types of brick bonds; principles and significance of stone masonry; types of stone masonry walls; building uses of common types of stones.
05.	Drawing of plans, elevations and sections giving constructiondetails of important building components including foundation,plinth, DPC, lintels, slabs and roofs; full specifications for eachcomponent.
06.	Simple drawing exercises on layouts of building services such selectrical, water supply and plumbing, sanitation etc.
07.	Doors, Windows, Ventilators and Lintels; Location, size anddifferent types including steel and aluminum: types of lintels andtheir construction details. Drawing of typical doors, windows and ventilators.

08.	Drawing of R.C.C. slabs & beams (including cantilevers), columns and footings.
09.	Stairs and Staircases: Various types and materials; proportioning of staircase, brief introduction of ramps, lifts and escalators. Drawing of R.C.C. stair case.
10.	Floors; Consideration of choice in ground and upper floors;various types of floors and their suitability; flooring materials andtheir construction details.
11.	Roofs & Roof Coverings: Classification of roofs with special reference to pitched roofs; different roof coverings and details of rain proofing at top wall. Drawings of various timber roof trusses with joint details.

References:

1. ShahM.G, Building Drawing,McGraw-Hill Inc.,US; 2nd Revised edition 1985.
2. Chakorobarty, Civil Engineering Drawing
3. J.B. Mc. Kay, Civil Engineering Drawing
4. Sharma and Koul, Textbook of Building Construction, S Chand & Co Ltd; 6th Revised edition, 1987.
5. Nevile, A.

Course Title: Mathematics-II (Code: MAT251)	**Syllabus for B.Tech. 4th Semester (Civil Engineering)**	**Total Course Credit: 4**			
Mid term Examination	Class Assessment (Assignments, interaction, tutorials, viva etc.)	End-Term Examination	L	T	P
30 Marks	10 Marks	60 Marks	3	1	0

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

CO1	Solve problems related to differentiation of complex functions, Analytic functions, harmonic functions and conformal mapping.
CO2	Solve problems related to Integration of complex functions.
CO3	Expand complex functions in terms of Taylor series, Laurant series and classify singularities of a complex function and calculation of residues.
CO4	Apply the concepts of Complex Analysis in Boundary value problems and potential theory.
CO5	Solve problems related to Legendre and Bessel functions.

Detailed Syllabus:

Unit-I: Analytic Functions **(10 hours)**

Function of a Complex variable, Limit, Continuity and Differentiablity of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Construction of Analytic function whose real or imaginary part is given, Elementary function, Reflection Principle, Conformal Mapping, Angle of Rotation, Mapping by Elementary functions. Bilinear Transformation.

Unit-II: Complex Integration **(10 Hours)**

Derivatives of functions w(t), Definite Integrals of functions w(t), Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Antiderivatives and Definite Integrals, Cauchy Integral Formula, Cauchy Integral formula for Derivatives, Evaluation of Improper Definite Integrals by Contour Integration, Liouville's Theorem and its consequences.

Unit-III: Taylor and Laurant Series- Residue Theorem and Applications **(7 Hours)**

Taylor Series, Laurant Series, Classification of Singularities, Residues, Cauchy's Residue Theorem and its Applications, Zeros of Analytic functions, Rouche's Theorem and its consequences, Gauss Lucas Theorem.

Unit-IV: Boundary Value Problems and Potential Theory **(6 Hours)**

Laplace's Equation and Conformal Mappings, Standard Solution of Laplace equation, Steady –State Temperature Distribution, Two Dimensional Electrostatics.

Unit-V: Special Functions **(8 Hours)**

Legendre's functions, Rodrigue's formula, generating functions for Legendre's Polynomials and recurrence formulae. Bessel's functions, Recurrence formulae and Bessel's functions of integral order.

Text Books:

1. J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 8th Edition, Mc-Graw Hill, (2009).
2. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Publications, (2008).

Reference Books:

1. Alan Jeffrey, *Complex Analysis and Applications*, 2nd Edition , CRC Press (2005).
2. T Needham, *Visual Complex Analysis*, Oxford University Press. (1998)

Course Title: FLUID MECHANICS LAB-II(Code: CVL256)	**Syllabus for B.Tech. 4th Semester (Civil Engineering)**	**Total Course Credit: 1**		
Mid Term/Class Assessment	End Term	L	T	P
40 Marks	60 Marks	0	0	2

S. No.	**Contents**	**Contact Hours**
1	To find friction factor for pipes of different materials.	3
2	To determine the minor head loss coefficient for different pipe fittings.	3
3	To determine the surface profile and total head distribution of a vortex.	3
4	To determine the elements of a hydraulic jump in a rectangular channel.	3
5	To determine the Manning's rugosity coefficient of a laboratory flume.	3
6	To obtain the velocity distribution for an open channel and to determine the values of α, β and n.	3
	Total	18

Course Title: SURVEYING LAB-II (Code: CVL257)	**Syllabus for B.Tech. 4th Semester (Civil Engineering)**	**Total Course Credit: 1**		
Mid Term/Class Assessment	End Term	L	T	P
40 Marks	60 Marks	0	0	2

Unit No.	**Course Contents**	**Lecture Hours**
Unit -1	a. Study of Equipment: Ordinary Theodolites, E D M Theodolites and G T S Theodolites.	15
	a. Temporary Adjustments of a Theodolite.	
	b. Field work using a Theodolite: (i). Measurement of Horizontal and Vertical Angles by ordinary and electronic Theodolites. (ii). Measurement of linear and angular measurements using EDM/GTS Instruments (Basic Introduction)	
Unit -2	a. TACHEOMETRIC SURVEYING: (i) Study of equipment and graduated staff. (ii) Temporary adjustment	15
	b. Field work: (i). Determination of Constants " K & C " (ii). Stadia Traversing & recording stadia field book (iii). Location of Details by Tacheometric Methods	
	a. Subtense Bar Method: Theory and Field work	
	Total	30

Subject: Geology Lab. (Code: CVL258)	Year & Semester: B. Tech Civil Engineering 2nd Year & 4th Semester		Total Course Credit: 1		
			L	T	P
			0	0	2
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	End-Term (60 Marks)		

Course Objective: To expose the students toward the study of rocks and minerals and to understand their physical attributes.

Course Outcomes:

CO1 To understand the physical properties of Minerals.

CO2 To understand the various characteristics of Rocks.

CO3 Determination of Specific gravity of stones using various methods.

Course Contents:

S. No	Course Contents
1	The study of Physical Properties of Minerals.
2	Determination of Specific Gravity by: (a) Jolly's Spring Balance (b) Walkers Steel Yard Balance (c) Beam Balance
3	Study of Rocks and their Characteristics
4	Study and Sketching of various types of Geological Structures.
5	Determination of Dip and Strike with a Clinometer Compass.

COMPUTER SCIENCE ENGINEERING DEPARTMENT

<table>
<tr><td rowspan="2">Subject: Object Oriented Programming
(Code: CST201)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Computer Science Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td rowspan="2">Mid-Term</td><td rowspan="2">Class Assessment</td><td rowspan="2">3</td><td rowspan="2">1</td><td rowspan="2">0</td></tr>
<tr><td colspan="2">End-Term</td></tr>
<tr><td></td><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
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Course Objectives

- To explore the principles of Object Oriented Programming (OOP).
- To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.
- To use the object-oriented paradigm in program design.
- To lay a foundation for advanced programming.
- Provide programming insight using OOP constructs

Learning Outcomes

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

- Analyze the strengths of object oriented programming
- Design and apply OOP principles for effective programming
- Develop programming application using object oriented programming language C++
- Percept the utility and applicability of OOP.

Course Synopsis

- Classes and Objects, Polymorphism and Inheritance, Virtual Functions, Templates and Exception handling, Files and Streams, Standard Template Library.

Course Outline / Content	
Unit	**Topics**
1.	**Classes and Objects:** Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object oriented programming language. C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members. Functions- Function, function prototype, accessing function and utility function, Constructors and destructors, Copy Constructor, Objects and Memory requirements, Static Class members, data abstraction and information hiding, in line function.
2.	**Polymorphism and Inheritance:** Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of

	Operator Overloading and Conversion, Keywords explicit and mutable. Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Inheritance, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation, Classes Within Classes. Polymorphism- concept, relationship among objects in inheritance hierarchy, abstract classes, polymorphism.
3.	**Virtual Functions:** Virtual Functions- Pointers- indirection Operators, Memory Management: new and delete, Pointers to Objects, A Linked List Example, accessing Arrays using pointers, Function pointers, Pointers to Pointers, A Parsing Example, Debugging Pointers, Dynamic Pointers, smart pointers, shared pointers, Case Study: Design of Horse Race Simulation. Virtual Function- Friend Functions, Static Functions, Assignment and Copy Initialization, this Pointer, virtual function, dynamic binding, Virtual destructor.
4.	**Templates and Exception handling:** Templates- function templates, Function overloading, overloading Function templates, class templates, class template and Non-type parameters, template and inheritance, template and friends Generic Functions, Applying Generic Function, Generic Classes, The typename and export keywords, The Power of Templates. Exception Handling- Fundamentals, other error handling techniques, simple exception handling Divide by Zero, rethrowing an exception, exception specifications, processing unexpected exceptions, stack unwinding, constructor, destructor and exception handling, exception and inheritance.
5.	**Files and Streams:** Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output, Early vs. Late Binding.
6.	**Standard Template Library:** Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, Container Classes, General Theory of Operation, Vectors.

Books Recommended

Text Books	1. Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2. Balagurusamy, "Object Oriented programming with C++", Tata McGraw Hill.
References	1. BjarneStrustrup, "The C++ programming Language", Addison Wesley, 2. Booch, "Object Oriented Analysis and Design with Applications, Addison Wesley. 3. Chair H. Pappas & William H. Murray, "The Complete Reference Visual C++", TMH.

Subject: Database Management Systems (Code: CST202)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

The goal of this course is for students to become well-grounded in basic concepts necessary for understanding dB and their users. DBMS concepts, architecture, the concepts of the Entity Relationship(ER) model, the data abstraction and semantic modelling concepts leading to EER data model. Describe the basic relational model, its integrity constraints and update operations, and the operation of relational algebra, describe relational schema design, and it covers the normalization and functional dependency algorithm. Practical experience gained designing and constructing data models and using SQL to interface to both multi-user DBMS packages and to desktop DBMS packages.

Learning Outcomes

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

- Differentiate database systems from file systems by enumerating the features provided by database systems and describe each in both function and benefit.
- Define the terminology, features, classifications, and characteristics embodied in database systems.
- Demonstrate an understanding of the relational data model.
- Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.
- Formulate, using relational algebra, solutions to a broad range of query problems.
- Formulate, using SQL, solutions to a broad range of query and data update problems.
- Demonstrate an understanding of normalization theory and apply such knowledge to the normalization of a database.
- Use an SQL interface of a multi-user relational DBMS package to create, secure, populate, maintain, and query a database.
- Understand the different query processing and transaction management techniques.
- Recover a database from a possible failure.

Course Synopsis

Introduction to DBMS- Historical perspective, File Versus a DBMS, Advantages of DBMS. ER model, Relational Algebra, Relational Calculus and SQL- Queries. ACID properties, transactions, schedules and concurrent execution of transactions. Overview of Query Evaluation, operator evaluation, Database Recovery, Failure classification, Recovery and atomicity.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction:** Introduction to DBMS- Historical perspective, File Versus a DBMS, Advantages of DBMS, Describing and storing data in DBMS, Architecture of a DBMS, Different Data Models, Entity Relationship model- features of ER model, conceptual design using ER model, design for large enterprises, Relational model structure and operations, Integrity constraints over relations
2.	**Query Languages:** Relational Algebra, Relational Calculus and SQL- Queries, Constraints, Form of SQL query, UNION, INTERSECT and EXCEPT, Nested queries, Aggregate Operators, Null values, Complex Integrity constraints in SQL, triggers and Embedded SQL
3.	**Database Design:** Mapping ER model to Relational form, Functional Dependency- Closer of functional dependencies, closer of attributes, canonical cover and Properties of Decompositions. Normalization process – 1NF, 2NF, 3NF and BCNF, Multivalued dependency- Closer properties of Multivalued dependency and 4NF, Join dependency- PJNF, Decomposition Algorithms.
4.	**Transaction Management:** ACID properties, transactions, schedules and concurrent execution of transactions, Concurrency control- lock based protocol, Serializability, recoverability, dealing with deadlocks and Concurrency control without locking.
5.	**Query Processing:** Overview of Query Evaluation, operator evaluation, Algorithms for relational operations- Selection operation, General selection condition, Projection operation, Join operation, set operation and aggregate operation, Evaluation of relational operations
6.	**Database Recovery:** Failure classification, Recovery and atomicity, Log-based recovery shadow paging and Advanced Recovery Techniques. Security and Authorization- Access control, Direct access control and Mandatory access control, Role of DBA.

Books Recommended

Text Books	1. Database system Concept by Silberschatz and Korth 6th Edition 2. Elamsri, Navathe, Somayajulu and Gupta, "Fundamentals of Database Systems", Pearson Education 3. Database Systems, Thomas Connolly, Carolyn Begg, Pearson 4th Edition
References	1. Raghu Ramakrishnan, Johannes Gehrke, "Database Management Systems", Tata McGraw Hill.

Subject: Discrete Mathematics (Code: MAT203	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Prerequisites: Elementary knowledge in basic set theory.

Course Outcomes : This course covers elementary discrete mathematics for computer science and engineering. So, at the end of the course, the student should:

CO 1	Be acquainted with counting techniques
CO 2	Be able to identify structures on many levels
CO 3	Have knowledge of the concepts needed to test the logic of a programme
CO 4	Be able to apply elementary algorithms and classical theorems on graphs.
CO 5	Be able to apply the concepts and properties of algebraic structures like groups, rings and fields

Detailed Syllabus:

Unit 1: Combinatorics **(08 hrs)**

Introduction, basic counting principles, pigeon hole priniciple with applications, inclusion-exclusion principle, recurrence relations and generating functions, introduction to special numbers.

Unit 2: Ordered sets and Lattices **(10 hrs)**

Ordered sets, Partially ordered sets, Supremum and Infimum, well ordered sets, Lattices, basic properties of algebraic systems defined by lattices, complemented lattices and distributive lattices. Coding Theory: coding of binary information and error detection, decoding and error correction.

Unit 3: Graph Theory-I **(10 hrs)**

Introduction to graphs, graph terminology, Euler and Hamiltonian paths, graph connectivity, graph homomorphism, graph isomorphism, planar graphs, graph coloring, matrix representation of graphs, introduction to directed graphs, strong directed graphs

Unit 4: Graph Theory-II **(06 hrs)**

Introduction to trees, properties of trees, spanning trees, minimal spanning trees, Prim's Algorithm and Kruskal's Algorithm, matrix tree theorem, Degree sequences in trees, Necessary and sufficient conditions for a sequence to be a degree sequence of a tree.

Unit 5: Algebraic Structures **(08 hrs)**

Groups, subgroups, generators and relations, cyclic groups, groups of rotations and reflections, cosets and Langrange's Theorem, homomorphisms and normal subgroups, isomorphisms, automorphisms, semi-groups, rings, ring homomorphism and isomorphism, ideals, finite fields.

Text Books:

1. G. Chartand and P. Zhang, *A first course in graph theory,* 2nd Edition, Dover publications, New York, (2012).

2. M. R. Spiegel: *Discrete Mathematics (Schaum's Outline series)*, Tata Mc-Graw Hill, (2009).

3. K. H. Rosen, *Discrete Mathematics and its applications*, 5th Edition, Tata Mc-Graw Hill, (2003).

Reference Books:

1. C. L. Liu, *Elements of Discrete Mathematics*, 2nd Edition, Tata Mc-Graw Hill, (2000).

2. B. Kolman, R. Busby and S. Ross, *Discrete Mathematical Structures*, 6th Edition, Prentice Hall, (2009).

3. D. B. West, *Introduction to Graph Theory*, 2nd Edition, Pearson publications, (2002).

4. T. Koshy, *Discrete Mathematics with Applications*, 1st Edition, Elesvier Academic press, (2004).

Subject: Signals & Systems (Code: ECT203)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

- To develop an understanding about basic signal and system modeling concept and definitions.
- To develop an understanding about the application and use of mathematical transforms and state-variables in order to solve electrical engineering problems.
- To develop knowledge about use of a modern computation software tool for the analysis of electrical engineering problems.

Learning Outcomes

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

- Should have gained knowledge about continuous-time signals,discrete-time signals,linear time-invariant systems theory and applications.
- Should be able to perform mathematical and graphical convolution of signals and systems.
- Should be able to solve electrical engineering signals and circuit problems

Course Synopsis

Basics of signals and its classification; Linear Time invariant systems; Fourier Transforms; Signal Transmission through Linear Systems; Sampling; Concept of Laplace Transforms; Fundamentals of Z-transform.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction to signals:** Classification of signals; Deterministic and non-deterministic, periodic and aperiodic, even and odd signals, energy and power signals, elementary signals; exponential, sinusoidal, impulse, step, ramp, pulse, square wave signals. Time shifting, time scaling and time-inversions of signals.
2.	**Linear Time invariant systems:** Continuous time system, basic system properties like causality, time invariance, stability, linearity, memory, order of system, interconnection of systems, Linear time invariant systems, characterization, unit impulse response , convolution, properties of LTI systems, linear constant co-efficient differential equations and system description.
3.	**Fourier Transforms:** Deriving Fourier transform from Fourier series, Fourier transform of arbitrary signal, Fourier transform of standard signals, Fourier transform of periodic signals, properties of Fourier transforms, Fourier transforms involving impulse function and Signum function. Introduction to Hilbert Transform.
4.	**Signal Transmission through Linear Systems:** Linear system, impulse response, Response of a linear system, Linear time invariant (LTI) system, Linear time variant

	(LTV) system, Transfer function of a LTI system. Filter characteristics of linear systems. Distortion less transmission through a system, Signal bandwidth, system bandwidth, Ideal LPF, HPF and BPF characteristics, Causality and Poly-Wiener criterion for physical realization, relationship between bandwidth and rise time.
5.	**Sampling:** Sampling theorem – Graphical and analytical proof for Band Limited Signals, impulse sampling, Natural and Flat top Sampling, Reconstruction of signal from its samples, effect of under sampling – Aliasing, Introduction to Band Pass sampling.
6.	**Laplace Transforms:** Review of Laplace transforms, Partial fraction expansion, Inverse Laplace transform, Concept of region of convergence (ROC) for Laplace transforms, constraints on ROC for various classes of signals, Properties of L.T's relation between L.T's, and F.T. of a signal. Laplace transform of certain signals using waveform synthesis.
7.	**Z–Transforms:** Fundamental difference between continuous and discrete time signals, discrete time signal representation using complex exponential and sinusoidal components, Periodicity of discrete time using complex exponential signal, Concept of Z- Transform of a discrete sequence. Distinction between Laplace, Fourier and Z transforms. Region of convergence in Z-Transform, constraints on ROC for various classes of signals, Inverse Z-transform, properties of Z-transforms.

Books Recommended

Text Books	1. Signals, Systems & Communications - B.P. Lathi, BS Publications, 2003. 2. Signals and Systems - A.V. Oppenheim, A.S. Willsky and S.H. Nawab, PHI, 2nd Edn
References	1. Signals & Systems - Simon Haykin and Van Veen,Wiley, 2nd Edition. 2. Network Analysis - M.E. Van Valkenburg, PHI Publications, 3rd Edn., 2000. 3. Fundamentals of Signals and Systems Michel J. Robert, MGH International Edition,2008 4. Signals, Systems and Transforms - C. L. Philips, J.M.Parr and Eve A.Riskin, Pearson education.3rd Edition, 2004.

Subject: Electronics (Code: ECT207)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

- To get basic idea about types, specification and common values of passive components.
- To familiarize the working and characteristics of diodes, transistors, MOSFETS and some measuring instruments.
- To understand working of diodes in circuits and in rectifiers.

Learning Outcomes

Student can identify the active and passive electronic components. Student can setup simple circuits using diodes and transistors. Student will get fundamental idea about basic communication systems and entertainment electronics.

Course Synopsis

Semi conductors, PN Junction Diode, Transistors, Field Effect Transistor, Amplifiers And Oscillators, Operational Amplifiers.

Course Outline / Content	
Unit	**Topics**
1.	**Semiconductors:** Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors, Charge Densities in Semiconductors, Mass action Law, Current Components in Semiconductors, The Continuity Equation, Injected minority Charge Carrier, Hall effect.
2.	**PN Junction Diode:** Characteristic and analysis, Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED‟s), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode, Clipping and clamping circuits.
3.	**Transistors:** Construction and characteristics of bipolar junction, transistors (BJT‟s)- Comm. Base, Comm. emitter, Comm. Collector configuration. Transistor at low frequencies – small signal low frequency transistor model (hparameters). Analysis of transistor amplifier circuit using h-parameters. Transistor biasing and bias stabilization: the operating point, stability factor, analysis of fixed base bias, collector to base bias, Emitter resistance bias circuit and self bias circuit. Bias compensation techniques.
4.	**Field Effect Transistor:** Construction and characteristics of JFET, JFET biasing circuit, JFET amplifier, MOSFET construction and characteristics.
5.	**Amplifiers And Oscillators:** Classification of amplifiers, concept of feedback, general characteristics of feedback amplifiers, Single stage RC coupled amplifier. Oscillators –

	Criterion for Oscillation, type of oscillators: Hartley oscillator, Colpitt Oscillator, RC Phase shift oscillator, Crystal oscillator.
6.	**Operational Amplifiers:** Introduction to Op-amp, Inverting and non-inverting configuration, Applications – adder, subtractor, integrator, differentiator.

Books Recommended

Text Books	1. Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata McGraw Hill, 2/e, 2013. 2. Electronics Devices and Circuit Theory by R. Boylestad, Pearson.
References	1. Bell, D. A., Electronic Devices and Circuits, Oxford University Press. 2. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education. 3. Frenzel, L. E., Principles of Electronic Communication Systems, McGraw Hill.

Subject: Electronics Lab. (Code: ECL208)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 1		
			L	T	P
			0	0	2
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

- To familiarize with the electronic components and basic electronic instruments.
- To enable the students to understand the behaviour of semi conductor devices based on experimentation.

Learning Outcomes

- To make familiar with PCB design and various processes involved.
- Ability to understand and analyse, linear and digital electronic circuits.

Course Synopsis

The objective of the lab course to familiarise students with concepts of basic electronics from a practical perspective.

Course Outline / Content	
Unit	**Topics**
1.	Characteristics of Semi conductor diode and Zener diode
2.	Characteristics of a NPN Transistor under common emitter, common collector and common base configurations
3.	Characteristics of JFET (Draw the equivalent circuit)
4.	Characteristics of UJT and generation of saw tooth waveforms
5.	Design and Frequency response characteristics of a common emitter amplifier
6.	Design and testing of RC phase shift, LC oscillators
7.	Single phase half-wave and full wave rectifiers
8.	a) To assemble a half wave and a full wave rectifier and to study their performance. b) To suppress the ripple using RC filter.
9.	To assemble and observe the performance of clipping and clamping circuits.
10.	Design and realize Inverting and Non-inverting amplifier using 741 Op-amp.

Books Recommended

Text Books	1. Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata McGraw Hill, 2/e, 2013 . 2. Electronics Devices and Circuit Theory by R. Boylestad, Pearson.
References	1. Bell, D. A., Electronic Devices and Circuits, Oxford University Press. 2. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education 3. Frenzel, L. E., Principles of Electronic Communication Systems, McGraw Hill.

Subject: Object Oriented Programming Lab (Code: CSL203)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 1		
			L	T	P
			0	0	2
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

- The student should be able to explain the fundamental properties of the C++ language.
- The student should be able to combine the elements of the C++ language in developing structured programs.
- The student should be able to demonstrate the skills necessary to correctly compile, debug, and test programs in C++.

Learning Outcomes

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

- Apply C++ features to program design and implementation
- Explain object-oriented concepts and describe how they are supported by C++
- Use C++ to demonstrate practical experience in developing object-oriented solutions
- Analyse a problem description and design and build object-oriented software using good coding practices and techniques
- Use common software patterns in object-oriented design and recognise their applicability to other software development contexts.

Course Synopsis

The objective of the lab course to familiarize students with C++ concepts.

Course Outline / Content	
Unit	**Topics**
1.	Function overloading and default arguments in C++
2.	Simple class design in C++, namespaces, object creation
3.	Class design in C++ using dynamic memory allocation
4.	Constructors and destructors
5.	Operator overloading and friend functions
6.	Overloading assignment operator and type conversions
7.	Inheritance, run time polymorphism and virtual functions
8.	Template design in C++
9.	Interface and abstract classes
10.	Exception handling
11.	File handling in C++

Books Recommended

Text Books	1. Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2. Balagurusamy, „Object Oriented programming with C++", Tata McGraw Hill.
References	1. BjarneStrustrup, "The C++ programming Language", Addison Wesley, 2. Booch, "Object Oriented Analysis and Design with Applications, Addison Wesley. 3. Chair H. Pappas & William H. Murray, "The Complete Reference Visual C++", TMH.

Subject: Database Management Systems Lab (Code: CSL204)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 1		
			L	T	P
			0	0	2
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

To implement the different concepts learned in the theory class of DBMS using embedded SQL and Oracle GUI.

Learning Outcomes

- Design and Implement a database schema
- Devise queries using DDL, DML, DCL and TCL commands.
- Develop application programs using PL/SQL
- Design and implement a project using embedded SQL and GUI.
- Apply modified components for performance tuning in open source software.

Course Synopsis

Familiarization of Oracle RDBMS, SQL*Plus, SQL- query structure, Exception Handling Compilation and Run-time, user-defined, Stored procedures. Triggers Data definition language triggers, Data manipulation triggers, Compound triggers and trigger restrictions.

Course Outline / Content	
Unit	**Topics**
1.	Familiarization of Oracle RDBMS, SQL*Plus, SQL- query structure, DDL-create, alter, drop, rename and Truncate DML-select, insert, update, delete and lock, set-operations, union, intersection and except, join, aggregate, group-by and having, nested sub-queries and views.
2.	DCL-grant and revoke, TCL-Commit, save point, rollback and set transaction. PL/SQL Environment, block structure, variables, operators, data types, control structures.
3.	Exception Handling: Compilation and Run-time, user-defined, Stored procedures-creation options, pass by-value and pass-by-reference, functions-pass-by-value and pass-by-reference.
4.	Triggers: Data definition language triggers, Data manipulation triggers, Compound triggers and trigger restrictions

Books Recommended

Text Books	1. James, Paul and Weinberg, Andy Oppel, "SQL: The Complete Reference", Tata McGraw Hill. 2. Michael McLaughlin, "Oracle Database 11g PL/SQL Programming", Oracle press.

Subject: Internet & Web Technologies (Code: ITL206)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 3rd Semester		Total Course Credit: 2		
			L	T	P
			0	0	4
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objectives

- To understand the concepts and architecture of the World Wide Web.
- To understand and practice markup languages
- To understand and practice embedded dynamic scripting on client side Internet Programming

To understand and practice web development techniques on client-side.

Learning Outcomes

- Create a basic website using HTML and Cascading Style Sheets.
- Design and implement dynamic web page with validation using JavaScript objects and by applying different event handling mechanisms.
- Design rich client presentation using AJAX.
- Design and implement simple web page in PHP, and to present data in XML format.
- Design front end web page and connect to the back end databases.

Course Synopsis

Client Sever implementation; Markup Languages; CSS; JavaScript; Introduction to .NET; Asp .NET.

Course Outline / Content	
Unit	**Topics**
1.	Administration, Client Sever implementation, Cyber law, Search Engine Optimization Techniques, Web Based Introduction to the Internet: brief overview of Internet, Internet and routing protocols, Web Server Systems
2.	Web 2.0: search, content networks, user-generated content, blogging, social networking, social media, tagging, social bookmarking, rich Internet applications, web services, location-based services, Web 2.0 monetization and business models, future of the Web.
3.	Mark up Languages (HTML, XHTML): HTML, dynamic HTML, XHTML syntax, headings, linking, images, special characters and horizontal rules, lists, tables, forms, internal linking, Meta elements.
4.	Cascading Style Sheets (CSS): separation of content and presentation, inline styles, embedded style sheets, conflicting styles, linking external style sheets, positioning

	elements, backgrounds, element dimensions, box model and text flow, media types, building a CSS drop-down menu, user style sheets.
5.	JavaScript: client side scripting, control statements, functions, arrays, objects, events. Document object model: objects and collections. Extensible Markup Language (XML) and RSS: Advantages and applications, structuring data, XML namespaces, Document Type Definitions (DTDs), XML vocabularies, RSS. Other advanced internet technologies: including HTML5, JSON and JQuery.
6.	Introduction to .NET and C#: Overview of the .NET Framework - Common Language Runtime – Framework Class Library - Understanding the C# Compiler. Basics of C#: Working with Variables - Making Decisions. Classes and Objects: Methods – Properties - Interface- Partial class- Null and Casting Handling Exceptions.
7.	ASP.NET Web Forms and Controls: Web Forms Controls Data Binding and Data Source Controls – Validation Controls - Master and Content pages. The Asp.Net Application Environment: Configuration Files - ASP.NET Application Security - Caching. Website Creation: Creation and hosting of websites including data connectivity.

Books Recommended

Text Books	1. Deitel H.M. and P. J. Deitel, Internet & World Wide Web. How to Program, 4/e, Prentice Hall, ISBN 0131752421, 2008. 2. J. Miller, V. Kirst and Marty Stepp, Web Programming Step by Step, Step by Step Publishing; 2nd edition (2012). 3. Stephen C. Perry, Core C# and .NET, Prentice Hall, New Jersey.
References	1. James Lee, BrentWare , "Open Source Development with LAMP: Using Linux, Apache, MySQL, Perl, and PHP" AddisonWesley, Pearson 2009. 2. Thomas A. Powell, "HTML & CSS: The Complete Reference", Fifth Edition, 2010. 3. Thomas A Powell, Fritz Schneider, "JavaScript: The Complete Reference", Third Edition, Tata McGraw Hill, 2013.

COMPUTER SCIENCE ENGINEERING DEPARTMENT

Subject: Data Structures (Code: CST250)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives

The course is intended to provide the foundations of the practical implementation and usage of Data Structures. The course intends to ensure that the student evolves into a competent programmer capable of designing and analyzing implementations of algorithms and data structures for different kinds of problems.

Learning Outcomes

By the end of the course, the students will be able to:

- Design and analyze programming problem statements.
- Choose appropriate data structures and algorithms and use it to design algorithms for a specific problem.
- Understand the necessary mathematical abstraction to solve problems.

Course Synopsis

The course seeks to empower students with advanced programming concepts to enable them to efficient programmers.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction:** Basic concept of data, structures and pointers.
2.	**Arrays:** Representation, implementation, polynomial representation. Limitations.
3.	**Strings:** Representation, String operations, Implementing String.h library functions.
4.	**Linked List:** Static and dynamic implementation. Single, double, circular, multiple linked lists.
5.	**Stacks:** Recursion and Stacks. Static and dynamic implementation. Expression evaluation. Infix, postfix expressions, multiple stacks.
6.	**Queues:** Static and dynamic implementation, circular queues, and implementation.
7.	**Hash Tables:** Hash tables implementation. Hashing techniques, single, double.
8.	**Storage Management:** Memory Management techniques, garbage collection.
8.	**Trees:** Binary trees, binary search trees, static and dynamic implementation. Tree operations, insert, delete, and search.
9.	**Heaps:** Implementation, sorting etc.
10.	**Sorting and Searching:** Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.
11.	**Graphs:** Representation of graphs, BFS, DFS sort. Graph Algorithms.

Text Books

1. Data Structures by Rajni Jindal
2. Data Structures - Schaum‘s Series

References

1. Data Structures by Knuth
2. Data Structures by Farouzan

Data Structures using C and C++ by Langsam, Augestern, Tanenbaum.

Subject: Introduction to Probability Theory and Statistics (Code: MAT252)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

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

CO1	Be acquainted with basic concepts of random variables, probability distribution.
CO2	Apply the concepts of different distributions and joint probability distribution on various platforms.
CO3	Be acquainted with concepts like correlation coefficient, Transformation of random variables, Regression Analysis and their applications
CO4	Compute point estimation of parameters, explain sampling distributions, and understand the central limit theorem.
CO5	Construct confidence intervals on parameters for a single sample, and perform hypothesis testing.

Course Outline / Content	
Unit	**Topics**
1.	**Random variables:** Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties. Discrete distributions: Binomial, Poisson and Geometric distributions and their applications. Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications
2.	**Two-Dimensional Random Variables:** Bivariate Random Variables, Joint Distribution Functions (Discrete and Continuous), Marginal and Conditional Distributions, Covariance and Correlation Coefficient, Transformation of random variables. Regression Analysis, Linear and Non-linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves.
3.	**Sampling Theory:** Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters.

Text Books:

1. Neil A. Weiss, *Introductory Statistics*, 9th Edition. Pearson, (2012).
2. Johnson, Miller and Freund, *Probability and Statistics for Engineers*, Pearson Education, 8th Edition, (2015).
3. S. C. Gupta, *Fundamentals of Statistics*, 7th Edition, Himalaya Publication (2018).
4. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
5. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, Second Edition, Prentice hall, (2007).

Reference Books:

1. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, Third Edition, Narosa Pub. House, (2008).
2. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 35th Edition, (2000).
3. V.K. Rohatgi and A. K. Md. Ehsanes Saleh, *An Introduction to Probability and Mathematical Statistics*, Second Edition, John Wiley and sons, (2008).
4. Hwei P. Hsu, *Schaum's Outline of Theory and Problems of Probability, Random Variables, and Random Processes*, Tata Mc-Graw Hill Edition (2014).

Subject: Digital Electronics & Logic Design (Code: ECT251)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives

To study number systems, simplification and implementation of digital functions, design & analysis of various combinational and sequential circuits, memory organization & its types and also understand basics of VHDL programming.

Learning Outcomes

The student will be able to:

- Use number systems, binary addition and subtraction.
- Understand the different switching algebra theorems and apply them for logic functions.
- Use the Karnaugh map for reduction of logic functions.
- Design the combinational circuits.
- Design the sequential circuits.
- Derive the state-machine analysis or synthesis.

Course Synopsis

Binary Systems, Boolean algebra & Logic Gates, Simplification of Boolean Functions, Combinational Logic, Sequential Logic, Registers, Counters, Data Converters, VHDL Programming.

Course Outline / Content	
Unit	**Topics**
1.	**Binary Systems:** Number Systems (binary, octal, hexadecimal), conversion from one system to another, addition and subtraction using different number systems, complements and codes.
2.	**Boolean algebra & Logic Gates:** Basic Definitions, Theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Logic Operations & Gates
3.	**Simplification of Boolean Functions:** K-Map Method and Tabulation Method (2, 3, 4, 5 variables)
4.	**Combinational Logic:** Design Procedure, Logic gates and Arithmetic Circuits
5.	**Combinational Logic with MSI & LSI:** Adder, Subtractor, Encoders, Decoders, Multiplexers, De-multiplexers ,ROMs, PLA‘s
6.	**Sequential Logic:** Moore and Mealy Machine Design Procedure state machine as a sequential controller, Flip-Flops (FF), Triggering, Analysis, State Reduction &

	Assignment. FF Excitation Tables, ASM Charts, Design Procedure, Design of Counters, Design with State Equations.
7.	**Registers, Counters:** Shift Registers, Synchronous and Asynchronous Counters **Data Converters:** ADC, DAC and their types.
8.	**VHDL Programming:** Introduction, Code Structure, Data Types Operators &Attributes, Concurrent Code, Sequential Code, Signals & Variables, Basic Circuit Designs.

Text Books

1. Digital Logic & Computer Design by M Morris Mano
2. Digital Electronics by Gupta & Singhal
3. Circuit Design with VHDL, V A Pedroni.

References

1. Digital principles and applications by A. P. Malvino
2. Switching Circuits by Marcus

Subject: Software Engineering (Code: ITT255)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives
This includes:

- Knowledge of basic SW engineering methods and practices, and their appropriate application; general understanding of software process models.
- An understanding of the role of project management including planning, scheduling, risk management, etc.;
- An understanding of software requirements and the SRS document.
- An understanding of approaches to verification and validation including static analysis, and reviews and an understanding of software testing approaches.
- An understanding on quality control and how to ensure good quality software

Learning Outcomes
After completion of course students will be able to:

- Apply the knowledge, techniques, skills, and modern tools of the discipline to narrowly defined engineering technology activities.
- Conduct standard tests and measurements, and to conduct, analyze, and interpret experiments.
- Identify, analyze, and solve narrowly defined engineering technology problems.

Course Synopsis
This course focuses on the principles and knowledge of software engineering. It covers the approaches taken in developing large programming projects, including requirements analysis, specification, design (e.g., top-down modularization), coding (e.g., structured programming), debugging and testing, maintenance, and thorough documentation as illustrated by examples and papers from current literature. This course will prepare students for working in teams to build quality software, and it provides the necessary hands-on practice for those who wish to enhance their knowledge base.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction:** What is software Engineering? Professional & Ethical responsibility, emergent systems properties, systems engineering, project management
2.	**Requirements and tools:** Requirements engineering process system model, critical system specification, informal and formal specifications.
3.	**Design methodologies:** architectural design, distributed systems design, application architectures, object oriented design, real time software design, user interface design, rapid software development, software reuse.
4.	**Structural and Functional Testing:** Verification and validation, software testing, critical systems validation
5.	**Models for reliability and cost:** Software cost estimation, quality management, process improvement, configuration management.
6.	**Security Engineering:** Service oriented software engineering, aspect oriented software Engineering.

Text Books

1. Software Engineering – A practitioner‘s approach by Roger S Pressman.
2. Fundamentals of Software Engineering by Ghezzi, jazayeri, Mandrioli.
3. Software Engineering by Sommerville.

References

1. Bernd Bruegge, Alan H.Dutoit, Object-Oriented Software Engineering, Pearson Education.
2. Stephen R. Schach, Object Oriented Software Engineering, McGraw-Hill

Subject: Communication System (Code: ECT253)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives

This course has been designed to familiarize students with the fundamentals of design and analysis of both analog and digital communications systems. In the first half of this course, "how a communications system works from signal modulation and transmission point of view" is discussed and in the second half the course "the behavior of the communications systems in the presence of noise" is discussed. In the last two weeks of this course, two most important areas of communications i.e., wireless and optical fiber communications are introduced to students to further motivate their interest in future communications courses and ultimately a career in communications industry.

Learning Outcomes

Upon completion of this course, students will have the ability to:

- Understand operation of digital and analog communication systems
- Obtain knowledge of theoretical principles of communication systems and statistical
- Properties of noise so to be able to apply them to engineering systems (a,c,e) should develop a knowledge and understanding of advanced communication.

Course Synopsis

This course provides a thorough introduction to the basic principles and techniques used in analog and digital communications. The course will introduce analog and digital modulation techniques, communication receiver and transmitter design, baseband and bandpass communication techniques, line coding techniques, noise analysis, and multiplexing techniques. The course also introduces analytical techniques to evaluate the performance of communication systems.

Course Outline / Content	
Unit	**Topics**
1.	Spread Spectrum Communication: Direct sequence and frequency hopped spread spectrum, spreading sequences and their correlation functions, Acquisition and tracking of spread spectrum signals Code Division Multiple Access (CDMA): DS-CDMA on AWGN channels, DS-CDMA on frequency selective fading channels, Performance analysis of cellular DS-CDMA, Capacity estimation, Power control effect of imperfect power control on DS-CDMA performance, Soft Hand offs, Spreading/coding tradeoffs, multi carrier CDMA, IS95A CDMA systems, 3rd Generation CDMA systems, Multi user detection, Optimum receivers, SIC, PIC receivers and performance.
2.	Networks & Services: Network Transmission System Design Services, Characterization of networks & teleservices, The Telephone Network – Past, Present & Future, and Network issues.

3.	Data Communication Networks: Basic principles of data communication – synchronous and asynchronous transmission – digital data transmission formats NRZ, RZ, AMI, ASI & Manchester coding, Error correcting codes, Hamming codes, Orthogonal codes, Switching – Circuit switching, Message switching, Packet switching, Standard communication interface multipliers and concentrators, Protocols (BOP-COP – standard networks and standards, OSI, (D) ARPANET, NICNET, SNA, SELS etc. Lan types of LAN – WAN, Digital telephony, Basic principle of ISDN – E Mail – Voice mail.
4.	Transmission Principles: Transmission aspects, Signals and Impairments, Digital Speech Transmission Digitisation of Speech & Audio.
5.	Teletraffic: Digital Networks, Network Synchronization, Multiplexing – Digital Hierarchies, Synchronous Digital Hierarchy, Digital Switching, Signaling, Introduction to Teletraffic.
6.	ISDN & ATM: Integrated Services Digital Network – ISDN, Broadband ISDN & ATM, Broadband Access Networks, Optical Networks. Network Aspects: Intelligent Network, Network Management, and Introduction to Network management softwares.

Text Books

1. Andrew J Viterbi, "CDMA Principles of spread spectrum communications", Addition Wesley, (1995).
2. J S Lee and L E Miller, "CDMA systems engineering handbook", Artech House, (1998).

References

1. Marvin K Simon, Jim K Omura, Robert A Scholtz, BaryKlevit, "Spread Spectrum Communications", (1995).
2. Sergio Verdu, "Multiuser Detection", Cambridge University Press, (1998).
3. Andrew S Tanenbaum, "Computer Networks", Prentice Hall of India.

Subject: Control Systems (Code: EET254)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objectives

- To develop an understanding of principles and applications of control systems in everyday life.
- To understand the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
- To develop an understanding of different aspects of stability analysis of systems in frequency domain and time domain.
- Design controllers to meet specifications.

Learning Outcomes

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

- Should have knowledge on open loop and closed loop control systems, concept of feedback in control systems etc.
- Should be able to apply the conceptual things to real-world electrical and electronics problems and applications.
- Test a linear system for stability by determining the system's pole locations.
- Test a linear system for controllability and observability.
- Should be able to develop and run a computer simulation of a control system using MATLAB.

Course Synopsis

Concept of feedback in control systems, mathematical modeling and transfer function derivations of Synchronouss, AC and DC servo motors, Transfer function representation through block diagram algebra and signal flow graphs, time response analysis of different ordered systems through their characteristic equation and time domain specifications, stability analysis of control systems in S-domain through R-H criteria and root-locus techniques, frequency response analysis through bode diagrams, Nyquist, polar plots and the basics of state space analysis.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction:** Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions.

	Transfer Function Representation: Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.
2.	**Time Response Analysis:** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.
3.	**Stability Analysis in S-Domain:** The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. **Root Locus Technique:** The root locus concept - construction of root loci-effects of adding poles and zeros to G(s) H(s) on the root loci.
4.	**Frequency Response Analysis:** Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots Stability Analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.
5.	**State Space Analysis of Continuous Systems:** Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books

1. Control Systems Theory and Applications - S. K. Bhattacharya, Pearson.
2. Control Systems - N. C. Jagan, BS Publications.
3. Modern Control Systems by Ogatta
4. Automatic Control systems by B C Kuo

References

1. Control Systems - A. Ananad Kumar, PHI.
2. Control Systems Engineering - S. Palani, TMH.
3. Control Systems - Dhanesh N. Manik, Cengage Learning.
4. Control Systems Engineering - I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers.
5. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.

Subject: Digital Electronics & Logic Design Lab (Code: ECL254)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

To gain a firm understanding of concepts learned in the Digital electronics and Logic design course work by practical demonstration.

Learning Outcomes

The student should be able to construct digital circuits using standards ICs and testing boards.

Course Synopsis

The objective of the lab course to familiarise students with digital electronics concepts from a practical perspective.

Course Outline / Content	
Unit	**Topics**
1.	To verify the truth table of following logic gates: a. AND OR and NOT b. NAND, NOR, XOR and XNOR
2.	To design and realize Logic gates using universal gates.
3.	To design and realize:- a. Half adder and verify its truth table. b. Full adder and verify its truth table. c. Half subtractor and verify its truth table d. Full subtractor and verify its truth table.
4.	To design a multiplexer/demultiplexer using two input NAND/NOR gates
5.	Design and realize the following flip flops using logic gates. • RS flip flop • JK flip flop • D flip flop • T flip flop
6.	To design a modulo-10 counter.
7.	To design frequency dividing circuits.

Text Books

1. Digital Logic & Computer Design by M Morris Mano.
2. Digital Electronics by Gupta &Singhal.
3. Circuit Design with VHDL, V A Pedroni.

References

1. Digital principles and applications by A. P. Malvino
2. Switching Circuits by Marcus.

Subject: Communication Systems Lab (Code: ECL255)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

This course has experiments provides the foundation education in communication engineering lab analysis and design. Through lecture, laboratory, and out-of-class assignments, students are provided learning experiences that enable them to Analyze and deign basic electronic circuits, to carry out AM and FM modulation experiments using discrete electronic components and Become proficient with computer skills (eg., OrCADPspice and MATLAB) for the analysis and design of circuits .

Learning Outcomes

- Study signal and linear time invariant system properties.
- Study, design, and build amplitude modulation systems examining tradeoffs in different communication systems.
- Study, design, and build angle modulation systems examining tradeoffs in different communication systems.
- Perform experiments in converting analog information into digital data via sampling, quantization, and coding.

Course Synopsis

Experiments illustrating the basic principles of communication systems.

Course Outline / Content	
Unit	**Topics**
1.	**Use Network Analyzer for the following experiments**: • Measurement of transmission line parameters. • S-parameter estimation of Microwave devices. • Design and testing of a Microstrip coupler. • Characteristics of λ/4 and λ/2 transmission lines.

2.	**Use appropriate simulation tools for the following experiments**: • Channel equalizer design (LMS, RLS) • Antenna Radiation Pattern measurement. • Performance Evaluation of digital modulation schemes • OFDM transceiver design • Simulation of Microstrip Antennas • Performance evaluation of simulated CDMA System.
3.	• Exponential Fourier Series • Fourier Series using Matlab • Autocorrelation and Energy Spectral Density • Amplitude Modulation • Envelope Detection • Study the Basic Operation of Phase-Lock-Loop (PLL) • FM Modulation and Demodulation using PLL • Single Transistor FM Voice Transmitter • A Simple Sampler using 555 Timer • Pulse Width Modulation • Pulse Position Modulation

References

1. Communication Systems Laboratory Manual by Muhammad Tahir et al Department of Electrical Engineering University of Engineering and Technology Lahore.

Subject: Data Structures Lab (Code: CSL251)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

The laboratory component will require the student to write computer programs using a careful choice of data structures (in C language) from scratch, based on the concepts learnt in the theory course.

Learning Outcomes

Basic concepts of data, linear lists, strings, arrays and orthogonal lists, representation of trees & graphs, storage systems, Arrays, Recursion, Stacks, Queues, Linked lists, Binary trees,

General Trees, Tree Traversal, Symbol Table and Searching Techniques, Sorting Techniques, Graphs.

Course Synopsis

To enable a student to have a practical command over the concepts learned in the course.

Course Outline / Content	
Unit	**Topics**
1.	Implement singly and doubly linked lists.
2.	Represent a polynomial as a linked list and write functions for polynomial addition.
3.	Implement stack and use it to convert infix to postfix expression
4.	Implement array-based circular queue and use it to simulate a producer-consumer problem
5.	Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
6.	Implement binary search tree.
7.	Implement priority queue using heaps
8.	Implement hashing techniques
9.	Implement various sorting techniques as taught in class.
10.	Implement Dijkstra's algorithm using priority queues
11.	Implement Prim's and Kruskal's algorithms

Text Books

1. Data Structures by Rajni Jindal
2. Data Structures - Schaum‘s Series

References

. 1. Data Structures by Knuth
2. Data Structures by Farouzan
3. Data Structures using C and C++ by Langsam, Augestern, Tanenbaum.

ELECTRICAL ENGINEERING DEPARTMENT

<table>
<tr><td rowspan="2">Subject: Electrical Measurement and Instrumentation (Code: EET201)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech. Electrical Engineering 2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td rowspan="2">Mid-Term</td><td rowspan="2">Class Assessment</td><td rowspan="2">3</td><td rowspan="2">1</td><td rowspan="2">0</td></tr>
<tr><td>End-Term</td></tr>
<tr><td></td><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
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Course Outcomes (COs):

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

CO1: To study the construction and principle of operation of various electromechanical indicating instruments and their mathematical analysis.

CO2: Evaluation of power, energy, and power factor of single and three phase circuits.

CO3: Determination of small, medium and large resistances using different methods.

CO4: Evaluation of Inductance, Capacitance, and Frequency using AC bridges.

Module 1: Definitions of basic terms used in measurements, errors and their classification.

Module 2: Electro-mechanical indicating instruments basic principles and their classification, various methods of damping, galvanometers (D'Arsonal and Ballistic) Ammeters and Voltmeters (PMMC, Induction, Electrostatic and Dynamometer type), errors in voltmeters and ammeters, extension of instrument ranges.

Module 3: Measurement of power in three phase a.c circuits using single-phase and three-phase watt-meter, Energy measurement using induction type meter, Energy meter testing, Power factor meter.

Module 4: Resistance classification, Measurement of Low resistance using potentiometer method and Kelvin double bridge, Measurement of medium resistance using ammeter-voltmeter method, substitution method, Wheatstone bridge, Measurement of high resistance using loss of charge method, Meggar.

Module 5: Measurement of Inductance, Capacitance and Frequency using a.c bridges. Potentiometers: DC and AC. Introduction to Virtual Instrumentation.

Recommended Book:

S. No	Name of Book	Author	Publisher
1	Electrical Measurements and Measuring Instruments	Golding, Widdis	Pitman
2	Electrical and Electronic Measurements	A.K Sawhney	DhanpatRai

Subject: Electronics I (Code: ECT201)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: Familiarize with the basic semiconductor devices and to know about the working and performance of semiconductor devices like diodes, BJTs and FETs. To understand DC analysis and AC models of semiconductor devices

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Familiarization with basic semiconductors

CO2: Understanding the behavior of different types of diodes at circuit level

CO3: Analyze and study the behavior of different types of transistors

CO4: Analysis of low frequency and high frequency amplifiers

S. No.	Particulars
1	**IntroductiontoSemiconductors:**Intrinsicandextrinsicsemiconductorstransportmechanismofcharge carriers, electric properties, Hall effect etc
2	**P-N junction diode: Current components in p-n junction,** Characteristics-piece wise linear approximation, Temperature dependence, Diode capacitance, and switching times, diode circuits' half wave, full wave rectifiers, clipping clamping circuits etc. Circuit operations and applications of Zener, avalanche, Schottky, Photo and tunnel diodes.
3	**BJT: Operation and characteristics,** Ebers-Mollmodel, CE,CB and CC configuration input, outputcharacteristicsandgraphicalanalysisofbasicamplifiercircuits,BiasingandBiasstability,Low frequency,h-parametermodel,AnalysisandDesignoftransistoramplifiercircuitsusingh-parameters. High frequency hybrid–pimodel, analysis and design of transistor amplifier circuits at high frequencies. Multistage amplifiers, phototransistors, Transistor as a switch
4	**JFET's Operation and characteristics,** model Application at low and high frequency, amplifiers, Switching circuits MOSFET types, Operation and characteristics
5	**Introduction to IGBT.**

Recommended Books:

S. No	Name of Book	Author
1.	Fundamentals of Microelectronics	Behzad Razavi
2.	Analysis and Design of Analog Integrated Circuits	Gray, Hurst, Lewis, Meyar
3.	Electronic Devices and Circuits	Millman,Halkias,andSatyabrataJit
4.	Analog Electronics	Maheshwari and Anand
5.	Electronic Devices & Circuits	Allan Mottershed
6.	Microelectronics	Sedra& Smith

Subject: Network Analysis (Code: ECT202)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective:

To introduce students with the basic concepts of Electric Circuit Theory and familiarize them how to analyze the circuits to get transits as well as steady state response of systems and their design, with emphasis on analysis in frequency domain using varioustechniques.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Comprehensive understanding of difference and network theorems

CO2: Analysis of transient and steady state response of circuits

CO3: Analysis of frequency response of circuits

CO4: Analysis of 2-port network and filters

S. No.	Particulars
1	**Development of the circuit Concept:** Charge and energy, capacitance, inductance and resistance parameters in the light of field and circuit concepts, approximate realization of a physical system as a circuit.
2	**Conventions for describing networks:** Reference directions for currents and voltages, conventions for magnetically coupled circuits, Circuit topology, KVL and KCL equations, Source transformation, Dual networks.
3	**First order differential equation:** Differential equations as applied in solving networks, Application of initial conditions, evaluating initial conditions in networks.
4	**Laplace Transformations:** Solution of Network problems with Laplace transformation, Heavisides expansion theorem.
5	**Wave form analysis and synthesis:** The unit step, ramp and impulse functions and their Laplace transforms, Initial and final value theorems, convolution integral, convolution as summation.
6	**Network theorems and impedance functions:** Complex frequency, transform impedance and transform circuits, series and parallel combinations of elements, Fosters reactance theorem and reciprocity theorem.
7	**Network Functions- Poles and Zeros**: Ports or terminal pairs, Network functions for one port and two port networks (ladder and general networks), Poles and Zeros of network functions, Restriction on pole and zero locations for driving point and transfer functions. Time domain behavior from pole zero plot.

8	**Two port parameters:** Relationship of two port parameters, Admittance, impedance, transmission and hybrid parameters, Relationship between parameter sets, Parallel connection of two port Networks, Characteristics impedance of two port networks.
9	**Filters** : Filter fundamentals – pass and stop band, filter classification, constant K & m derived filters, Behavior of characteristic impedance over pass & stop bands, design of filters.

Recommended Books:

S. No.	Name of Book	Author
1	Network Analysis	M. E. Van Valkenberg
2	Network Analysis and Synthesis	F. F. Kuo
3	Network Analysis and Synthesis	K. M. Soni
4	Network and Systems	Roy Choudhury

Subject: EMF & Waves (Code: PHT201)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: To acquaint the students with the behavior of Electromagnetic wave and field and to learn the application of Electromagnetic wave in different modes

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Students will remember the concepts of vector calculus and will be able to apply in Electrodynamics

CO2: Students will understand special techniques and will be able to evaluate potential problems

CO3: Students will understand the concepts of the Magnetostatic Fields

CO4: Students will understand the concept of the Electromagnetic wave and will be able its propagation in conductors and Rectangular wave guide in different modes

CO5: Students will understand the production of Electromagnetic waves i.e. how they radiate?

Unit	Course Content
I	**Introduction to the Electrostatics** Dirac–Delta function, Helmholtz Theorem, Divergence and Curl of Electrostatic field, Poisson Equation and Laplace Equation, Electrostatic Boundary Conditions, Basic Properties of the Conductors, Induced Charges, Surface Charge and Force on a Conductor, Numerical Problems.
II	**Special Techniques for Calculating the Potentials** Laplace's equation in one, two and three Dimensions, Boundary Conditions and Uniqueness Theorem, Conductors and Second Uniqueness Theorem, The Method of Images: The Classic Image Problem, Induced Surface Charges, Force and Energy, Separation of Variables: Cartesian and Spherical Coordinates, Multipole Expansion : Approximate Potential at Large Distances, The Monopole and Dipole Terms, Numerical Problems.
III	**Magnetostatics Fields** The Biot-Savert Law, Divergence and Curl of Magnetic field (**B**), Magnetic Vector Potential and Magnetostatics Boundary Conditions, Multipole Expansion of the

	vector Potential, Torque and Force on Magnetic Dipoles, Effect of a Magnetic Field on Atomic Orbitals, Ampere's law in Magnetic Materials, Numerical Problems.
IV	**Electro Magnetic Wave** Electromagnetic Wave in one Dimension, Sinusoidal Waves, Polarization, Boundary Condition, Reflection and Transmission, Energy and Momentum of Electromagnetic Wave, Propagation Through Linear Media, Reflection and Refraction at Oblique Incidence, Electromagnetic Wave in Conductors, Rectangular Wave Guide, TE and TM Modes Numerical Problems.
V	**Radiation** Dipole Radiation, Electric Dipole radiation, Magnetic Dipole radiation, Radiation from an Arbitrary Source, Power Radiated by a Point Charges, Numerical Problems.

Books Recommended:

1. Introduction to Electrodynamics by David J. Griffith (Prentice-Hall of India Pvt. Limited).
2. Classical Electrodynamics by J.D. Jackson (Wiley-India Private limited).
3. Mathematical Method for Physicists by A. Weber (Harcourt India).
4. Classical Theory & Fields by L.D.Landau , E.M. Lypshitz (Pergman).
5. Principles of Electrodynamics by Melvin Schwartz (McGraw-Hill).

Subject: Electrical Engineering Materials (Code: MMT209)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Objective: To acquaint the students with the fundamental knowledge of different kinds of materials used in electrical engineering and their importance in various applications /electrical devices

Course Outcomes (COs): Upon successful completion of the course, student should be able to: Recognise the importance of different kinds of materials in electrical engineering by their applications

CO1: Understand about the crystal structures of different metals and alloys

CO2: Understand the basics of electrical conduction in metal and alloys

CO3: Understand the semiconductor materials and dielectric behaviour of materials

CO4: Discussabout basic principles of magnetic materials and superconductive materials

CO5: Understand about optical properties in metals and non-metals

Unit	Course Content
I	**Crystal Structure** Atomic structure, Electronic configuration, Periodic table, Atomic bonding in solids- Ionic bonding, Covalent bonding, Metallic bonding, Crystalline nature of solids, Lattice Points, Unit Cell, Bravais Lattices, Crystal structure - SC, BCC, FCC and HCP, Atomic packing factor, Theoretical density, Crystallographic direction and planes, Liner and Planar densities, Anisotropy, Transformation in alloys, Polymorphism/Allotropy, Amorphous materials, Single crystal and polycrystalline material.
II	**Electrical Properties** Electrical conduction- Ohm's Law, Electrical resistivity, Electrical conductivity, Current density, Electron energy band, valence band, conduction band, Fermi energy, Electron mobility, Drift velocity, Influence of parameters on electrical resistivity of metals, Matthiessen's rule, Applications of different electrical conduction alloys
III	**Semiconductor Materials and Dielectric behavior** Semiconducting materials – Intrinsic and Extrinsic semiconductor, Concept of hole, n type and p-type extrinsic semiconductor,

	Temperature dependence of carrier concentration, Factors affecting charge mobility, Hall effect, Semiconductor devices – p-n rectifying junction, forward and reverse bias, breakdown phenomenon, Transistor – Junction transistor (n-p-n and p-n-p configuration), The MOSFET. Dielectric Behaviour – Capacitance, Dielectric constant, Electric dipole, polarization, Surface charge density, dielectric displacement, Types of polarization, Dielectric strength, Dielectric materials, Piezoelectricity
IV	**Magnetic Properties** Basic concept- Origin of magnetic dipole, Bohr magnetrons, Magnetic field vectors, Magnetic fulx density, Magnetic field strength, permeability, Magnetization, magnetic susceptibility, Types of Magnetism-Diamagnetic, Paramagnetic and Ferromagnetism, Curie temperature, Domains and Hysteresis, Hysteresis Curve, Remanence, Coercivity, Magnetic anisotropy Soft Magnetic Materials and their applications, Hard Magnetic Materials and their applications, some important carbon steels and precipitation hardening type magnet and their applications Super conductivity, Classification of superconductors- Meissner effect, Applications of superconducting materials
V	**Optical Properties** Electromagnetic radiations, Photon, Light Interactions with solids, Atomic and Electronic Interactions – Electronic polarization and Electron transitions, Optical properties of Metals – Photon absorption and reemission during excitation of electron (valence and conduction band), Optical properties of Non-metals – Refraction, Reflection, Absorption and Transmission. Application of Optical phenomena – Luminescence, Fluorescence, Phosphorescence, Light emitting diodes, Photoconductivity, Lasers, Optical fibers in communication

Recommended Books:

Text Books	1. William D. Callister, Jr. David G. Rethwisch : Material Science and Engineering – An introduction, 8th Edition John Wiley & Sons, Inc. 2. V. Raghavan: Material Science and Engineering , 8th Edition PHI Learning Private Limited, New Delhi 3. Dekker A. J: Electrical Engineering Materials, Prentice Hall India Learning Private Limited (1970) 4. Indulkar C. S.: An Introduction to Electrical Engineering Materials, Revised Edition S Chand & Co Ltd 5. Banerjee G.K: Electrical and Electronics Engineering Materials, Prentice Hall India Learning Private Limited (17 December 2014).
Reference Books	1. L. Solymar, D. Wash, & R. R. A. Syms: Electrical Properties of Materials, 9th Edition Oxford University Press 2. N Alagappan: Electrical Engineering Materials, 1st Edition McGraw Hill Education

Subject: Mathematics-III (Code: MAT204)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To understand various transformation techniques and their use to solve boundary value problems, and various linear differential equations.

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

CO1 Evaluate Laplace and Inverse Laplace transforms of various functions and related problems.

CO2 Evaluate Fourier and Inverse Fourier transforms of various functions and related problems.

CO3 Apply the methods of Laplace and Fourier transforms in solving ODE, PDE and Integral equations.

CO4 Evaluate Z-transforms and Inverse Z- transforms of various functions and apply these concepts to solve difference equations.

Unit	Course Content
I	**Laplace Transforms:** Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem and properties of Convolution, Evaluation of definite integrals by Laplace transforms, Use of Laplace transforms in the solution of linear differential equation.
II	**Fourier Transforms:** Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations.
III	**Z-Transforms:** Definition, Linearity property, Z- transform of elementary functions, Shifting theorems, Initial and Final value theorems, Convolution theorem, Inversion of Z- Transforms, Use of Z- transforms in solving difference equations.

Recommended Books:

Text Books	3. L. Debnath and D. Bhatta,*Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007). 4. M. R. Spiegel, *Schaum's Outlines Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005).
Reference Books	1. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008). 2. I.N. Sneddon, *The use of Integral Transforms*, 2nd Edition, Mc-Graw Hill Pub.,(1972).

Subject: Electronics-I Lab (Code: ECL204)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, synthesize basic electronic networks to get desired output.

Course Outcomes (COs):	Upon successful completion of the course, student should be able to:
CO1:	Familiarization and working of different electronic equipment
CO2:	Choose testing and experimental procedures on different types of electronic circuit and analyze their operation under different operating conditions
CO3:	Identify relevant information to supplement the Electronics I course
CO4:	Experimental characterization of diodes , BJT, and FETs

List of Experiments:

S. No.	Particulars
1	Study of CRO-Measurement of Voltage frequency and Phase of a given waveform
2	To obtain diode characteristics. Half wave and a full wave rectifier and to study their performance .Clipping and Clamping circuits
3	Comparison of Zener diode and Avalanche diode characteristics and to use Zener diode as a voltage regulator.
4	To obtain transistor characteristics in the following configurations. c) Common base d) Common emitter
5	To assemble a CE amplifier and observe its performance
6	To obtain frequency response of a RC coupled CE amplifier
7	To obtain JFET characteristics and to observe performance ofa source follower
8	JFET as a voltage variable resistor
9	Transfer and Output Characteristics of MOSFET

ELECTRICAL ENGINEERING DEPARTMENT

Subject: Electrical Machines-I (Code: EET250)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To study and understand different types of DC generators, motors and transformers, their construction, operating characteristics and applications.

Course Outcomes (COs): Upon successful completion of the course, students should be able to:

CO1: Describe the constructional details of a transformer, Apply the principles of electromagnetics to understand the operation of transformers and develop phasor diagrams.

CO2: Develop the equivalent circuit of a transformer and analyse the operating performance like voltage regulation, losses and efficiency

CO3: Evaluate the performance of autotransformers and three-phase power transformer connections.

CO4: Describe the principle of operation, constructional details, winding layout, magnetic field, emf induced and torque development in dc machines.

CO5: Analyse the operating performance and application suitability of dc generators

CO6: Investigate the starting and running performance of dc motos and determine their suitability for various applications,

Unit - I D.C. Generators:

Principle of operation – Action of commutator – constructional features – armature windings – lap and wave windings – simplex and multiplex windings- E.M.F Equation. Armature reaction – Cross magnetizing and de-magnetizing AT/pole – compensating winding – commutation – reactance voltage – methods of improving commutation. Methods of Excitation – separately excited and self-excited generators – build-up of E.M.F - critical field resistance and critical speed - causes for failure to self-excite and remedial measures. Load characteristics of shunt, series and compound generators.

Unit – II D.C Motors:

Principle of operation – Back E.M.F. - Torque equation – characteristics and application of shunt, series and compound motors – Speed control of D.C. Motors - Armature voltage and field flux control methods. Motor starters (3-point and 4-point starters) - Losses – Constant & Variable losses – calculation of efficiency – condition for maximum efficiency.

Unit - III Testing of DC Machines:
Methods of Testing – direct, indirect, and regenerative testing – Brake test – Swinburne's test – Hopkinson's test – Field's test - separation of stray losses in a d.c. motor test.

Unit - IV Single Phase Transformers:
Types - constructional details-minimization of hysteresis and eddy current losses- EMF equation - operation on no load and on load - phasor diagrams Equivalent circuit - losses and efficiency – regulation - All day efficiency - effect of variations of frequency & supply voltage on iron losses.

Unit - V Testing of Transformers and Poly-Phase Transformers:
OC and SC tests - Sumpner's test - determination of efficiency and regulation-separation of losses -parallel operation with equal and unequal voltage ratios - auto transformers-equivalent circuit - comparison with two winding transformers. Poly-phase transformers – Poly-phase connections - Y/Y, Y/Δ, Δ/Δ,Δ/ Y and openΔ.

Text Books:

1. Electrical Machines, I.J Nagrath& D.P Kothari, Tata McGraw-Hill.
2. Electrical Machines, P.S. Bimbra, Khanna Publishers.

Reference Books:

1. Electric Machinery, Fitzgerald, Kingslay, Umans, Tata McGraw-Hill
2. Electric Machines Vincent Del Toro, Prentice Hall
3. Electric Machinery and Transformer, Guru, Hiziroglu, Oxford University press
4. Electric Machinery Fundamentals, Chapman, McGraw-Hill.

Subject: Control Systems-I (Code: EET251)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Introduction to continuous control systems open/closed loop, Automatic/manual.

CO2: Mathematical modeling transfer functions block diagrams and signal flow graphs.

CO3: To determine the time response analysis of first and second order systems to various standard test inputs.

CO4: Stability studies of control systems, absolute and relative stability analysis.

CO5: Study of PID controllers, lead-lag Compensators, Introduction to modeling of dynamic systems in state space.

Module I: Introduction to continuous control systems:

Definition of a control system, open-loop, closed loop (automatic and manual) control.

Module II: Mathematical modeling:

Transfer functions, block diagrams, signal flow graphs

Module III: First and second order system:

Example of first and second order systems, responses of these systems to step, ramp, parabolic and sinusoidal inputs, transient, steady state and error analysis

Module IV: Stability studies:

Definition of stability, stability and pole locations, stability and Routh Table, stability and frequency response bode plot, polar plot, root locus.

Module V: Study of PID controllers, lead-lag Compensators

Proportional, Integral, Derivative (P.I.D) control. Compensator design Lead – lag compensators, Modeling of dynamic systems in state space (Introduction).

Text Books:

1.Control Systems Engineering, Norman S. Nise, John wiley.

2.Control Systems (Principles and Design), M. Gopal, Tata McGraw-Hill Publishing.

Reference Books:

1.Control systems, A. Anand Kumar, PHI Learning Private Limited.

2. Feedback control of dynamic systems, Franklin and Powel, Prentice Hall.

3. Design of feedback control systems, Stefani, Oxford university, press.

Subject: Thermal Engineering (Code: MET257)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

- **CO1:** Analyze and apply the laws of thermodynamics.
- **CO2:** Identify the properties of steam, steam table, property diagrams, and apply the vapor power cycle.
- **CO3:** Understand the working of Refrigeration and Air condition system.
- **CO4:** Understand the operations of Steam Turbine and Hydraulic Turbine.
- **CO5:** Understand the operations of I C Engine and Gas Turbine.

Unit- I

Fundamental Concepts & Definitions of Thermodynamics. Temperature as an important property. Work and Heat transfer. Pure substance, simple compressible substances. Laws of Thermodynamics, steady state-steady flow energy equation, Heat engine, Cornot Engine, Principle of increase of entropy.

Unit- II

PROPERTIES OF STEAM

Generation of Steam & Steam Table Pure Substances, Representation of pure substance properties on p-T, h-S and p-V diagrams, Introduction of Boiler.

VAPOUR POWER CYCLES: Carnot vapour power cycle, Effect of pressure & temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapour cycle, Combined cycles, Cogeneration.

Unit -III

REFRIGERATION & AIR CONDITIONING

Applications of Refrigeration, Thermal Principles for Refrigeration, Vapor Compression Refrigeration System, Psychometric properties, Wet bulb temperature, Psychometric chart, mixing process.Applications of Air-conditioning.

Unit -IV

STEAM TURBINE / HYDRAULIC TURBINE: Impulse turbine, Reaction turbine, work output, Losses and efficiency, degree of reaction, Modern steam power cycles, Regenerative and Reheat cycles, Governing of steam Turbines, Fields of Application.

Unit –V

I.C. ENGINES: Otto, Diesel and Dual cycles, Introduction I C Engine parts, Octane Number, various I.C engines fuels, Carburation and Injection , Lubrication, Cooling, Governing of I.C Engines.

GAS TURBINES: Present status and future trends, Basic types and Cycles, Thermal refinements, jet propulsion, fields of Application.

Text Books:

1. Nag, P. K., Basic and Applied Thermodynamics', , McGraw Hill, 2010, 2nd Edition

Reference Books:

1. Cengal, Y., Boles, "Thermodynamics", Mc-Graw Hill, 2001.
2. Van-Wylen, G.J., "Fundamentals of Classical Thermodynamics", John Wiley, 2001.
3. Moran, M.J., Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley, 2005.
4. Rajput, R.K., Thermal Engineering, Laxmi Publication,7thedition book, 2008.

Subject: Electronics-II (Code: ECT250)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective: To make students aware about the effects of feedback in electronic amplifiers, to analyze the amplifiers under different feedback configuration, to design different sinusoidal oscillators; To understand operational amplifier basics and its application in electronics, to design various wave shaping circuits, to understand power amplifiers and design power supplies.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Develop the concept of feedback analysis of different feedback topologies

CO2: Analysis and design of sinusoidal oscillators and multi vibrators

CO3: Understanding the basic concept of power amplifiers and IC regulated power supplies

CO4: Understanding basics of op-amps, its linear and non-linear applications and circuits of basic gates using various logic families

1 Feedback Basics:
Negative feedback, Effect of negative feedback on the performance of amplifiers e.g. on Gain, Bandwidth. Types of feedback amplifiers, current shunt, current series, voltage shunt, and voltage series feedback. Analysis of feedback amplifiers circuits

2 Sinusoidal Oscillators:
Basic operations, Positive feedback, analysis of general oscillator circuit, Barkhausen's criteria, various types of oscillator circuits and their analysis, Design of practical oscillator circuits.

3 Power Amplifiers and Power Supplies
Classification of power amplifiers, Class A, Class B, Class AB and Class C power amplifiers; analysis and design. Power supplies and IC regulators.

4 Operational Amplifiers:
Operational amplifiers stages, Differential amplifier, CMRR, Cascade amplifier, Ideal and practical operational amplifier characteristics and properties OP amp applications, inverting and non-inverting amplifiers, difference amplifier, summer differentiator and integrator, rectifiers etc. OP-AMP in analog computation. Frequency response, Gain Bandwidth product, Signal to noise ratio. Active Filters.

5 Multivibrators and Wave Form Generators
Bi-stable, Monostable and astable multivibrator circuits, and their analysis. Wave form generators, triangular and square wave generators.

6 Logic families:DTL, TTL, ECL, RTL

Recommended Books:

1	Fundamentals of Microelectronics	Behzad Razavi
2	Analysis and Design of Analog Integrated Circuits	Gray, Hurst, Lewis, Meyar
3	Electronic Devices and Circuits	Millman, Halkias, and SatyabrataJit
4	Analog Electronics	Maheshwari and Anand
5	ElectronicDevices&Circuits	Allan Mottershed
6	Microelectronics	Sedra& Smith

Subject: Hydraulics and Hydraulic Machines (Code: CVT259)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Objective

To impart the knowledge of basic principles of hydraulics and fluid flow in closed conduits, open channels and through hydraulic machinery. Also, introduce the students to planning and layout of hydro-electric power plant.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

- **CO1:** Understand the concept of real fluids, ideal fluids and various physical properties of fluids
- **CO2:** Tounderstand and apply the concepts of Fluid Statics, Kinematics and Dynamics
- **CO3:** Understand the basic hydraulics and carry out computations of flow through pipes and Open channels
- **CO4:** Appreciate the flow characteristics and selection of hydraulic turbines and pumps
- **CO5:** Have a general idea about planning and layout of power house of hydro-electric power plants

S. No	Contents
1.	**Introduction to Fluid Mechanics**: Engineering definition of Fluids, Evolution of the subject of Modern Fluid Mechanics, a brief historical overview, Real and Ideal Fluids.
2.	**Physical Properties of Fluids**: Mass Density, Specific weight, Viscosity, Compressibility, Surface tension, capillarity, etc.
3.	**Fluid Statics**: Pressure intensity, Pascal's law, pressure-density-height relationship, pressure measurement, manometers, pressure on plain and curved surfaces, centre of pressure.
4.	**Kinematics of Fluid Flow**: Types of flow, streamlines, path lines, streak lines, continuity equation or mass conservation principle.
5.	**Dynamics of Fluid Flow**: Equations of Motion- Derivation of Euler's equation along a streamline and it's integration to yield Bernouli's equation, Flow Measurement: Pitot tube, prandtl tube, venturimeter, orificemeter, orifice and mouth piece, notches and weirs.
6	**Flow Through Pipes**: Concepts of turbulent flow through pipes, hydraulic grade line, Darcy-Weisbach formula, Pipes in series and parallels, Design of pipes, power transmission through pipes.
7.	**Flow in Open Channels**: Resistance formulae- Chezy's and Manning's formulae, Prismatic Channels, hydraulic design of channels, Economical channel section.

8.	**Hydraulic Machinery**: Types of turbines, description and principles of Impulse and Reaction turbines, unit quantities and specific speed, runaway speed, turbine characteristics, selection of turbines, governing of turbines; Centrifugal pumps, specific speed, power requirement, reciprocating pumps.
9.	**Power House Planning**: General layout and arrangement of various hydro-mechanical and electrical units in surface and underground hydro-power plants.

Recommended Books:

1. Kumar, D.S. (2009) Fluid Mechanics and Fluid Power Engineering, S.K. Kataria and Sons.
2. Garde, R.J. and Mirajgoaker A.G. Engineering Fluid Mechanics, Scitech Publications(India) Pvt. Ltd.
3. Bansal, R.K. (2018) A text book of Fluid Mechanics and Hydraulic Machines, Laxmi Publications.

Subject: Mathematics-IV (Code: MAT253)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

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

- **CO1** Solve problems related to Differentiation of complex functions, Analytic functions, harmonic functions and conformal mapping.
- **CO2** Solve problems related to Integration of complex functions.
- **CO3** Expand complex functions in terms of Taylor series, Laurant series and classify singularities of a complex function and calculation of residues.
- **CO4** Apply the concepts of Complex Analysis in Boundary value problems and potential theory.
- **CO5** Solve problems related to Legendre and Bessel functions.

Unit-I: Analytic Functions

Function of a Complex variable, Limit, Continuity and Differentiablity of complex function. Cauchy-Riemann Equations, Polar Coordinates, Analytic function, Harmonic functions and Properties of Analytic functions, Construction of Analytic function whose real or imaginary part is given, Elementary function, Reflection Principle, Conformal Mapping, Angle of Rotation, Mapping by Elementary functions. Bilinear Transformation.

Unit-II: Complex Integration

Derivatives of functions w(t), Definite Integrals of functions w(t), Contours and Contour Integrals, ML Theorem, Cauchy Integral Theorem, Antiderivatives and Definite Integrals, Cauchy Integral Formula, Cauchy Integral formula for Derivatives, Evaluation of Improper Definite Integrals by Contour Integration, Liouville's Theorem and its consequences.

Unit-III: Taylor and Laurant Series- Residue Theorem and Applications

Taylor Series, Laurant Series, Classification of Singularities, Residues, Cauchy's Residue Theorem and its Applications, Zeros of Analytic functions, Rouche's Theorem and its consequences, Gauss Lucas Theorem.

Unit-IV: Boundary Value Problems and Potential Theory

Laplace's Equation and Conformal Mappings, Standard Solution of Laplace equation, Two Dimensional Electrostatics.

Unit-V: Special Functions

Legendre's functions, Rodrigue's formula, generating functions for Legendre's Polynomials and recurrence formulae. Bessel's functions, Recurrence formulae and Bessel's functions of integral order.

Text Books:

1. J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 8th Edition, Mc-GrawHill, (2009).
2. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rdEdition, Narosa Publications, (2008).

Reference Books:

3. Alan Jeffrey, *Complex Analysis and Applications*, 2ndEdition , CRC Press (2005).
4. T Needham, *Visual Complex Analysis*, Oxford University Press. (1998)

Subject: Electrical Machines-I Lab. (Code: EEL252)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objective:
To familiarize the students with the operation and performance of transformers and DC machines, and perform various tests on them.

Course Outcomes (COs): Upon successful completion of the course, students should be able to:

CO1: Determine the parameters of the equivalent circuit of a transformer.

CO2: Determine the performance indices of a transformer like voltage regulation and efficiency.

CO3: Connect single-phase transformers banks for three-phase power transformation.

CO4: Run a dc machine as a generator and understand the voltage build up.

CO5: Determine the external characteristics of various types of dc generators.

CO6: Run a dc machine as a motor and determine its performance under load.

List of Experiments:

The students will conduct a minimum of 10 experiments out of the following list:

S. No.	Name of the experiment
1	To perform open-circuit and short-circuit tests on a single-phase transformer
2	To perform polarity test on a single-phase transformer
3	To determine the efficiency and voltage regulation of a single-phase transformer
4	To perform Sumpner's test on two identical transformers
5	To study three-phase connections on a bank of three single-phase transformers
6	To study various parts of a dc machine and draw sketches of the same
7	To plot the saturation curve of a dc machine
8	To plot the external characteristics of a separately-excited dc generator.
9	To study the voltage build-up of a dc shunt generator

10	To plot the external characteristic of a dc shunt generator and compare the characteristics with that of a separately-excited generator
11	To plot the external characteristics of a dc series generator
12	To plot the external characteristic of a dc compound generator and run it as shunt, over-compound, flat-compound, under-compound generator and differentially-compounded generator
13	To study the methods of speed control of dc shunt motor.
14	To study the methods of speed control of dc series motor.
15	To plot the torque-speed characteristics of dc shunt and series motors

Subject: Electrical Measurement & Instrumentation Lab. (Code: EEL253)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Measurement of power in single phase and three phase circuits using single phase and three phase Wattmeter.

CO2: Energy measurement using watt-hour meter as well as using wattmeter and stop watch.

CO3: To study the constructional details of an electromechanical indicating instrument with the help of demonstration type of instrument.

CO4: Measurement of inductance and capacitance using Bridge technique (Anderson's bridge, Wheat-stone bridge).

CO5: Measurement of resistance by different methods (Loss of charge method, substitution method, Kelvin's double bridge).

CO6: To study RC and LC models of a transmission line and observe the variation of voltage magnitude and phase along the line.

List of Experiments:

Expt. No.	Name of the Experiment
1	Measurement of power in single phase and three phase circuits using single phase and three phase watt meters.
2	Energy Measurement using watt-hour meter as well as using wattmeter and stop watch.
3	To study the constructional details of electromechanical indicating instrument with the help of demonstration type of instrument.
4	Measurement of Inductance and Capacitance using a.c bridges (Anderson's Bridge, Wheat Stone's Bridge).
5	Resistance measurement using Loss of charge method, substitution method, Kelvin's double bridge.

Subject: Electronics II Laboratory (Code: ECL253)	Year & Semester: B. Tech Electrical Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize electronic feedback networks, operational amplifiers, and power amplifiers.

Course Outcomes (COs): Upon successful completion of the course, student should be able to:

CO1: Identify relevant information to supplement the Electronics II course

CO2: Experimental characterization of negative and positive feedback circuits

CO3: Experimental characterization and study of different applications of OPAMP's and 555 timer chip

CO4: Experimental Analysis of different topologies of Power Amplifiers

List of Experiments:

S. No.	Particulars
1	Feedback a. To assemble current series feedback amplifier and study its performance. b. To assemble a voltage shunt feedback amplifier and study its performance.
2	To assemble an RC phase shift oscillator.
3	To assemble a differential amplifier and obtainits CMRR.
4	To study different applications of OPAMPS. e. OP-AMP as an inverting amplifier. f. OPAMP as a non-inverting amplifier g. OPAMP as an integrator h. OPAMP as a differentiator
5	To measure the following parameters ofa typical OP-AMP. e. I/P Impedance f. O/P Impedance g. Slew rate h. CMRR
6	Obtain frequency response of an OP-AMP & hence find its band width.
7	Study performance of multivibrator circuits using 555 chip in following modes: **a.** Bistable **b.** Astable **c.** Monostable **d.** Useof555 chipas a timer circuit
8	To assemble a Schmitt trigger Circuit and to obtain its characteristics and to use it as squaring circuit.
9	To assemble a Class A Power amplifier and to determine its power gain
10	To study the performance of a voltage regulator IC Chip.

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Subject: Electronics-I (Code: ECT201)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: Familiarize with the basic semiconductor devices and to know about the working and performance of semiconductor devices like diodes, BJTs and FETs. To understand DC analysis and AC models of semiconductor devices.

Course Outcomes:

CO1 Familiarization with basic semiconductors

CO2 Understanding the behavior of different types of diodes at circuit level

CO3 Analyze and study the behavior of different types of transistors

CO4 Analysis of low frequency and high frequency amplifiers

Details of the Syllabus:

S. No.	Particulars
1	**IntroductiontoSemiconductors:**Intrinsicandextrinsicsemiconductorstransportmechanismofcharge carriers, electric properties, Hall effect etc
2	**P-N junction diode: Current components in p-n junction,** Characteristics-piece wise linear approximation,Temperaturedependence,Diodecapacitance,andswitchingtimes,diodecircuits'half wave, full wave rectifiers, clipping clamping circuits etc. Circuit operations and applications of Zener, avalanche, Schottky, Photo and tunnel diodes.
3	**BJT: Operation and characteristics,** Ebers- Mollmodel, CE,CB and CC configuration input, outputcharacteristicsandgraphicalanalysisofbasicamplifiercircuits,Biasing and Bias stability, Low frequency,h-parametermodel,AnalysisandDesignoftransistoramplifiercircuitsusingh-parameters. High frequency hybrid–pi model, analysis and design of transistor amplifier circuits at high frequencies. Multistage amplifiers, phototransistors, Transistor as a switch
4	**JFET's Operationand characteristics,** model Application at low and high frequency, amplifiers, Switchingcircuits MOSFETtypes, Operation and characteristics
5	**Introduction to IGBT.**

Recommended Books

S. No.	Name of Book	Author
1.	Fundamentals of Microelectronics	BehzadRazavi
2.	Analysis and Design of Analog Integrated Circuits	Gray, Hurst, Lewis, Meyar
3.	Electronic Devices and Circuits	Millman, Halkias, and SatyabrataJit
4.	Analog Electronics	Maheshwari and Anand
5.	ElectronicDevices&Circuits	Allan Mottershed
6.	Microelectronics	Sedra& Smith

Subject: Network Analysis (Code: ECT202)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To introduce students with the basic concepts of Electric Circuit theory and familiarize them how to analyze the circuits to get transits as well as steady state response of the system with emphasis on analysis in frequency domain using various techniques.

Course Outcomes:

CO1 Comprehensive understanding of difference and network theorems

CO2 Analysis of transient and steady state response of circuits

CO3 Analysis of frequency response of circuits

CO4 Analysis of 2-port network and filters

Details of the Syllabus:

S. No.	Particulars
1	**Development of the circuit Concept:** Charge and energy, capacitance, inductance and resistance parameters in the light of field and circuit concepts, approximate realization of a physical system as a circuit.
2	**Conventions for describing networks:** Reference directions for currents and voltages, conventions for magnetically coupled circuits, Circuit topology, KVL and KCL equations, Source transformation, Dual networks.
3	**First order differential equation:** Differential equations as applied in solving networks, Application of initial conditions, evaluating initial conditions in networks.
4	**Laplace Transformations:** Solution of Network problems with Laplace transformation, Heavisides expansion theorem.
5	**Wave form analysis and synthesis:** The unit step, ramp and impulse functions and their Laplace transforms, Initial and final value theorems, convolution integral, convolution as summation.

6	**Network theorems and impedance functions:** Complex frequency, transform impedance and transform circuits, series and parallel combinations of elements, Fosters reactance theorem and reciprocity theorem.
7	**Network Functions- Poles and Zeros**: Ports or terminal pairs, Network functions for one port and two port networks (ladder and general networks), Poles and Zeros of network functions, Restriction on pole and zero locations for driving point and transfer functions. Time domain behavior from pole zero plot.
8	**Two port parameters:** Relationship of two port parameters, Admittance, impedance, transmission and hybrid parameters, Relationship between parameter sets, Parallel connection of two port Networks, Characteristics impedance of two port networks.
9	**Filters** : Filter fundamentals – pass and stop band, filter classification, constant K & m derived filters, Behavior of characteristic impedance over pass & stop bands, design of filters.

Recommended Books:

S. No.	Name of the Book	Author
1	Network Analysis	M. E. Van Valkenberg
2	Network Analysis and Synthesis	F. F. Kuo
3	Network Analysis and Synthesis	K. M. Soni
4	Network and Systems	Roy Choudhury

Subject: Signals and Systems (Code: ECT203)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To acquire knowledge and become familiar with various types of signals, their use in various types of systems with emphasis in time domain.

Course Outcomes:

CO1	Generate and characterize various continuous and discrete time signals and perform basic operations on signals.
CO2	Classify systems based on their properties and determine the response of LTI systems using convolution.
CO3	Analyze the spectral characteristics of continuous-time periodic and aperiodic signals using Fourier analysis.
CO4	Apply the Laplace transform and Z- transform for analysis of continuous-time and discrete-time signals and systems.

Details of the syllabus:

S. No.	Particulars
1	**IntroductiontoSignals&Systems:**Definitionofasignal&System,ClassificationofSignals,Basic operationsonSignals,ElementarySignals,Systemsviewedasinterconnectionofoperations,Properties of Systems, Sampling theorem, Graphical & Analytical proof of Band-limited signals, Impulse Sampling, Aliasing
2	**Linear Time Invariant (LTI) Systems:** Time-Domain representation &Characterization of LTI systems,Impulseresponserepresentation,Convolutionintegral&Convolutionsum,propertiesofLTI systems, Stability criteria for LTI systems, Elements of Continuous time & Discrete-time LTI systems.
3	**Fourier Representation of Signals:** Fourier representation of Signals, Continuous-time Fourier series and their properties, Application of Fourier series to LTI systems, Fourier Transform &its properties, Applications of Fourier Transform to LTI systems, Discrete-time Fourier Transform & its properties. Circular Convolution, Relationship to other transforms.

4	**Laplace Transform:** Introduction &Definition, Region-of- convergence, Properties of Laplace transform,InverseLaplaceTransform,ApplicationsofLaplaceTransforminanalysisofLTIsystems, UnilateralLaplacetransform&itsapplicationstosolvedifferentialequations,AnalysisofElectric circuits.
5	**Z-Transform:** The Z -Transform, Region-of-convergence, Properties of Z-Transform, Inverse Z-Transform,TransformAnalysisofDiscrete-timeLTIsystems,UnilateralZ-Transform&itsapplications to LTI systems described by difference equations.

Recommended Books:

S. No.	Name of the Book	Author
1	Signals &Systems	Haykins
2	Signals &Systems	Ziemer
3	Signals&Systems	Sanjay Sharma
4	Signals Analysis	A Papoulis
5	Schaum's Series Signals &Systems	HSU

Subject: Data Structures (Code: CST205)	Year & Semester: B. Tech. Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To understand efficient storage mechanisms of data for an easy access, design and implementation of various basic and advanced data structures**.**

Course Outcomes:

CO1 Understand the basic concepts of data, structures and pointers.

CO2 Understand and implement basic data structures such as arrays, linked lists, stacks and queues and to assess how the choice of data structures and algorithm design methods impacts the performance of programs.

CO3 Apply Algorithm for solving problems like sorting, searching, insertion and deletion of data and recursion.

CO4 Implementing hash table and understanding different hashing techniques, Solve problems involving graphs, trees and heaps.

Details of the syllabus:

S. No.	Particulars
1	**Introduction:** Basic concept of data, structures and pointers.
2	**Arrays:** Representation, implementation, polynomial representation. Limitations.
3	**Strings:** Representation, String operations, Implementing String. h library functions.
4	**Linked List:** Static and dynamic implementation. Single, double, circular, multiple linked lists.
5	**Stacks:** Recursion and Stacks. Static and dynamic implementation. Expression evaluation. Infix, postfix expressions, multiple stacks.
6	**Queues:** Static and dynamic implementation, circular queues, and implementation.
7	**Hash Tables:** Hash tables implementation. Hashing techniques, single, double.
8	**Storage Management:** Memory Management techniques, garbage collection.
9	**Trees:** Binary trees, binary search trees, static and dynamic implementation. Tree operations, insert, delete, and search.

10	**Heaps:** Implementation, sorting etc.
11	**Sorting and Searching:** Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.
12	**Graphs:** Representation of graphs, BFS, DFS sort. Graph Algorithms.

Recommended Books

S. No.	Name of the Book	Author
1	Data Structures	Rajni Jindal
2	Data Structures	Schaum's Series
3	Data Structures	Knuth
4	Data Structures	Farouzan
5	Data Structures using C and C++	Langsam, A

Subject: Mathematics-III (Code: MAT204)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To understand various transformation techniques and their use to solve boundary value problems, and various linear differential equations.

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

CO1 Evaluate Laplace and Inverse Laplace transforms of various functions and related problems.

CO2 Evaluate Fourier and Inverse Fourier transforms of various functions and related problems.

CO3 Apply the methods of Laplace and Fourier transforms in solving ODE, PDE and Integral equations.

CO4 Evaluate Z-transforms and Inverse Z- transforms of various functions and apply these concepts to solve difference equations.

Unit	Course Content
I	**Laplace Transforms:** Laplace transform, Condition for the existence of Laplace transform, Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform. Laplace transforms of periodic functions and other special functions, Unit Impulse function, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem and properties of Convolution, Evaluation of definite integrals by Laplace transforms, Use of Laplace transforms in the solution of linear differential equation.
II	**Fourier Transforms:** Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Parseval's Identity for Fourier transform, Solution of Integral equations, Evaluation of definite integrals using Fourier transform, Applications of Fourier transforms to Ordinary and Partial differential equations.
III	**Z-Tranforms:** Definition, Linearity property, Z- transform of elementary functions, Shifting theorems, Initial and Final value theorems, Convolution theorem, Inversion of Z- Transforms, Use of Z- transforms in solving difference equations.

Recommended Books:

Text Books	5. L. Debnath and D. Bhatta,*Integral Transforms and their Applications*, 2nd Edition, CRC press, (2007). 6. M. R. Spiegel, *Schaum's Outlines Laplace Transforms*, Tata Mc-Graw Hill Edition, (2005).
Reference Books	3. R.K Jain and S.R.K Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008). 4. I.N. Sneddon, *The use of Integral Transforms*, 2nd Edition, Mc-Graw Hill Pub.,(1972).

Subject: Electronics Engineering Materials (Code: MMT210)	Year & Semester: B. Tech. Electronics and Communication Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Objectives: To familiarize with the basic principles related to the physics of materials relevant to electrical, electronic, magnetic and optical properties.

Course Outcomes:

CO1 To understand the correlation of material properties with crystal structure, composition and nature of bonding

CO2 Understanding the growth of semiconductor materials and semiconductor properties

CO3 Understanding about electronic, magnetic , dielectric and optical properties of materials and their applications

CO4 Understanding the state of the art new materials for electronic applications

Details of the syllabus:

S. No.	Particulars
1	**CrystalStructure:**Crystallinestate,Bravaislattices,Millerindices,reciprocallattice,commoncrystal structures,interferencephenomenon,Bragg'sdiffraction,crystalimperfections.
2	**Crystal Growth**: single crystal growth techniques, zone refining technique (specifically for semiconductors)
3	**Semiconductor materials:** Their properties and applications, Binary, Ternary and Quaternary semiconductors, Physical parameters of semiconductors.
4	**Magnetism:**Magneticpropertiesofmaterials,diamagnetism,para-magnetism,and ferromagnetism, Blackwell, domain dimensions, anti-ferromagnetism, and ferromagnetism, ferrites, Magnetic Materials: Fe, Si, Ni, Co, Hard magnetic materials.
5	**Dielectric materials:** Electric &optical properties, polarization in static and alternating field, piezoelectricity, polarizability and dielectric constant, optical transition in solids, absorption and emission of radiation. Ferroelectric materials
6	Materials for resistors, capacitors and inductors, properties and application of plastic materials.
7	Low Temperature and High Temperature Materials

8	Superconductivity and Superconductors
9	Introduction to material characterization techniques

Recommended Books

S. No.	Name of the Book	Author
1	Introduction to Solid State physics	Kittle
2	Solid state Physics	Dekker
3	Physical Met. Principles	Reedhill
4	Material Science and Engineering	Raghavan
5	Electronic Processes in Materials	Azaroff

Subject: Data Structures Laboratory (Code: CSL206)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: To develop programs for:

Understanding Structures and Pointers

Implementation of Stacks and Queues using arrays and link list

Implementation of sorting algorithms & hash tables

Course Outcomes:

CO1 Be able to design and analyze the time and space efficiency of the data structure

CO2 Understand and apply different data structure such as stacks, queues, trees, etc. to solve varied computing problems.

CO3 Different searching and sorting techniques; and their applications

CO4 Practical knowledge on the applications of data structures, and to solve a real world problem

Details of the syllabus:

S. No.	Particulars
1	Basic concepts of data, linear lists, strings, arrays and orthogonal lists, representation of trees & graphs, storage systems, Arrays, Recursion, Stacks, Queues, Linked lists, Binary trees, General Trees, Tree Traversal, Symbol Table and Searching Techniques, Sorting Techniques, graphs.
2	Implement singly and doubly linked lists.
3	Represent a polynomial as a linked list and write functions for polynomial addition.
4	Implement stack and use it to convert infix to postfix expression
5	Implement array-based circular queue and use it to simulate a producer-consumer problem.

6	Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.
7	Implement binary search tree.
8	Implement priority queue using heaps
9	Implement hashing techniques
10	Implement various sorting techniques as taught in class.
11	Implement Dijkstra's algorithm using priority queues
12	Implement Prim's and Kruskal's algorithms

Subject: Electronics Laboratory (Code: ECL204)	Year & Semester: B. Tech Electronics and Communication Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, synthesize basic electronic networks to get desired output.

Course Outcomes:

CO1 Familiarization and working of different electronic equipment

CO2 Choose testing and experimental procedures on different types of electronic circuit and analyze their operation under different operating conditions

CO3 Identify relevant information to supplement the Electronics I course

CO4 Experimental characterization of diodes , BJT, and FETs

Details of the syllabus:

S. No.	Particulars
1	Study of CRO-Measurement of Voltage, frequency and Phase of a given waveform
2	To obtain diode characteristics. Half wave and a full wave rectifier and to study their performance. Clipping and Clamping circuits
3	Comparison of Zener diode and Avalanche diode characteristics and to use Zener diode as a voltage regulator.
4	To obtain transistor characteristics in the following configurations. e) Common base f) Common emitter
5	To assemble a CE amplifier and observe its performance
6	To obtain frequency response of an RC coupled CE amplifier
7	To obtain JFET characteristics and to observe performance of a source follower
8	JFET as a voltage variable resistor
9	Transfer and Output Characteristics of a MOSFET

ELECTRONICS AND COMMUNICATION ENGINEERING DEPARTMENT

Subject: Electronics II (Code: ECT250)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: To make students aware about the effects of feedback in electronic amplifiers, to analyze the amplifiers under different feedback configuration, to design different sinusoidal oscillators; To understand operational amplifier basics and its application in electronics, to design various wave shaping circuits, to understand power amplifiers and design power supplies.

Course Outcomes:

CO1 Develop the concept of feedback analysis of different feedback topologies

CO2 Analysis and design of sinusoidal oscillators and multi vibrators

CO3 Understanding the basic concept of power amplifiers and IC regulated power supplies

CO4 Understanding basics of op-amps, its linear and non-linear applications and circuits of basic gates using various logic families

Details of the syllabus:

S. No	Particulars
1	**Feedback Basics :** Negative feedback, Effect of negative feedback on the performance of amplifiers e.g. on Gain, Bandwidth. Types of feedback amplifiers, current shunt, current series, voltage shunt, and voltage series feedback. Analysis of feedback amplifiers circuits
2	**Sinusoidal Oscillators:** Basic operations, Positive feedback, analysis of general oscillator circuit, Barkhausen's criteria, various types of oscillator circuits and their analysis, Design of practical oscillator circuits.
3	**Power Amplifiers and Power Supplies** Classification of power amplifiers, Class A, Class B, Class AB and Class C power amplifiers; analysis and design. Power supplies and IC regulators

4	**Operational Amplifiers:** Operational amplifiers stages, Differential amplifier, CMRR, Cascade amplifier, Ideal and practical operational amplifier characteristics and properties OP amp applications, inverting and non inverting amplifiers, difference amplifier, summer differentiator and integrator, rectifiers etc. OP-AMP in analog computation. Frequency response, Gain Bandwidth product, Signal to noise ratio Active Filters
5	**Multivibrators and Wave Form Generators** Bi-stable, Monostable and astable multivibrator circuits, and their analysis. Wave form generators, triangular and square wave generators.
6	**Logic families:** DTL, TTL, ECL, RTL

Recommended Books:

1	Fundamentals of Microelectronics	Behzad Razavi
2	Analysis and Design of Analog Integrated Circuits	Gray, Hurst, Lewis, Meyar
3	Electronic Devices and Circuits	Millman, Halkias, and SatyabrataJit
4	Analog Electronics	Maheshwari and Anand
5	ElectronicDevices&Circuits	Allan Mottershed
6	Microelectronics	Sedra & Smith

Subject: Digital Electronics and Logic Design (Code: ECT251)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: To study number systems, simplification and implementation of digital functions, design & analysis of various combinational and sequential circuits, memory organization & its implementations.

Course Outcomes:

CO1	To represent numbers in different number systems, binary codes and to perform their conversions and arithmetic operations.
CO2	To understand the Boolean algebra/theorems, K-Map and Q-M method and minimization of logic function using them, design and analysis of various combinational circuits.
CO3	To understand lathes and flip flops and designing various sequential circuits using various flip flops.
CO4	To understand basic concept of PLA, PAL, ADC, DAC, IEEE standards and notations

Details of the syllabus:

S. No.	Particulars
1	Review of Binary, octal and hexadecimal number systems. Various types of codes
2	Boolean algebra and Boolean theorems
3	Logic gates and implementation of Boolean functions with different types of logic gates. Circuit equivalence
4	Simplification techniques and minimization by map methods. Tabular method
5	Combination logic and arithmetic circuits. Encoders and Decoders, Multiplexes and Demultiplexes
6	Sequential circuits– statediagrams and statetables, design and analysis of flip flops, registers, counters, Synchronous and Asynchronous operation of sequential circuits. State Machines, Analysis and Design using State Machines
7	Analog to Digital converter, Digital to Analog converter
8	Latches and memory organizations. ROM's, EPROM's and RAM's Dynamic and Static
9	Introduction to PLA's, FPGA
10	IEEE standards and notations.

Recommended Books

1	Digital System Design An Integrated Approach	Uyemura
2	Digital Logic & Computer Design	M Morris Mano
3	Digital Electronics	Gupta &Singhal
4	Digital principles and applications	A. P.Malvino
5	Switching Circuits	Marcus

Subject: Communication Systems-I (Code: ECT252)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: To analyze various analog modulation & demodulation schemes, to understand operation of AM & FM radio receivers, to perform noise analysis of AM & FM systems, to understand the basics of random process.

Course Outcomes:

CO1	Understanding of basic principles of communication system and Fourier analysis of different signals.
CO2	To understand and analyze various analog modulation and demodulation schemes
CO3	To understand the random processes and different sources, classification of noise effecting the communication system.
CO4	To understand various reception techniques and the performance analysis of different radio receivers in presence of Noise.

Details of the syllabus:

S. No	Particulars
1	**Amplitude Modulation**: Principles of Amplitude Modulation Systems- DSB, SSB and VSB modulations, Frequency discriminator, Demodulation of AM, Diodedetector, Monodyne, Homodyne and Super heterodyne receiver
2	**Angle Modulation:** Basic definitions, Frequency Modulation: Narrow Band FM, Wide Band FM, Spectral characteristics of angle modulated signals, Transmission bandwidth of FM Signals, Generation of FM Signals, Demodulation of FM Signals, FM Stereo Multiplexing, Phase-Locked Loop: Nonlinear model of PLL, Linear model of PLL, Nonlinear Effects in FM Systems, FM Receiver and Transmitter
3	**Introduction to Random Process** Random Process, Mean Function, Autocorrelation function, Stationary Process , Wide Sense Stationary Process, White Gaussian Noise (WGN), Power Spectral Density of WGN (Basic Definition), Random process through LTI (Linear Time Invariant) System.

4	**Noise Analysis**: Signal to Noise Ratio, Noise Figure, PerformanceofAM &FM Systems in presenceof noise, Preemphasis and Deemphasis, Threshold effect in AM &FM Demodulation

Recommended Books

1	Principles of Communication Systems	Taub &schling
2	Taub's Principles of Communication Systems	Taub, schling & G Saha
3	Communication systems	Simon Haykins
4	Electronic Communication Systems	G. Kennedy
5	Introduction to Communication Science and Systems	John R. Pierce and Edward C. Posner
6	Probability, Random Variables And Random Signal Principles	Peebles
7	Introduction to Random Signals and Noise	Wim C. Van Etten

Subject: Electrical Machines (Code: EET255)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: The objective of the course is to describe the operating principles, characteristics & applications of transformers and rotating electric machines

Course Outcomes:

CO1	To study transformer construction, operation, various tests, find efficiency & voltage regulation.
CO2	Study about DC machines, operation, performance, applications, recent advancements.
CO3	To study induction motor operation, find efficiency & speed regulation
CO4	Study of synchronous machine and its applications.

Details of the syllabus:

S. No.	Particulars
1	**Transformers:** Operating principle, classification, construction, EMF equation, phasor diagrams, equivalent circuit model, losses &efficiency, voltage regulation, frequency response, polarity test, autotransformers, three-phase transformer connections, impedance matching, isolation &instrument transformers.
2	**DCMachines:** Operating principle, generator& motor action, construction, types of excitation, EMF & torque equations, power stages & efficiency. Commutation & Armature Reaction, characteristics &application of DC generators, starting &speed control of DC motors, characteristics &applications of DC motors, electric braking.
3	**Induction Machines:** Three-phase induction motors. Principle of operation, construction, types. Rotating magnetic field, EMF equation of an AC Machine, torque developed in an induction motor, equivalent circuit model, torque-speed characteristics, starting &speed control. Single phase induction motors, starting, application
4	**Synchronous Machines:** Construction, types &operating principle of synchronous generator, AC armature windings, equivalent circuit, phasor diagrams, voltage regulation, parallel operation, synchronization, Power Angle characteristics, and effect of field excitation change. Synchronous Motor, principle, starting, hunting, damper windings
5	**Special Purpose Motors:** Stepper Motor, Universal Motor, Shaded-pole Motor

Recommended Books

1	Electric Machinery	Fitzgerald,Kingslay,Umans
2	Electric Machinery Fundamentals	Chapman
3	Electric Machines	Nagrath and Kothari
4	Electric Machinery and Transformer	Guru, Hiziroglu
5	Electric Machinery	P.S.Bimbhra
6	Basic Electric Machines	Vincent Deltoro

Subject: Control System (Code: EET256)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: The objective of the course is to introduce the students to modeling, analysis and design of control systems which are an integral part of modern society and have widespread application in science, engineering, and industry.

Course Outcomes:

CO1	To determine and analyze the time response of first and second order systems to various standard test inputs.
CO2	Investigate, evaluate and analyze the stability of control systems, compare and contrast absolute and relative stability.
CO3	Study and design of PID controllers, lead-lag Compensators and modeling of dynamic systems in state space.
CO4	To determine and analyze the time response of first and second order systems to various standard test inputs.

1 Details of the syllabus:

S No	
1	**Introduction to continuous control systems:** Definition of a control system, open-loop, closed loop (automatic and manual) control
2	**Mathematical modeling:** Transfer functions, block diagrams, signal flow graphs
3	**First and second order system:** Example of first and second order systems, responses of these systems to step, ramp, parabolic and sinusoidal inputs, transient, steady state and error analysis
4	**Stability studies:** Definition of stability, stability and pole locations, stability and Routh Table, stability and frequency response bode plot, polar plot, root locus.
5	**Study of PID controllers, lead-lag Compensators** Proportional, Integral, Derivative (P.I.D) control. Compensator design Lead – lag compensators, Modeling of dynamic systems in state space (Introduction).

Suggested Books

1	Modern Control Engineering	K. Ogatta
2	Automatic Control Systems	B. C. Kuo
3	Control System Engineering	Norman S Nise
4	Control Systems	M Gopal
5	Design of Feedback Control Systems	Stefani
6	Feedback control of dynamic systems	Franklin and Powel
7	Control systems,	A. Anand Kumar

Subject: Mathematics IV (Code: MAT254)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Objectives: To understand Probability theory with applications to engineering problems such as the reliability of circuits and systems to statistical methods for hypothesis testing, decision making under uncertainty, and parameter estimation.

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

CO1	Be acquainted with basic concepts of random variables, probability distribution.
CO2	Apply the concepts of different distributions and joint probability distribution on various platforms.
CO3	Be acquainted with concepts like correlation coefficient, Transformation of random variables, Regression Analysis and their applications
CO4	Compute point estimation of parameters, explain sampling distributions, and understand the central limit theorem.
CO5	Construct confidence intervals on parameters for a single sample, and perform hypothesis testing.

Details of the syllabus

Unit-I Random variables: (12 Hours)

Discrete and Continuous Random variables, Distribution functions, Expectation and Variance of Probability distribution, and Moment Generating function, Moments and properties. Discrete distributions: Binomial, Poisson and Geometric distributions and their applications. Continuous distribution: Uniform, Exponential and Normal distributions, Normal approximation to Binomial distribution and their applications.

Unit II: Two-Dimensional Random Variables (15 Hours)

Bivariate Random Variables, Joint Distribution Functions (Discrete and Continuous), Marginal and Conditional Distributions, Covariance and Correlation Coefficient, Transformation of random variables. Regression Analysis, Linear and Non linear Regression, Multiple regression, Curve fitting by method of least squares, fitting of straight lines, polynomials, exponential curves.

Unit III: Sampling Theory (14 Hours)

Population and Sample, Statistical inference, Sampling with and without replacement, Random samples, Population parameters, Sample statics, Sampling distributions, Sample mean, Sampling distribution of means, Sample variances, Sampling distribution of variances, Case where population variances is unknown, Unbiased estimates and efficient estimates, point estimate and Interval Estimates, Confidence Interval estimates of population parameters.

Text Books:

5. Neil A. Weiss, *Introductory Statistics*, 9th Edition. Pearson, (2012).
6. Johnson, Miller and Freund, *Probability and Statistics for Engineers*, Pearson Education, 8th Edition, (2015).
7. S. C. Gupta, *Fundamentals of Statistics*, 7th Edition, Himalaya Publications (2018).
8. S. Ross, *A First Course in Probability*, 6th Edition, Pearson Education India, (2002).
9. Robert V. Hogg, Joseph W. McKean and Allen T. Craig, *Introduction to Mathematical Statistics*, 2nd Edition, Prentice hall, (2007).

Reference Books:

3. R. K. Jain and S. R. K. Iyengar, *Advanced Engineering Mathematics*, 3rd Edition, Narosa Pub. House, (2008).
4. B.S. Grewal, *Higher Engineering Mathematics*, Khanna Publishers, 35th Edition, (2000).
5. V.K. Rohatgi and A. K. Md. Ehsanes Saleh, *An Introduction to Probability and Mathematical Statistics*, 2nd Edition, John Wiley and sons, (2008).
6. Hwei P. Hsu, *Schaum's Outline of Theory and Problems of Probability, Random Variables, and Random Processes*, 4th Edition Tata Mc-Graw Hill (2019).

Subject: Electronics II Laboratory (Code: ECL253)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize electronic feedback networks, operational amplifiers, and power amplifiers.

Course Outcomes:

CO1 Identify relevant information to supplement the Electronics II course

CO2 Experimental characterization of negative and positive feedback circuits

CO3 Experimental characterization and study of different applications of OPAMP's and 555 timer chip

CO4 Experimental Analysis of different topologies of Power Amplifiers

Details of the syllabus:

S. No.	Particulars
1	Feedback c. To assemble current series feedback amplifier and study its performance. d. To assemble a voltage shunt feedback amplifier and study its performance.
2	To assemble an RC phase shift oscillator.
3	To assemble a differential amplifier and obtain its CMRR.
4	To study different applications of OPAMPS. i. OP-AMP as an inverting amplifier. j. OPAMP as a non inverting amplifier k. OPAMP as an integrator l. OPAMP as a differentiator
5	To measurethe following parameters of a typical OP-AMP. i. I/PImpedance j. O/PImpedance k. Slewrate l. CMRR
6	Obtain frequency response of an OP-AMP & hence find its banwidth.
7	Study performance of multivibrator circuits using 555 chip in following modes: **e.** Bistable **f.** Astable **g.** Monostable

	h. Useof555 chipas a timer circuit
8	To assemble a Schmitt trigger Circuit and to obtain its characteristics and to use it as squaring circuit.
9	To assemble a Class A Power amplifier and to determine its power gain
10	To study the performance of a voltage regulator IC Chip.

Subject: Digital Electronics & Logic Design Lab (Code: ECL254)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: To acquire knowledge and become familiar with the different characterization techniques to analyze, and synthesize the digital logic, combinational and sequential circuits.

Course Outcomes:

CO1 Identify relevant information to supplement the Digital Electronics & logic Design course

CO2 Develop competence in Combinational Logic Problem identification and solution

CO3 Develop design capability in the field of combinatorial logic using gates and blocks

CO4 Analysis and design of synchronous and asynchronous sequential circuits

Details of the syllabus:

S. No.	Particulars
1	To verify the truth table of following logic gates: d. AND OR and NOT e. NAND, NOR, XOR and XNOR f. To realize the above gates using discrete active and passive components.
2	To implement XOR and XNOR using universal logic gates.
3	**a.** To verify DeMorgans law using logic gates. **b.** To implement typical Boolean expressions and check their equality.
4	To design and realize:- **a.** Half adder and verify its truth table. **b.** Full adder and verifyits truth table. **c.** Half subtractor and verify its truth table **d.** Full subtractor and verify its truth table.
5	To design a multiplexer/demultiplexer using two input NAND gates
6	To designa4 bit binary to decimal converter.
7	To designamodulo-10 counter.
8	Given a frequency f obtain the waveforms with frequencies f/2,f/5&f/10
9	Design and realize the following flip flops using logic gates. **a.** RS flip flop **b.** JK flip flop **c.** D flip flop **d.** T flip flop
10	UsePLL as: **a.** Frequency multiplier. **b.** Frequency demodulator.

Subject: Communication Systems I Lab (Code: ECL257)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: Familiarize the students with analog communication systems. Integration of communication systems theory with experimental characterization techniques.

Course Outcomes:

CO1 Familiarization and working of different electronic equipment used in communication systems

CO2 Choose testing and experimental procedures on different types of communication circuits and systems; and analyze their operation under different operating conditions

CO3 Design analog modulation circuits as amplitude and frequency modulation for different topologies

CO4 Analysis and Design of communication receivers under different noise conditions.

Details of the syllabus:

S. No	Particulars
1	Linear Systems Characteristics
2	Spectrum Analysis
3	Generation and detection of DSB_SC amplitude modulated signals.
4	Generation and detection of DSB_C amplitude modulated signals.
5	Generation and detection of frequency modulated signals.
6	To measure sensitivity, selectivity, and fidelity of a radio receiver.
7	To measure the noise figure of the following systems: a. A.M. System b. F.M. System
8	Zero crossing and PLL receivers of FM signals
9	Experiments on digital Communications

Subject: Electrical Machines Laboratory (Code: EEL257)	Year & Semester: B. Tech Electronics & Communication Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Objectives: To prepare the students to have a basic knowledge of transformers and different types of motors with applications specifically in low power Electronics

Course Outcomes:

CO1 Familiarization and working of different equipment used in Electrical Machinery

CO2 Ability to conduct and analyze experiments on transformers

CO3 Acquire knowledge about the constructional details and principle of operation of dc and ac machines

CO4 Undertake the testing and develop application capabilities for different types of electrical machines.

Details of the syllabus:

S. No	Particulars
1	To perform open circuit, short circuit, and polarity tests on a single-phase transformer
2	To determine the efficiency and voltage regulation of a single phase transformer
3	To study three phase connections on a bank of three single phase transformers To plot the saturation curve of a dc machine
4	To plot the external characteristics of a separately excited dc generator
5	To plot the external characteristic of a dc shunt generator and compare the characteristics with that of a separately excited generator
6	To determine the Torque/ speed characteristics of a 3-ϕInduction motor
7	To determine the speed characteristics of a schrage motor
8	To determine the speed / Torque characteristics of an AC series motor (Universal motor)
9	To determine the equivalent circuit parameters of a 1-ϕInduction motor by (i) No load test (ii) Blocked rotor test
10	To obtain the OCC and SCC of a synchronous machine by Synchronous impedance method

INFORMATION TECHNOLOGY DEPARTMENT

<table>
<tr><td rowspan="2">Subject: Data Structures (Code: ITT201)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Information Technology Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
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<tr><td rowspan="2">Evaluation Policy</td><td>Mid-Term</td><td>Class Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
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Course Outcomes (COs):

CO1: Understand basic data structures such as arrays, strings, and linked lists.

CO2: Study linear data structures such as stacks and queues and understand their difference.

CO3: Describe the hash function and concepts of collision and its resolution methods.

CO4: Understand the concept of memory management.

CO5: Study tree, heap and graphs along with their basic operations.

CO6: Study different techniques for solving problems like sorting and searching

Syllabus:

Introduction: Basic concept of data, structures and pointers.

Arrays: Representation, implementation, polynomial representation. Limitations.

Strings: Representation, String operations, Implementing String.h library functions.

Linked List: Static and dynamic implementation. Single, double, circular, multiple linked lists.

Stacks: Recursion and Stacks. Static and dynamic implementation. Expression evaluation. Infix, postfix expressions, multiple stacks.

Queues: Static and dynamic implementation, circular queues, and implementation.

Hash Tables: Hash tables implementation. Hashing techniques, single, double.

Storage Management: Memory Management techniques, garbage collection.

Trees: Binary trees, binary search trees, static and dynamic implementation. Tree operations,

insert, delete, and search.

Heaps: Implementation, sorting etc.

Sorting and Searching: Different sorting techniques. Insertion sort, selection sort, bubble sort, radix sort, quick sort, merge sort, heap sort.

Graphs: Representation of graphs, BFS, DFS sort. Graph Algorithms.

Books Recommended:

1. Data Structures by Rajni Jindal

2. Data Structures - Schaum‘s Series

3. Data Structures by Knuth

4. Data Structures by Farouzan

5. Data Structures using C and C++ by Langsam, Augestern, Tanenbaum.

Subject: Signals & Systems (Code: ITT202)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcomes (COs):

CO1. Understand the basic classification, properties and operations on signals

CO2. Understand the basic classification, properties of systems and LTI systems.

CO3. Finding the Fourier and inverse transform of signals and its properties

CO4. Finding the Laplace and Inverse transform of signals and its properties.

CO5. To understand use of probability distribution function and density for signals and Systems

CO6. Using autocorrelation and cross correlation functions and noise in LTI systems

Syllabus:

1. Introduction to signals:

Classification of signals; Deterministic and non-deterministic, periodic and aperiodic, even and odd signals, energy and power signals, elementary signals; exponential, sinusoidal, impulse, step, ramp, pulse, square wave signals. Time shifting, time scaling and time-inversions of signals

2. Linear Time invariant systems

Continuous time system, basic system properties like causality, time invariance, stability, linearity, memory, order of system, interconnection of systems, Linear time invariant systems, characterization, unit impulse response , convolution, properties of LTI systems, linear constant co-efficient differential equations and system description.

3. Fourier analysis of signals and systems

Fourier series of periodic signals and its properties, Fourier transform of aperiodic signals and its properties, fourier transform of periodic signals, convolution in time and frequency

domain, energy and signals, parsevals theorem, energy spectral density and its properties, Transfer function of LTI system.

4. The Laplace Transform

Definition, relation between Laplace and Fourier transforms, region of convergence, properties of Laplace transform, initial and final value theorems, convolution, transfer function of LTI system, concept of poles and zeroes, stability criteria.

5. Random variable theory and random signals

Probability, conditional probability, statistical independence, random variables, discrete and continuous random variables, probability distribution and probability density functions, statistical averages of random variables. Some important density functions.

6. Random processes and characterization

Ensemble and time averages, stationary and non-stationary random process, wide sense stationary random process, autocorrelation and cross-correlation functions, response of LTI systems to random inputs, noise and its types, white noise, signal to noise ratio of LTI systems.

Text Books:

1. Signals and Systems by Zieman, Tranter, Fannin
2. Signals and Systems by Sanjay Sharma

Reference Books:

1. Signals and Systems by A Populis
2. Random processes and Systems by A Populis
3. Signals and Systems by S. Hykin

Subject: Software Engineering (Code: ITT203)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcomes (COs):

CO1 Students will know classical and evolving software engineering methods, can select and tailor appropriate methods for projects, and can apply them as both team members and managers to achieve project goals.

CO2 Ability to effectively apply software engineering practice over the entire system lifecycle. This includes requirements engineering, analysis, prototyping, design, implementation, testing, maintenance activities and management of risks involved in software and embedded systems.

CO3 To make students proficient in effective written and oral communication skills so that they can prepare and publish the necessary documents required throughout the project lifecycle. It also includes effectively contributing to project discussions, presentations, and reviews.

CO4 To make students knowledgeable of the ethics, professionalism, and cultural diversity in the work environment and develop an awareness of the role and responsibilities of the professional software Engineers and Understanding software testing approaches such as unit testing and integration testing along with the need for lifelong learning and readily adapting to new software engineering environments.

Syllabus:

Unit I - Software Process:

The Evolving role of Software , Defining Software, Software Myths, Legacy software, A generic view of process, A layered Technology, Process Framework, Capability Maturity Model Integration (CMMI), Process Assessment, Personal and Team Process Models, Product and Process, Process Models – Build and fix model, The Waterfall Model, Incremental Process Model, RAD Model, Evolutionary Process Models, Unified Process, Agile Methodology, SCRUM Approach.

Unit II - Requirement Engineering:

Software Engineering Practice, Requirements Engineering tasks, Types of requirements, Feasibility studies, initiating the requirements Engineering Process, Eliciting Requirements, Developing Use cases, Requirement Analysis, Documentation and validation, Building the Analysis Model, Elements of the Analysis Model

Unit III - Analysis Modeling And Project Planning:

Requirements Analysis, Analysis Modeling approaches, data modeling concepts, Object oriented Analysis, Scenario based modeling, Flow oriented Modeling, Class based modeling, creating a behavior model. Planning: Size estimation, Cost estimation, COCOMO, Software risk management.

Unit IV - Design & Implementation:

Design Engineering, Design Concepts, Modularity, Strategy of Design, Function oriented Design, Architectural Design, Detailed Design, Design process, Design Quality, Design model, User interface Design, Implementation, issues in implementation. Software metrics, SCM.

Unit V - Testing & Maintenance:

Testing strategies, Testing Tactics and terminologies, functional testing, structural testing, levels of testing, validation testing, system testing, Art of debugging. Software maintenance, maintenance models, Regression testing, Reverse Engineering, Re-Engineering, evolution, Quality Management, Process Improvement, Risk Management.

Text Books:

1. Ian Sommerville, “Software Engineering”, Pearson Education.
2. Software Engineering – A Practitioner’s Approach, Roger S. Pressman, McGraw Hill.
3. Software Engineering, K.K. Aggarwal, Yogesh Singh, New Age International Publishers.

Reference Books:

1. Richard Fairley, "Software Engineering Concepts", McGraw Hill.
2. Stephan Schach, “Software Engineering”, Tata McGraw Hill.
3. Pfleeger and Lawrence,“Software Engineering: Theory and Practice”, Pearson Education.

Subject: Discrete Mathematics & Graph Theory (Code: ITT204)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcomes (COs):

CO1	Understand discrete structures such as sets, relations, and lattices.
CO2	Study the basic operations of Propositional logic and Boolean Algebra.
CO3	Analyse and study various proof techniques.
CO4	Understand basics of Graph theory and how it can be used to visualize and simplify problems.
CO5	Understand the various properties of algebraic systems like Rings, Monoids and Groups.

Syllabus:

Unit I - Sets and Relations:

Sets, Relations, Representation of Relations, Composition of Relations, Partitions, Equivalence Relations. Ordered sets and Lattices: Ordered sets, Diagram of Partially ordered sets, Supremum and Infimum, well ordered sets, Lattices, Bounded and complemented lattice, Distributive Lattice.

Unit II - Propositional Calculus:

Statements, Basic operations, Truth value of compound statements, Algebra of Propositions, Tautologies and contradiction, Conditional and Bi-conditional statements, logical implications,logical equivalence, predicates, Universal and existential quantifiers.Logic gates, Boolean Algebra, Postulates of Boolean Algebra; Theorems of Boolean Algebra, Sum of products and product of sums Simplification.

Unit III - Proof techniques:

Notions of implication, converse, inverse, contrapositive, negation, and contradiction; the structure of formal proofs; direct proofs; proof by counterexample; proof by contraposition; proof by contradiction; mathematical induction.

Unit IV - Graph Theory:

Graphs and Multi-graphs, Degree of a vertex, Paths connectivity, Cut points Bridges, Walks, paths, cycles, connected graphs, Bipartite, Regular,Planar and connected graphs,Euler graphs, Euler's theorem, Hamiltonian path and circuits, Graph coloring, chromatic number, isomorphism and Homomorphism of graphs,Konigsberg seven bridge problem, Shortest path. Trees, properties of trees, pendant vertices in trees, Degree sequences in trees, Necessary and sufficient conditions for a sequence to be a degree sequence of a tree.

Unit V - Group Theory:

Groups, semigroup, infinite group, Finite group, order of a group, Abelian group, subgroup, Lagrange's Theorem, Cosets, Normal Subgroups, order of an element of a group, cyclic group. Rings , Homomorphism and Isomerphism of rings.

Books Recommended

1. C. L. Liu : Elements of Discrete Mathematics, 2nd Ed.Tata Mc-Graw Hill.

2. Kolman, Busby and Ross : Discrete Mathematical Structers, 6th Ed.PHI (2009).

3. NarsinghDeo : Graph Theory with Applications to Engineering and Computer Sciences, PHI.

4. Murry R. Spiegel: Discrete Mathematics (Schaums Outline series) Tata McGraw Hill (2009).

5. K. Bogart, S. Drysdale, C. Stein. Discrete Math for Computer Science Students.

Reference Books

1. Kenneth H. Rosen:Discrete Mathematics and its applications,Tata McGraw Hill (2003).

2. K.R Parthasarty : basic Graph Theory, Tata Mc-Graw Hill

Subject: Object Oriented Programming (Code: CST201)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

·To explore the principles of Object Oriented Programming (OOP).

·To understand object-oriented concepts such as data abstraction, encapsulation, inheritance, dynamic binding, and polymorphism.

·To use the object-oriented paradigm in program design.

·To lay a foundation for advanced programming.

·Provide programming insight using OOP constructs

Learning Outcomes

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

·Analyze the strengths of object oriented programming

·Design and apply OOP principles for effective programming

·Develop programming application using object oriented programming language C++

·Percept the utility and applicability of OOP.

Course Outline / Content	
Unit	**Topics**
1.	**Classes and Objects:** Need of Object-Oriented Programming (OOP), Object Oriented Programming Paradigm, Basic Concepts of Object-Oriented Programming, Benefits of OOP, C++ as object oriented programming language. C++ Programming- C++ programming Basics, Data Types, Structures, Enumerations, control structures, Arrays and Strings, Class, Object, class and data abstraction, class scope and accessing class members, separating interface from implementation, controlling access to members. Functions- Function, function prototype, accessing function and utility function, Constructors and destructors, Copy Constructor, Objects and Memory requirements, Static Class members, data abstraction and information hiding, inline function.
2.	**Polymorphism and Inheritance:** Operator Overloading- concept of overloading, operator overloading, Overloading Unary Operators, Overloading Binary Operators, Data Conversion, Type casting (implicit and explicit), Pitfalls of Operator Overloading and Conversion, Keywords explicit and mutable. Inheritance- Base Class and derived Class, protected members, relationship between base Class and derived Class, Constructor and destructor in Derived Class, Overriding Member Functions, Class Hierarchies, Inheritance, Public and Private Inheritance, Levels of Inheritance, Multiple Inheritance, Ambiguity in Multiple Inheritance, Aggregation, Classes Within Classes. Polymorphism- concept, relationship among objects in inheritance hierarchy, abstract classes, polymorphism.
3.	**Virtual Functions:** Virtual Functions- Pointers- indirection Operators, Memory Management: new and delete, Pointers to Objects, A Linked List Example, accessing Arrays using pointers, Function pointers, Pointers to Pointers, A Parsing Example, Debugging Pointers, Dynamic Pointers, smart pointers, shared pointers, Case Study : Design of Horse Race Simulation.

	Virtual Function- Friend Functions, Static Functions, Assignment and Copy Initialization, this Pointer, virtual function, dynamic binding, Virtual destructor.
4.	**Templates and Exception handling:** Templates- function templates, Function overloading, overloading Function templates, class templates, class template and Non-type parameters, template and inheritance, template and friends Generic Functions, Applying Generic Function, Generic Classes, The typename and export keywords, The Power of Templates. Exception Handling- Fundamentals, other error handling techniques, simple exception handlingDivide by Zero, rethrowing an exception, exception specifications, processing unexpected exceptions, stack unwinding, constructor, destructor and exception handling, exception and inheritance.
5.	**Files and Streams:** Data hierarchy, Stream and files, Stream Classes, Stream Errors, Disk File I/O with Streams, File Pointers, and Error Handling in File I/O, File I/O with Member Functions, Overloading the Extraction and Insertion Operators, memory as a Stream Object, Command-Line Arguments, Printer output, Early vs. Late Binding.
1.	**Standard Template Library:** Standard Template Library, Overview of Standard Template Library, Containers, Algorithms, Iterators, Other STL Elements, Container Classes, General Theory of Operation, Vectors.

Books Recommended

Text Books	1.Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2.Balagurusamy, "Object Oriented programming with C++", Tata McGraw Hill.
References	1.BjarneStrustrup, "The C++ programming Language", Addison Wesley, 2.Booch, "Object Oriented Analysis and Design with Applications, Addison Wesley. 3.Chair H. Pappas & William H. Murray, "The Complete Reference Visual C++", TMH.

Subject: Electronics (Code: ECT207)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

·To get basic idea about types, specification and common values of passive components.

·To familiarize the working and characteristics of diodes, transistors, MOSFETS and some measuring instruments.

·To understand working of diodes in circuits and in rectifiers.

Learning Outcomes

Student can identify the active and passive electronic components. Student can setup simple circuits using diodes and transistors. Student will get fundamental idea about basic communication systems and entertainment electronics.

Course Outline / Content	
Unit	**Topics**
1.	**Semiconductors:** Insulators, semiconductors and metals, Mobility and conductivity, Intrinsic and extrinsic semiconductors, Charge Densities in Semiconductors, Mass action Law, Current Components in Semiconductors, The Continuity Equation, Injected minority Charge Carrier, Hall effect.
2.	**PN Junction Diode:** Characteristic and analysis, Types of diodes – Zener diodes, Photodiodes, Light emitting diodes (LED‟s), Varactor diodes and tunnel diodes. Rectifiers and filter circuit: Half wave, full wave and Bridge rectifier circuits and their analysis, L, C and Pi filters, Basic regulator supply using zener diode, Clipping and clamping circuits.
3.	**Transistors:** Construction and characteristics of bipolar junction, transistors (BJT‟s)-Comm. Base, Comm. emitter, Comm. Collector configuration. Transistor at low frequencies – small signal low frequency transistor model (hparameters). Analysis of transistor amplifier circuit using h-parameters. Transistor biasing and bias stabilization: the operating point, stability factor, analysis of fixed base bias, collector to base bias, Emitter resistance bias circuit and self bias circuit. Bias compensation techniques.
4.	**Field Effect Transistor:** Construction and characteristics of JFET, JFET biasing circuit, JFET amplifier, MOSFET construction and characteristics.
5.	**Amplifiers And Oscillators:** Classification of amplifiers, concept of feedback, general characteristics of feedback amplifiers, Single stage RC coupled amplifier. Oscillators – Criterion for Oscillation, type of oscillators: Hartley oscillator, Colpitt Oscillator, RC Phase shift oscillator, Crystal oscillator.
6.	**Operational Amplifiers:** Introduction to Op-amp, Inverting and non-inverting configuration, Applications – adder, subtractor, integrator, differentiator.

Books Recommended

Text Books	1. Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata McGraw Hill, 2/e, 2013. 2. Electronics Devices and Circuit Theory by R. Boylestad, Pearson.
References	1. Bell, D. A., Electronic Devices and Circuits, Oxford University Press. 2. Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education. 3. Frenzel, L. E., Principles of Electronic Communication Systems, McGraw Hill.

Subject: Object Oriented Programming Lab (Code: CSL203)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

·The student should be able to explain the fundamental properties of the C++ language.

·The student should be able to combine the elements of the C++ language in developing structured programs.

·The student should be able to demonstrate the skills necessary to correctly compile, debug, and test programs in C++.

Learning Outcomes

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

·Apply C++ features to program design and implementation

·Explain object-oriented concepts and describe how they are supported by C++

·Use C++ to demonstrate practical experience in developing object-oriented solutions

·Analyse a problem description and design and build object-oriented software using good coding practices and techniques

·Use common software patterns in object-oriented design and recognise their applicability to other software development contexts.

Course Outline / Content	
Unit	**Topics**
1.	Function overloading and default arguments in C++
2.	Simple class design in C++, namespaces, object creation
3.	Class design in C++ using dynamic memory allocation
4.	Constructors and destructors
5.	Operator overloading and friend functions
6.	Overloading assignment operator and type conversions
7.	Inheritance, run time polymorphism and virtual functions
8.	Template design in C++
9.	Interface and abstract classes
10.	Exception handling
11.	File handling in C++

Books Recommended

Text Books	1.Robert Lafore, "Object Oriented Programming in Turbo C++", Galgotia Publications, 2.Balagurusamy, „Object Oriented programming with C++", Tata McGraw Hill.
References	1.BjarneStrustrup, "The C++ programming Language", Addison Wesley, 2.Booch, "Object Oriented Analysis and Design with Applications, Addison Wesley. 3.Chair H. Pappas & William H. Murray, "The Complete Reference Visual C++", TMH.

Subject: Electronics Lab (Code: ECL208)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

·To familiarize with the electronic components and basic electronic instruments.

·To enable the students to understand the behaviour of semi conductor devices based on experimentation.

Learning Outcomes

·To make familiar with PCB design and various processes involved.

·Ability to understand and analyse, linear and digital electronic circuits.

Course Outline / Content	
Unit	**Topics**
1.	Characteristics of Semi conductor diode and Zener diode
2.	Characteristics of a NPN Transistor under common emitter, common collector and common base configurations
3.	Characteristics of JFET (Draw the equivalent circuit)
4.	Characteristics of UJT and generation of saw tooth waveforms
5.	Design and Frequency response characteristics of a common emitter amplifier
6.	Design and testing of RC phase shift, LC oscillators
1.	Single phase half-wave and full wave rectifiers
8.	a) To assemble a half wave and a full wave rectifier and to study their performance. b) To suppress the ripple using RC filter.
9.	To assemble and observe the performance of clipping and clamping circuits.
10.	Design and realize Inverting and Non-inverting amplifier using 741 Op-amp.

Books Recommended

Text Books	1.Bhargava N. N., D C Kulshreshtha and S C Gupta, "Basic Electronics & Linear Circuits", Tata McGraw Hill, 2/e, 2013. 2Electronics Devices and Circuit Theory by R. Boylestad, Pearson.
References	1.Bell, D. A., Electronic Devices and Circuits, Oxford University Press. 2.Boylested, R. L. and Nashelsky, L., Electronic Devices and Circuit Theory, Pearson Education 3.Frenzel, L. E., Principles of Electronic Communication Systems, McGraw Hill.

Subject: Data Structures Lab (Code: ITL205)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

CO1 Implement and understand linked lists for polynomial manipulation.

CO2 Study stack data structure and use it for expression parsing (prefix, infix, postfix).

CO3 Implement circular queues for producer-consumer problem simulation.

CO4 Implement search trees and priority queues using heaps.

CO5 Implement various hashing techniques.

CO6 Study and implement various searching and sorting techniques.

C07 Implement various Graph Algorithms

Syllabus:

Basic concepts of data, linear lists, strings, arrays and orthogonal lists, representation of trees

& graphs, storage systems, Arrays, Recursion, Stacks, Queues, Linked lists, Binary trees,

General Trees, Tree Traversal, Symbol Table and Searching Techniques, Sorting Techniques,

Graphs:

1. Implement singly and doubly linked lists.

2. Represent a polynomial as a linked list and write functions for polynomial addition.

3. Implement stack and use it to convert infix to postfix expression

4. Implement array-based circular queue and use it to simulate a producer-consumer problem.

5. Implement an expression tree. Produce its pre-order, in-order, and post-order traversals.

6. Implement a binary search tree.

7. Implement priority queue using heaps

9. Implement hashing techniques

10. Implement various sorting techniques as taught in class.

11. Implement Dijkstra's algorithm using priority queues.

12. Implement Prim's and Kruskal's algorithms

Subject: Operating Systems (Code: ITT250)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

At the end of the course students will be able to understand the:
CO1: Functions of operating System.
CO2: Operating System processes, management and coordination.
CO3: Interprocess Communication and process control.
CO4: Deadlocks detection, prevention and avoidance mechanisms.
CO5: Process Scheduling Algorithms.
CO6: Memory and I/O Device Management.

Syllabus:

UNIT I
INTRODUCTION:
Computer System Overview-Basic Elements, Instruction Execution, Operating system functions and structure, Interrupts, Memory Hierarchy, Cache Memory, Direct Memory Access, Multiprocessor and Multicore Organization. Operating system overview-objectives and functions, Evolution of Operating System, Distributed OS.

UNIT II
PROCESS MANAGEMENT AND COORDINATION:
Process concept, Process States, Process Description and Process Control, Interprocess Communication, Processes and Threads, Types of Threads, Multicore and Multithreading,

UNIT III
CONCURRENCY AND SCHEDULING:
Principles of Concurrency - Mutual Exclusion, Semaphores, Monitors, Readers/Writers problem. Deadlocks – prevention- avoidance – detection, Scheduling- Types of Scheduling – Scheduling algorithms.

UNIT IV
MEMORY MANAGEMENT:
Memory management requirements, Partitioning, Paging and Segmentation, Virtual memory - Hardware and control structures, operating system software, Linux memory management, Windows memory management. Virtual memory management.

UNIT V

INPUT/OUTPUT AND FILE SYSTEMS:

I/O management and disk scheduling – I/O devices, organization of I/O functions; OS design issues, I/O buffering, disk scheduling, Disk cache. File management – Organization, Directories, File sharing, and Record blocking, secondary storage management.

Text Books:

1. Silberschatz, Peter Galvin, Greg gagne "Operating System Principles".
2. William Stallings, "Operating Systems – internals and design principles", Prentice Hall.

Reference Books:

1. Andrew S. Tannenbaum & Albert S. Woodhull, "Operating System Design and Implementation", Prentice Hall.
2. Andrew S. Tannenbaum, "Modern Operating Systems", Prentice Hall.
3. Gary J.Nutt, "Operating Systems", Pearson/Addison Wesley.
4. Pramod Chandra P.Bhatt, "An Introduction to Operating Systems Concepts and Practice".

Subject: Database Management System (Code: ITT251)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

CO1: Identify the basic concepts and various data model used in Database design.

CO2: Apply relational database theory and be able to describe relational algebra expression, tuple and domain relation expression for queries and SQL for implementing the queries.

CO3: Recognize and identify the use of normalization and functional dependency.

CO4: Apply and relate the concept of transaction, concurrency control and recovery in database.

CO5: Recognize / identify the purpose of query processing and optimization, indexing and hashing technique used in database design.

Syllabus:

UNIT I

INTRODUCTION:

Introduction to database management, data abstraction and system structure, Purpose of database system , uses of database approach, database applications, Views of data, Database languages, Database system – Concepts and architecture, Database users and administrator, database types.

UNIT II

DATA MODELLING:

Data models definition and types, Entity- Relationship Model (E-R Model), E-R diagrams, entity set, relationship sets, mapping, cardinalities. Introduction to relational databases, The relational model - Keys, Relational algebra – Domain relational calculus – Tuple relational calculus – Fundamental operations – Additional operations – SQL fundamentals, Views, Introduction to distributed databases and client/server databases.

UNIT III

DATABASE DESIGN:

Relational database design, Functional dependencies, Non-loss decomposition, First, Second, Third Normal Forms – Dependency Preservation – Boyce/Codd Normal Form, Multi-Valued Dependencies and higher normal Forms.

UNIT IV

TRANSACTIONS:

Transaction Concepts, Transaction Recovery, ACID Properties, System Recovery, Media recovery, Two phase commit, Save points, SQL facilities for recovery, Concurrency, Need for concurrency, Locking protocols - Two phase locking, Intent locking, Deadlock, Serializability, Recovery isolation levels, SQL facilities for concurrency**.**

UNIT V

IMPLEMENTATION TECHNIQUES:

Overview of physical storage media – Magnetic disks, Tertiary storage, File organization – Organization of records in files, Indexing and hashing, ordered indices, B trees index files, Static hashing, dynamic hashing, RAID organization and levels. Data warehouse and data mining- basic concepts and overview.

Text Books:

1. R. and Navathe, S.B., "Fundamentals of Database Systems", Pearson Education.

Reference Books:

1. Abraham, H. and Sudershan, S., "Database System Concepts",McGraw-Hill.Elmasri.
2. Ramakrishnan, R. and Gekhre, J., "Database Management Systems", McGraw-Hill.

Subject: Digital Electronics & Logic Design (Code: ECT251)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

To study number systems, simplification and implementation of digital functions, design & analysis of various combinational and sequential circuits, memory organization & its types and also understand basics of VHDL programming.

Learning Outcomes

The student will be able to:

- Use number systems, binary addition and subtraction.
- Understand the different switching algebra theorems and apply them for logic functions.
- Use the Karnaugh map for reduction of logic functions.
- Design the combinational circuits.
- Design the sequential circuits.
- Derive the state-machine analysis or synthesis.

Course Outline / Content	
Unit	**Topics**
1.	**Binary Systems:** Number Systems (binary, octal, hexadecimal), conversion from one system to another, addition and subtraction using different number systems, complements and codes.
2.	**Boolean algebra & Logic Gates:** Basic Definitions, Theorems and Properties of Boolean Algebra, Boolean functions, Canonical and Standard Forms, Logic Operations & Gates
3.	**Simplification of Boolean Functions:** K-Map Method and Tabulation Method (2, 3, 4, 5 variables)
4.	**Combinational Logic:** Design Procedure, Logic gates and Arithmetic Circuits
5.	**Combinational Logic with MSI & LSI:** Adder, Subtractor, Encoders, Decoders, Multiplexers, De-multiplexers ,ROMs, PLA's
6.	**Sequential Logic:** Moore and Mealy Machine Design Procedure state machine as a sequential controller, Flip-Flops (FF), Triggering, Analysis, State Reduction &Assignment. FF Excitation Tables, ASM Charts, Design Procedure, Design of Counters, Design with State Equations.
7.	**Registers, Counters:** Shift Registers, Synchronous and Asynchronous Counters **Data Converters:** ADC, DAC and their types.
8.	**VHDL Programming:** Introduction, Code Structure, Data Types Operators &Attributes, Concurrent Code, Sequential Code, Signals & Variables, Basic Circuit Designs.

Text Books

1. Digital Logic & Computer Design by M Morris Mano
2. Digital Electronics by Gupta & Singhal
3. Circuit Design with VHDL, V A Pedroni.

References

1. Digital principles and applications by A. P. Malvino

2. Switching Circuits by Marcus

Subject: Communication System (Code: ECT253)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 4		
		L	T	P
		3	1	0
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

This course has been designed to familiarize students with the fundamentals of design and analysis of both analog and digital communications systems. In the first half of this course, "how a communications system works from signal modulation and transmission point of view" is discussed and in the second half the course "the behavior of the communications systems in the presence of noise" is discussed. In the last two weeks of this course, two most important areas of communications i.e., wireless and optical fiber communications are introduced to students to further motivate their interest in future communications courses and ultimately a career in communications industry.

Learning Outcomes

Upon completion of this course, students will have the ability to:

·Understand operation of digital and analog communication systems

·Obtain knowledge of theoretical principles of communication systems and statistical

·Properties of noise so to be able to apply them to engineering systems (a,c,e) should develop a knowledge and understanding of advanced communication.

Course Outline / Content	
Unit	**Topics**
1.	Spread Spectrum Communication: Direct sequence and frequency hopped spread spectrum, spreading sequences and their correlation functions, Acquisition and tracking of spread spectrum signals Code Division Multiple Access (CDMA): DS-CDMA on AWGN channels, DS-CDMA on frequency selective fading channels, Performance analysis of cellular DS-CDMA, Capacity estimation, Power control effect of imperfect power control on DS-CDMA performance, Soft Hand offs, Spreading/coding tradeoffs, multi carrier CDMA, IS95A CDMA systems, 3rd Generation CDMA systems, Multi user detection, Optimum receivers, SIC, PIC receivers and performance.
2.	Networks & Services: Network Transmission System Design Services, Characterization of networks & teleservices, The Telephone Network – Past, Present & Future, and Network issues.
3.	Data Communication Networks: Basic principles of data communication – synchronous and asynchronous transmission – digital data transmission formats NRZ, RZ, AMI, ASI & Manchester coding, Error correcting codes, Hamming codes, Orthogonal codes, Switching – Circuit switching, Message switching, Packet switching, Standard communication interface multipliers and concentrators, Protocols (BOP-COP – standard networks and standards, OSI, (D) ARPANET, NICNET, SNA, SELS etc. Lan types of LAN – WAN, Digital telephony, Basic principle of ISDN – E Mail – Voice mail.
4.	Transmission Principles: Transmission aspects, Signals and Impairments, Digital Speech Transmission Digitisation of Speech & Audio.
5.	Teletraffic: Digital Networks, Network Synchronization, Multiplexing – Digital Hierarchies, Synchronous Digital Hierarchy, Digital Switching, Signaling, Introduction to Teletraffic.
6.	ISDN & ATM: Integrated Services Digital Network – ISDN, Broadband ISDN & ATM, Broadband Access Networks, Optical Networks. Network Aspects: Intelligent Network, Network Management, and Introduction to Network management softwares.

Text Books

1. Andrew J Viterbi, “CDMA Principles of spread spectrum communications”, Addition Wesley, (1995).

2. J S Lee and L E Miller, “CDMA systems engineering handbook”, Artech House, (1998).

References

1. Marvin K Simon, Jim K Omura, Robert A Scholtz, BaryKlevit, “Spread Spectrum Communications”, (1995).

2. Sergio Verdu, “Multiuser Detection”, Cambridge University Press, (1998).

3. Andrew S Tanenbaum, “Computer Networks”, Prentice Hall of India.

<table>
<tr><td rowspan="2">Subject: Control System (Code: EET258)</td><td rowspan="2">Year & Semester: B. Tech Information Technology Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 3</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td rowspan="2">Mid-Term/Class Assessment
(40 Marks)</td><td colspan="3">Final-Term
(60 Marks)</td></tr>
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Course Objectives

- To develop an understanding of principles and applications of control systems in everyday life.
- To understand the basic concepts of block diagram reduction, time domain analysis solutions to time invariant systems.
- To develop an understanding of different aspects of stability analysis of systems in frequency domain and time domain.
- Design controllers to meet specifications.

Learning Outcomes

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

- Should have knowledge on open loop and closed loop control systems, concept of feedback in control systems etc.
- Should be able to apply the conceptual things to real-world electrical and electronics problems and applications.
- Test a linear system for stability by determining the system's pole locations.
- Test a linear system for controllability and observability.
- Should be able to develop and run a computer simulation of a control system using MATLAB.

Course Outline / Content	
Unit	**Topics**
1.	**Introduction:** Concepts of Control Systems- Open Loop and closed loop control systems and their differences- Different examples of control systems- Classification of control systems, Feed-Back Characteristics, Effects of feedback. Mathematical models – Differential equations, Impulse Response and transfer functions. **Transfer Function Representation:** Block diagram representation of systems considering electrical systems as examples -Block diagram algebra – Representation by Signal flow graph - Reduction using mason's gain formula.
2.	**Time Response Analysis:** Standard test signals - Time response of first order systems – Characteristic Equation of Feedback control systems, Transient response of second order systems - Time domain specifications – Steady state response - Steady state errors and error constants – Effects of proportional derivative, proportional integral systems.
3.	**Stability Analysis in S-Domain:** The concept of stability – Routh's stability criterion – qualitative stability and conditional stability – limitations of Routh's stability. **Root Locus Technique:** The root locus concept - construction of root loci- effects of adding poles and zeros to G(s) H(s) on the root loci.
4.	**Frequency Response Analysis:** Introduction, Frequency domain specifications-Bode diagrams-Determination of Frequency domain specifications and Phase margin and Gain margin-Stability Analysis from Bode Plots. Polar Plots, Nyquist Plots Stability Analysis. Compensation techniques – Lag, Lead, Lead-Lag Controllers design in frequency Domain, PID Controllers.

5.	**State Space Analysis of Continuous Systems:** Concepts of state, state variables and state model, derivation of state models from block diagrams, Diagonalization- Solving the Time invariant state Equations- State Transition Matrix and it's Properties – Concepts of Controllability and Observability.

Text Books

1. Control Systems Theory and Applications - S. K. Bhattacharya, Pearson.
2. Control Systems - N. C. Jagan, BS Publications.
3. Modern Control Systems by Ogatta
4. Automatic Control systems by B C Kuo

References

1. Control Systems - A. Ananad Kumar, PHI.
2. Control Systems Engineering - S. Palani, TMH.
3. Control Systems - Dhanesh N. Manik, Cengage Learning.
4. Control Systems Engineering - I. J. Nagrath and M. Gopal, New Age International (P) Limited, Publishers.
5. Control Systems - N. K. Sinha, New Age International (P) Limited Publishers.

Subject: Digital Electronics & Logic Design Lab (Code: ECL254)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

To gain a firm understanding of concepts learned in the Digital electronics and Logic design course work by practical demonstration.

Learning Outcomes

The student should be able to construct digital circuits using standards ICs and testing boards.

Course Outline / Content	
Unit	**Topics**
1.	To verify the truth table of following logic gates: 1. AND OR and NOT 2. NAND, NOR, XOR and XNOR
2.	To design and realize Logic gates using universal gates.
3.	To design and realize:- a. Half adder and verify its truth table. b. Full adder and verify its truth table. c. Half subtractor and verify its truth table d. Full subtractor and verify its truth table.
4.	To design a multiplexer/demultiplexer using two input NAND/NOR gates
5.	Design and realize the following flip flops using logic gates. ● RS flip flop ● JK flip flop ● D flip flop ● T flip flop
6.	To design a modulo-10 counter.
7.	To design frequency dividing circuits.

Text Books

1. Digital Logic & Computer Design by M Morris Mano.
2. Digital Electronics by Gupta &Singhal.
3. Circuit Design with VHDL, V A Pedroni.

References

1. Digital principles and applications by A. P. Malvino
2. Switching Circuits by Marcus.

Subject: Communication System Lab (Code: ECL255)	Year & Semester: B. Tech Computer Science Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Objectives

This course has experiments provides the foundation education in communication engineering lab analysis and design. Through lecture, laboratory, and out-of-class assignments, students are provided learning experiences that enable them to Analyze and deign basic electronic circuits, to carry out AM and FM modulation experiments using discrete electronic components and Become proficient with computer skills (eg., OrCADPspice and MATLAB) for the analysis and design of circuits .

Learning Outcomes

·Study signal and linear time invariant system properties.

·Study, design, and build amplitude modulation systems examining tradeoffs in different communication systems.

·Study, design, and build angle modulation systems examining tradeoffs in different communication systems.

·Perform experiments in converting analog information into digital data via sampling, quantization, and coding.

Course Outline / Content	
Unit	**Topics**
1.	**Use Network Analyzer for the following experiments**: ·Measurement of transmission line parameters. ·S-parameter estimation of Microwave devices. ·Design and testing of a Microstrip coupler. ·Characteristics of λ/4 and λ/2 transmission lines.
2.	**Use appropriate simulation tools for the following experiments**: ·Channel equalizer design (LMS, RLS) ·Antenna Radiation Pattern measurement. ·Performance Evaluation of digital modulation schemes ·OFDM transceiver design ·Simulation of Microstrip Antennas ·Performance evaluation of simulated CDMA System.

3.	·Exponential Fourier Series ·Fourier Series using Matlab ·Autocorrelation and Energy Spectral Density ·Amplitude Modulation ·Envelope Detection ·Study the Basic Operation of Phase-Lock-Loop (PLL) ·FM Modulation and Demodulation using PLL ·Single Transistor FM Voice Transmitter ·A Simple Sampler using 555 Timer ·Pulse Width Modulation ·Pulse Position Modulation

References

1. Communication Systems Laboratory Manual by Muhammad Tahir et al Department of Electrical Engineering University of Engineering and Technology Lahore.

Subject: Operating System Lab (Code: ITL252)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

To familiarize the students with:

CO1: Operating System commands.

CO2: Process Management and Control.

CO3: Implementation of Scheduling Algorithms.

CO4: Analysis of deadlocks in the Operating System.

CO5: System Programming and Kernel design.

List of Experiments:

1. To familiarize the students with the Operating Systems.
2. Introduction and use of basic Linux commands.
3. To demonstrate the process, memory, file and directory management modules under the Linux/Windows operating systems
4. To introduce Linux basic commands
5. To demonstrate use of Window APIs.
6. Write programs using the following system calls of UNIX operating system:

Fork, exec, getpid, exit, wait, close, stat, opendir, readdir

7. Write programs to implement Thread management using pthread library.
8. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for FCFS and SJF. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
9. Given the list of processes, their CPU burst times and arrival times, display/print the Gantt chart for Priority and Round robin. For each of the scheduling policies, compute and print the average waiting time and average turnaround time.
10. Write programs to simulate and analyze page replacement algorithms with respect to various parameters. Implement the Producer Consumer problem using semaphores.
11. Implement the deadlock free solution to Dining Philosophers problem to illustrate the problem of deadlock and/or starvation that can occur when many synchronized threads are competing for limited resources.
12. System Programming and Kernel design.

Subject: Database Management System Lab (Code: ITL253)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

CO1: Transform an information model into a relational database schema and to use a data definition language and/or utilities to implement the schema using a DBMS.

CO2: Analyze the database using queries to retrieve records.

CO3: Formulatequery, using SQL, solutions to a broad range of queries, and data update problems.

CO4: Applying PL/SQL for processing database.

CO5: Analyse front end tools to design forms, menus, etc and establish back-end connectivity

CO6: Develop solutions using database concepts for real-time requirements.

List Of Experiments:

1. Creation of a database and writing SQL queries to retrieve information from the database.
2. Performing Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on conditions.
3. Creation of Views for different users.
4. Creating an Employee database to set various constraints.
5. Creating relationship between the databases.
6. Study of PL/SQL block.
7. Creation of Procedures.
8. Creation of database triggers, cursors and functions.
9. Mini project (Application Development using Oracle/ Mysql/DB2)

a)Inventory Control System.

b) Material Requirement Processing.

c) Hospital Management System.

d) Railway Reservation System.

e) Personal Information System.

f) Web Based User Identification System. g) Timetable Management System.

h) Hotel Management System

Subject: Web Programming (Code: ITL254)	Year & Semester: B. Tech Information Technology Engineering 2nd Year & 3rd Semester	Total Course Credit: 2		
		L	T	P
		0	0	4
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

CO1: Students will be able to create HTML Documents with formatting, images, tables, frames, embed multi-media objects and develop a static website using Hyper Text Mark-up Language.

CO2: Students will learn how to Create web pages using Cascading Style Sheets.

CO3: Students will design and implement dynamic websites with good aesthetic sense of designing and latest technical know-how's.

Syllabus:

UNIT I - HTML & Introduction to CSS

HTML for structure, CSS for layout, and JavaScript for client-side programming; Suggestions for learning. Web Site Basics: Dreamweaver, HTML: Elements. Attributes and values.HTML Tables: Table, heading, row, data elements and attributes. Table structure not for page layout. Links and server-side includes: HTML links and anchors. Linking to external files to modularize html, build script libraries, or share styles; Server-side Includes. Standards: W3C, the World Wide Web Consortium: W3C recommendations as standards.HTML rules: Extensible markup languages; Frames: A glance at a common but deprecated element; advantages and disadvantages; frame and frameset properties. Images:
Image types (JPG, GIF, PNG). Inline, embedded, and external styles. Writing Style Rules: Writing CSS selectors and rules to tie style attributes and values to html elements. The cascade: Inheritance, specificity, and the cascade.CSS positioning: Static, relative, and absolute positioning.

UNIT II - Introduction to JavaScript:
Client-side programming for browsers. Event Handlers. JavaScript Overview: Language characteristics. Variables. Assignment and comparison operators; expressions.HTML Forms: The form element and inputs: textbox, radio buttons, checkbox, text area.

UNIT III - Advanced HTML & CSS:
HTML Form Basics, JavaScript, JavaScript Functions: Writing blocks of separate, reusable code, Getting started with developing simple functions for form validators. Form Validation: JavaScript for Simple Form Validation, The DOM and JavaScript Object Models: The W3C Document Object Model; using nodes; DHTML: JavaScript + CSS = Dynamic HTML,

Advanced form validation: Javascript'sinner HTML and dynamic CSS for advanced form validation

UNIT IV - JavaScript Programming:
Tracking the Mouse: Reporting the x and y position of the mouse, Annotating text: Adding hidden text and accessing through JavaScript, Advanced JavaScript—Super Hypertexts: Finding. JavaScript's Built-in Objects: Arrays. Dates. Math. Number and String Objects, Web Site Design / Redesign: Overview of site redesign. Client survey.

Text Books:

1. Dietel & Dietel "Internet & Web Designing".
2. John Duckett. "JavaScript and Jquery: Interactive Front-end Web Development".

Reference Books:

1. Greenlaw R and Hepp E "Fundamentals of Internet and www".
2. B. Underdahle and K.Underdahle, "Internet and Web Page / WebSite Design", IDG Books India (P) Ltd.
3. D. Comer, "The Internet Book", Prentice Hall of India.
4. David Flanagan. "JavaScript: The Definitive Guide".

MECHANICAL ENGINEERING DEPARTMENT

<table>
<tr><td rowspan="2">Subject: Manufacturing Processes
(Code: MET201)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Mechanical Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td colspan="2">3</td><td>1</td><td>0</td></tr>
<tr><td>Mid-Term</td><td>Class Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

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

CO1: Identify and analyse the functioning of machine tools and estimate the machining time
CO2: Explain and analyse the conventional machining processes
CO3: Analyse the welding process behaviour for fusion and solid state welding techniques
CO4: Explain the basics of casting processes and their applications in manufacturing domain

Detailed Syllabus:

UNIT I

Introduction to manufacturing processes, Introduction to machine tool. Basic elements of machine tool, machine tool drives. Lathe machine: Tool geometry, machining parameters. Lathe operations (Facing, Turning, Drilling, Reaming, Boring), Taper turning by different methods. Milling Machine: types, working principle, milling parameters, operations (slab, end, slot, face milling), up and down milling. Estimating machining time in lathe and milling operations, different types of indexing methods in milling

UNIT II

Drilling: Types of drilling machines, portable, bench, upright, Radial**,** Spot facing. Drilling process parameters, Estimating machine time. Reaming: Types of reamer, reaming operations. Broaching: Types of broaches, tool material, teeth terminology and other details. Methods of broaching. Working principle and operation of shaping, planning and slotting

UNIT III

Welding: Introduction to welding, Principle of Welding, Classification of welding, Arc Initiation, Characteristic and power of electric arc, Power source characteristics, Modes of metal transfer in Arc welding, Gas welding, SMAW, GTAW, GMAW, Resistance and Thermit welding, High energy beam welding, Solid state welding processes, Underwater Welding, Welding defects, Welding of Plastics

UNIT IV

Casting Processes: Introduction, Industrial applications, casting terminology, mould, types of mould (Grey and Dry sand Mould), Pattern types, allowances, preparation of mould, various stages in the casting process, testing of moulding sand, types of casting processes (Die, Centrifugal, Continuous, and investment casting), Solidification time, Gating and rising system design

Text Book:

1. Ghosh, A. and Malik, A.K., "Manufacturing Science", Affiliated East Press, New-Delhi.

Reference Books:

1. Campbell, J.S., "Principles of Manufacturing Materials and Processes", McGraw-Hill, New-York.
2. Rao, P.N., "Manufacturing Technology", Vol. 2, McGraw-Hill Education, New Delhi.
3. Lindberg, R.A., "Processes and Materials of Manufacturing", Allyn and Bacon, Boston.
4. Schey, J.A., "Introduction to Manufacturing Processes", McGraw-Hill, New-York.
5. Sindo Kou, "Welding Metallurgy", 2nd Edition, Wiley-Inderscience.

Subject: Mechanics of Solids (Code: MET202)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Evaluate and solve statically determinate and indeterminate problems
- **CO2:** Determine the resistance and deformation in machine members subjected to axial, flexural and torsional loads
- **CO3:** Evaluate principal stresses, strains and apply the concept of failure theories for design
- **CO4:** Analyze thin and thick cylinders and design closed-coil helical and leaf springs

Detailed Syllabus:

UNIT I

Concept of Resistance and deformation, determinate and indeterminate problems in tension and compression, thermal stresses, pure shear, Young's modulus of elasticity, Poisson's ratio, Modulus of rigidity and Bulk modulus, relation between elastic constants, Stress-strain diagrams for brittle and ductile materials, working stress, Strain energy in tension and compression, Impact loading

UNIT II

Analysis of Stress and Strain, Plane stress, Stresses on inclined planes, Principal stresses and maximum shear stress, Principal planes, Shear stresses on principal planes, Maximum shear tress, Mohr circle for plane stress conditions, Thin and Thick Cylinders, spherical shells subjected to internal fluid pressure, Wire-wound thin cylinders, Compound cylinders, Shrink fit.

UNIT III

Shear Force and Bending Moment, types of supports and beams, types of loads, articulated beams, Shear Force and Bending Moment diagrams, Theory of Simple Bending, Bending stresses in beams, Efficiency of various cross-sections, Composite beams, Flexural shear stress distribution in different cross sections of beams, Deflection of Beams, Slope and deflection of beams, Double Integration method, Macaulay's method, strain energy method

UNIT IV

Torsion of Circular cross sections, theory of pure torsion, transmission of power in solid and hollow circular shafts, Combined bending and torsion, Springs, Axial load and torque on helical springs, stresses and deformations, strain energy, compound springs, leaf springs, Strain Energy, Castigliano's theorems I and II, Load-deformation diagram, Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion.

Text Books:

1. Hibbeler, R. C., *"Mechanics of Materials"* 8th Edition, Pearson Education India, 2011.
2. Timoshenko and Gere, "Mechanics of Materials", CBS Publishers, 2011.
3. Shames, I. H., Pitarresi, J. M., "Introduction to Solid Mechanics", Pearson, 2015.

Reference Books:

1. Popov, E. P., "Engineering Mechanics of Solids", PHI, 2009.
2. Beer, F. Jr., Johnston, E. R., DeWolf, J., Mazurek, D., "Mechanics of Materials", 7th Edition, McGraw-Hill Education, 2014.

Subject: Fundamentals of Dynamics (Code: MET203)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

CO1: Apply the concepts and laws of dynamics to solve complex engineering problems
CO2: Use the concepts of impulse-momentum to develop relations governing particle impacts
CO3: Use Newton's second law to determine trajectory properties of particles under central-force attraction
CO4: Apply the knowledge of dynamics of rigid bodies to systems like ships and airplanes

Detailed Syllabus:

UNIT I
Kinematics of particles, basic concepts, rectilinear motion, plane curvilinear motion, rectangular coordinates (x-y), normal and tangential coordinates (n-t), polar coordinates (r-θ), space curvilinear motion, relative motion (translating axes), constrained motion of connected particles

UNIT II
Kinetics of particles, equations of motion and their solution, impulse, momentum, work and energy, linear impulse and linear momentum, angular impulse and angular momentum, impact, central-force motion, relative motion, kinetics of systems of particles, generalized Newton's second law, work-energy, impulse-momentum, conservation of energy and momentum

UNIT III
Dynamics of rigid bodies, rotation, absolute motion, relative velocity, instantaneous center of zero velocity, relative acceleration, motion relative to rotating axes, plane kinetics of rigid bodies, translation, fixed-axis rotation, general plane motion, mass moments of inertia

UNIT IV
Work energy relations, virtual work, impulse-momentum equation, and three-dimensional dynamics of rigid bodies, gyroscopic motion, and steady precession

Text Book:

1. Meriam, J. L., Kraige, L. G., Bolton, J. N., "Engineering Mechanics: Volume 2, Dynamics", 9th Edition, Wiley, 2018.

Reference Book:

1. Shames I. H. and Rao, G. K., "Engineering Mechanics Statics and Dynamics", Pearson Education India; 4th Edition, 2005.

Subject: Engineering Thermodynamics (Code: MET204)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Apply the basic concepts of thermodynamics to engineering systems
- **CO2:** Apply various laws of thermodynamics to solve problems involving heat and work transfer
- **CO3:** Design heat engines and heat pumps using the knowledge of basic thermodynamic cycles
- **CO4:** Develop fundamental relations between various thermodynamic properties to evaluate the un-measurable properties

Detailed Syllabus:

UNIT I

Introduction and basic concepts, microscopic and macroscopic views of matter, thermodynamic systems, properties, processes, cycles, thermal equilibrium, the state postulate, Zeroth law of thermodynamics, temperature, temperature scales, thermodynamic equilibrium, energy and the First law of thermodynamics, mechanical forms of work, internal energy, conservation of energy, energy transfer as work and heat, First law for a closed system, specific heats, isothermal, isobaric, and isentropic processes, compressibility.

UNIT II

First law for open systems, enthalpy, First law for cyclic processes, applications, Second law of Thermodynamics, Entropy and the Second law, Various statements of the Second law and their equivalence, Clausius statement, Kelvin-Planck statement, reversible cycles, Carnot cycle, inequality of Clausius, the principle of increase of entropy and its applications, Second law for closed systems, Second law for open systems.

UNIT III

The Maxwell relations, Gibb's function, Helmholtz function, relationship between specific heats, the Clapeyron equation, thermodynamic relations for ideal gases, computation of entropy and internal energy from measurable quantities, process with ideal gases and vapours, Ideal gas mixtures, Dalton's law of partial pressures, Gibbs–Dalton law, Amagat's law of additive volumes

UNIT IV

Internal energy, enthalpy, specific heat and entropy of an ideal gas mixture, air-water vapour mixture**,** complete and incomplete combustion analysis, heating value of fuels, analysis of products of combustion, Orsat apparatus.

Text Books:

1. Moran, M.J., Shapiro, H.J., Boettner, D.D., Bailey, M.B., "Fundamentals of Engineering Thermodynamics", John Wiley, 2018.
2. Cengal, Y., Boles, M., and Kanoglu, M., "Thermodynamics: An Engineering Approach", McGraw Hill, 2019.

Reference Books:

1. Wark, K., "Thermodynamics", McGraw Hill, 2001.
2. Van-Wylen, G.J., "Fundamentals of Classical Thermodynamics", John Wiley, 2001.

Subject: Fluid Mechanics-I (Code: MET205)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Apply the basic laws of hydrostatics to engineering problems involving static fluids and submerged surfaces
- **CO2:** Evaluate and apply the principles of continuity, momentum, and energy conservation to systems involving fluid motion
- **CO3:** Apply the Bernoulli equation to compute pressure and velocity changes in flow systems of different configuration and appreciate the application of elementary potential theory
- **CO4:** Apply the knowledge of fluid dynamics to determine head losses in circular pipes and use elementary boundary-layer theory to determine lift and drag forces in engineering systems

Detailed Syllabus:

UNIT I

Definition of a fluid, methods of analysis, system and control volume, differential versus integral approach, methods of description, fluid as a continuum, velocity field, timelines, path lines, streak lines, and streamlines, stress field, viscosity, Newtonian and non-Newtonian fluids, surface tension, viscous and inviscid flows, laminar and turbulent flows, the basic equation of fluid statics, pressure variations in a static fluid, manometers, hydraulic systems, hydrostatic force on submerged surfaces, buoyancy and stability, fluids in rigid-body motion

UNIT II

Conservation of mass, control volume formulation, differential control volume, control volume moving with constant velocity, momentum equation for control volume with rectilinear acceleration, the angular-momentum principle, equation for fixed control volume, equation for rotating control volume, the rate of work done by a control volume, differential analysis of fluid motion, stream function and velocity potential, fluid translation, acceleration of a fluid particle in a velocity field, fluid rotation, fluid deformation, momentum equation, Navier-Stokes equations

UNIT III

Incompressible inviscid flow, momentum equation for frictionless flow, Euler's equation, Bernoulli equation, integration of Euler's equation along a streamline, static, stagnation, and dynamic pressures, applications of the Bernoulli equation, the Bernoulli equation interpreted as an energy equation, energy grade line and hydraulic grade line, unsteady Bernoulli equation,

irrotational flow, stream function and velocity potential, Laplace's equation, superposition of elementary plane flows

UNIT IV

Dimensional analysis and similitude, non-dimensionalization of the basic differential equations, Buckingham Pi theorem, determining the π groups, significant dimensionless groups, flow similarity and model studies, internal incompressible viscous flow, fully developed laminar flow between infinite parallel plates, fully developed laminar flow in a pipe, flow in pipes and ducts, shear stress distribution, turbulent velocity profiles in fully developed pipe flow, energy considerations in pipe flow, kinetic energy coefficient, head loss calculation, major and minor losses, friction factor, restriction flow meters for internal flows, boundary-layer theory, boundary-layer thicknesses, laminar flat-plate boundary layer, momentum integral equation for flow with zero pressure gradient, friction and pressure drag, streamlining, aerodynamic lift

Text Book:

1. Pritchard, P. J., Leylegian, J. C., "Fox and McDonald's Introduction to Fluid Mechanics", Eighth edition, John Wiley and Sons, Inc., 2011.

Reference Books:

1. Shames, I. H., "Mechanics of Fluids", Fourth Edition, McGraw Hill, 2003
2. White , F.M., "Fluid Mechanics", McGraw Hill, 2001

Subject: Machine Drawing & Solid Modelling (Code: MEL206)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 2		
			L	T	P
			0	0	4
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Draw machine elements including keys, couplings, cotters, rivets, bolted and welded joints, using the conventions for engineering components and materials
- **CO2:** Construct an assembly drawing using part drawings of machine components
- **CO3:** Create part drawing of machine components using machine assembly
- **CO4:** Apply geometric modelling techniques in design and analysis

Detailed Syllabus:

UNIT I

Introduction to machine element drawing, review of dimensioning, types of sectioning and use, need and significance of version control in drawings, methods of recording modifications in typical drawings, Introduction to generation of drawings as a design process for machine assembly. Use of datum planes to locate features and machine elements uniquely in assemblies. Standardized representation and types of threads, fasteners, welds.

UNIT II

Introduction to important machine elements such as bearings (rolling contact/sliding contact), Use of appropriate fits for correct functioning, representation of springs and related components, detailing of components involving shafts, bearing, pulleys, gears, belts, brackets for assembly, generation of assembly drawings using standard modeling software including sectioning and bill of materials, evolving details of components from assembly considerations.

UNIT III

Solids Modelling for Design: Solid entities, Boolean operations, Topological aspects, Invariants. Write-frame modelling, B-rep of Solid Modelling, CSG approach of solid modelling. Popular modelling methods in CAD software. Data Exchange Formats and CAD Applications.

UNIT IV

Development of three-dimensional models and fabrication/assembly drawings from engineering sketches and orthographic drawings and utilization of three-dimensional models in design work. Introduction to engineering topics such as finite-element analysis (FEA) and computational fluid dynamics (CFD). Additional advanced topics include stress/deflection calculations using beam theory mathematical models.

Text Books:

1. Bhatt, N.D., "Machine Drawing", Charotar Publishing House, 2003.
2. Saxena A. and Sahay B., "Computer-Aided Engineering Design", Anamaya Publishers, New Delhi, 2005.

Reference Books:

1. Sidheswar, N., Kannaiah, P. and Sastry, V.V.S., "Machine Drawing", Tata McGraw Hill Book Company, New Delhi, 2000.
2. Mortenson M. E., "Geometric Modeling", Tata McGraw Hill, 2013.

Subject: Applied Mathematics for Engineers (Code: MAT205)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Solve problems related to differentiation and integration of complex functions
- **CO2:** Express complex functions in terms of series expansion, classify singularities and the apply the concepts of complex analysis in boundary value problems and potential theory
- **CO3:** Evaluate Laplace, Inverse Laplace transforms, Fourier and Inverse Fourier transforms of various functions and related problems
- **CO4:** Apply the methods of Laplace and Fourier transforms in solving ODE, PDE and Integral equations

Detailed Syllabus:

UNIT I

Complex Variables:

Function of a Complex variable, Limit, Continuity and Differentiability of complex function. Cauchy-Riemann Equations, Analytic function, Harmonic functions, Complex Integration Cauchy Integral Theorem and its consequences, Taylor Series, Laurant Series, Classification of Singularities, Residues, Cauchy's Residue Theorem and its Applications, Zeros of Analytic functions.

UNIT II

Boundary Value Problems and Potential Theory:

Laplace's Equation and Conformal Mappings, Standard Solution of Laplace equation, Steady–State Temperature Distribution, Steady Two Dimensional Fluid Flow.

UNIT III

Laplace transform:

Laplace transform of some elementary functions, Properties of Laplace transform, Differentiation and Integration of Laplace transform, Dirac-delta function and its Laplace transform, Heaviside's expansion theorem, Inverse Laplace transform, Initial and Final value theorems, Convolution theorem, Use of Laplace transforms in the solution of linear differential equation.

UNIT IV

Fourier Transforms, Definition of Fourier transform, Fourier Integral Theorem, Properties of Fourier transform, Fourier sine and cosine, Convolution Theorem, Applications of Fourier transforms to Ordinary and Partial differential equations.

Text Books:

7. Brown, W., and Churchill, R. V., "Complex Variables and Applications," 8th Edition, Mc-Graw Hill International Edition, 2009
8. Debnath, L., and Bhatta, D., "Integral Transforms and their Applications," 2nd Edition, CRC press, 2007

Reference Books:

1. Jeffrey, A., "Complex Analysis and Applications," 2nd Edition, CRC Press, 2005
2. Needham, T., "Visual Complex Analysis," Oxford University Press
3. Jain, R. K., and Iyengar, S. R. K., "Advanced Engineering Mathematics," 3rd Edition, Narosa Pub. House, 2008
4. Spiegel, M. R., "Schaum's Outlines Laplace Transforms," Tata Mc-Graw Hill, 2005

Subject: Mechanics of Solids Lab (Code: MEL207)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Continuous Assessment (40 Marks)	End-Term (60 Marks)		

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

CO1: Determine the tensile or compressive strength of different material and interpret various critical point locations on the stress-strain diagram
CO2: Identify different engineering materials, describe their properties and predict their behaviour under different types of loading
CO3: Determine elastic constants using various flexural and torsion tests
CO4: Determine the mechanical properties of materials by destructive methods

List of Experiments:

1. To study the stress-strain characteristics of (a) Mild Steel and (b) Cast Iron by conducting tension test on UTM
2. To study the stress-strain characteristics of (a) Copper and (b) Aluminum by conducting tension test on Hounsfield Tensometer
3. To find the compressive strength of wood and punching shear strength of G.I. sheet by conducting relevant tests on Hounsfield Tensometer
4. To find the Brinnell's and Vicker's hardness numbers of (a) Steel (b) Brass (c) Aluminum (d) Copper by conducting hardness test
5. To determine the modulus of rigidity by conducting Torsion test on (a) Solid shaft (b) Hollow shaft
6. To find the modulus of rigidity of the material of a spring by conducting compression test
7. To determine the Young's modulus of the material by conducting deflection test on a simply supported beam
8. To determine the modulus of elasticity of the material by conducting deflection test on a propped cantilever beam
9. To determine the modulus of elasticity of the material by conducting deflection test on a continuous beam
10. To investigate the load deflection characteristics of various types of spring and determine their spring rate

Subject: Manufacturing Processes Lab (Code: MEL208)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Continuous Assessment (40 Marks)	End-Term (60 Marks)		

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

CO1: Describe the geometry of single point cutting tool
CO2: Apply knowledge of metal cutting to perform various machining operations
CO3: Explain the working and use of various components of conventional machine tools
CO4: Investigate the effect of machining process parameters on surface roughness

List of Experiments:

1. To study the construction details and working principle of Lathe Machine.
2. To perform taper turning operation on Lathe Machine
3. To perform step turning operation on Lathe Machine
4. To study the tool geometry of a single point cutting tool.
5. To perform drilling operation on a given work piece using Drilling Machine
6. To perform shaping operation on a given work piece using Shaper Machine
7. To perform external thread cutting operation on Lathe Machine
8. To investigate the effect of turning process parameters on the surface roughness of machined component

Subject: Applied Thermodynamics (Code: MET250)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Identify and describe the various components of boilers and power plant
- **CO2:** Explain the operation of steam turbines and steam power plants
- **CO3:** Explain the operation of diesel and gas turbine power plants and address the general challenges in thermal power plants
- **CO4:** Analyze the principles and applications of refrigeration systems and air-conditioning processes using the principles of psychometry.

Detailed Syllabus:

UNIT I

Pure Substance, Ideal and real Gases, perfect gases, Generation of Steam, use of Steam Tables and Mollier diagram, various phases of a substance, triple point and critical point, sub-cooled liquid, saturated liquid, vapor pressure, two-phase mixture of liquid and vapor, saturated vapor and superheated vapor states of a pure substance (with water as an example), dryness fraction and its measurement, representation of the properties of a pure substance on p-T, h-s and p-V diagrams, detailed treatment of properties of steam for industrial and scientific use.

Vapor Power cycles: Carnot vapor power cycle, Effect of pressure & temperature on Rankine cycle, Reheat cycle, Regenerative cycle, Feed water heaters, Binary vapor cycle, combined cycles, Cogeneration, Air standard Cycles, Carnot, Otto, Diesel and dual cycles, work output and efficiency, mean effective pressure, deviation of actual cycles from ideal cycles

UNIT II

Fuels and Combustion: Combustion analysis, Heating Values, Air requirement, Air/Fuel ratio, Standard heat of reaction and effect of temperature on standard heat of reaction, heat of formation, adiabatic flame temperature.

Boilers: Steam generators-classifications, working of fire-tube and water-tube boilers, boiler mountings and accessories, draught and its calculations, air preheater, feed water heater, super heater. Boiler efficiency, Equivalent evaporation. Boiler trial and heat balance, Condensers: classification, Air leakage, Condenser performance parameters

UNIT III

Nozzles: Flow through nozzle, Variation of velocity, Area and specific volume, Choked flow, Throat area, Nozzle efficiency, off design operation of nozzle, Effect of friction on nozzle, super saturated flow. Steam Engines: Rankine and modified Rankine cycles, working of stream engine, Steam Turbines :Classification of steam turbine, Impulse and reaction turbines, Staging, Stage and overall efficiency, Reheat factor, Bleeding, Velocity diagram of simple & compound multistage impulse & reaction turbines & related calculations work done efficiencies of reaction, Impulse reaction Turbines, state point locus, Comparison with steam engines, Losses in steam turbines, Governing of turbines.

UNIT IV

Applications of Refrigeration and Air-conditioning, Thermal Principles for Refrigeration, Vapor Compression System, Reversed Carnot Cycle, Survey of Refrigerants, Designation of Refrigerants, Selection of Refrigerants, Thermodynamic Requirements, Centrifugal compressors, Multistage compression, multi-evaporator system, cascade systems, Condensers, Heat Transfer in Condensers, Evaporators, Heat Transfer in Evaporators, Extended surface Evaporator, Cooling and Dehumidifying coils, Automatic or constant-pressure expansion valve, Psychometric properties, Wet bulb temperature, Psychometric chart, mixing process.

Text Books:

1. Eastop, T. D., "Applied Thermodynamics for Engineering Technologist", Pearson Education, 1990.
2. Arora, C. P., "Refrigeration and Air-conditioning", McGraw Hill, New Delhi,

Reference Books:

1. Helsdon, R. M., Hiller, N., Walker, G. E., "Introduction to Applied Thermodynamics", Elsevier, 1965.
2. Pai, B. U., "Turbomachines", 1st Edition, Wiley.
3. Hundy, G. H., Trott, Albert Runcorn, Welch, T., "Refrigeration, Air Conditioning and Heat Pumps," 5th Edition, Butterworth-Heinemann, Elsevier.

Subject: Mechanics of Materials (Code: MET251)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Apply the fundamental concepts of stress and strain and their relationships to solve problems for three-dimensional elastic solids
- **CO2:** Explain the concept of buckling of columns and solve the problems related to isolated bars
- **CO3:** Solve problems relating to torsional deformation of bars and other simple three-dimensional structures
- **CO4:** Apply principles of linear elasticity in the design and analysis of structures such as curved bars, crane hooks, thin plates

Detailed Syllabus:

UNIT I

Stress in three dimension: Concept of continuum, homogeneity and isotropy, types of force on a body, state of stress at a point, equality of cross shear, Cauchy formula, principal stresses and planes, stress invariants, hydrostatic and deviatoric stress tensor, Mohr's circle for general state of stress, stress transformations, octahedral stresses, differential equation of equilibrium. Strain in three dimension: Types of strain, strain displacement relationship, shear strain, rigid body rotation, principal strain and axes, strain deviator and invariants, compatibility conditions, concept of plane stress and strain, stress strain relationship.

UNIT II

Theories of Elastic Failure: Concept of factor of safety, Maximum Principal Stress Theory, Maximum Principal Strain Theory, Maximum Shear Stress Theory, Strain Energy Theory, Distortion energy theory. Buckling of columns: Concept of buckling and stability, differential equations of compression member with different boundary conditions, eccentrically loaded columns, secant formula, column with initial imperfections, Rankine formula.

UNIT III

Stresses due to rotation: Rotating ring, rotating thin disc, and rotating thin solid and hollow disc, disc of uniform strength, rotating long solids and hollow cylinders. Torsion of non-circular member: St. Venant's theory, approximate solution of rectangular and elliptical sections, rigorous solution, stress function approach, membrane analogy, torsion of thin hollow section, torsion of thin and open sections.

UNIT IV

Bending of curved bars: Introduction, stresses in curved bars (Winkler-Bach theory) having rectangular, circular, triangular and trapezoidal section, stresses in crane hooks. Bending of thin plates: Assumption of plate theory, governing differential equations for deflection of plates, boundary conditions, solution for rectangular plate.

Text Books:

1. Hibbeler, R. C., "*Mechanics of Materials",* 6th Edition, East Rutherford, NJ: Pearson Prentice Hall, 2004
2. Srinath L. S., "Advanced Mechanics of Solids", TMH Publishing Company Limited, 1992

Reference Books:

1. Boresi A. P., Schmidt R. J., Sidebottom O. M., "Advanced Mechanics of Materials", 5th Edition, John Wiley & Sons, 1993
2. Cook, R. D., Young, W. C., "Advanced Mechanics of Materials", Collier Macmillan Publishers, 1985
3. Ugural A. C., S. K. Fenster, "Advanced Mechanics of Materials and Applied Elasticity", Prentice Hall; 5th Edition, 2011

Subject: Theory of Mechanisms and Machines (Code: MET252)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

CO1: Select and analyse the kinematic parameters for designing a suitable linkage mechanism
CO2: Explain the working principle of governors and gyroscopes in motion control
CO3: Select and design gear and cam mechanisms for a given input and output motion relationship
CO4: Apply the laws of friction in applications of mechanisms and machines

Detailed Syllabus:

UNIT I
Mechanism and machine, links and kinematic pairs, degrees of freedom, kinematic chain, mechanical advantage, transmission angle, inversions of four bar and slider crank mechanisms, Quick-return mechanism, straight line generators, velocity and acceleration analysis using instantaneous centre method and loop-closure equations, computer-aided analysis of four bar mechanism, graphical and computer-aided synthesis for motion and path generation

UNIT II
Governors, Watt governor, Porter governor, Proell governor, Hartnell governor, controlling force, sensitivity, stability, hunting, isochronism, effort and power of a governor, gyroscope, gyroscopic torque, gyroscopic effects on an airplane and ships, gyroscopic stabilization, stability analysis of a two-wheel vehicle, four-wheel drive on a curved path

UNIT III
Gears, classification, law of gearing, involute and cycloidal profiles, path and arc of contact, contact ratio, interference and undercutting, interchangeable gears, helical, bevel and spiral gears, gear trains, classification, simple, compound, reverted, and epicyclic gear trains, analysis of epicyclic gear trains, sun and planet gears, automobile differential

UNIT IV
Friction, types and laws of friction, screw jack, pivots and collars, bearings, friction clutches, brakes, Cams, classification and terminology, displacement diagrams, derivatives of follower motion, pressure angle and undercutting, motions of the follower, layout of cam profiles, graphical and analytical disc cam profile synthesis

Text Book:

1. Pennock, G. R., Shigley J. E., Uicker, J. J., "Theory of Machines and Mechanisms", Oxford University Press, 4th Edition, 2014.

Reference Books:

1. Bevan, T., "Theory of Machines", 3rd Edition, CBS publishers and distributors, 2005.
2. Norton, R. L., "Kinematics and Dynamics of Machinery", Tata McGrawHill, 2009.
3. Ghosh A. and Mallick A. K. "Theory of Mechanisms and Machines" East West Private Limited, New Delhi, 1988.
4. Rattan S. S. "Theory of Machines", 5th Edition, Tata McGrawHill, 2019.

Subject: Materials Science and Engineering (Code: MET253)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Explain the underlying concepts of engineering material chemistry and crystallography
- **CO2:** Determine crystallographic directions and explain imperfections in solids, and processing of engineering materials
- **CO3:** Explain the mechanisms of strengthening and the phase diagrams
- **CO4:** Recognize the need of heat treatment processes and analyse the effect of cooling media on microstructure

Detailed Syllabus:

UNIT I

Introduction to material science and engineering, Importance of materials, Classification of engineering materials, Modern and advanced materials, Atomic structure and bonding, Fundamentals of electron arrangements and modern periodic table, Primary bonds and secondary bonds. Crystallography, Concept of unit cells and lattice arrangements, Crystal structure, Crystal systems, Bravais lattices, Co-ordination number, Atomic packing factor

UNIT II

Miller indices of direction and planes, single crystals, polycrystalline materials, Amorphous material, x-ray diffraction and determination of crystal structures, Imperfections in solids, point defects, line defects and volume defects, dislocations.

Ceramics: structure, types, properties and applications of ceramics, processing of ceramics. Composite materials. Nanomaterials and their potential applications. Plastics: Types of plastics/polymers, polymer structure, thermoplastic and thermosetting polymers, processing of polymers

UNIT III

Deformation and strengthening mechanisms, strain hardening, grain refinement, mechanical alloying, solid solution strengthening, precipitation hardening. Diffusion in solids, Phase diagrams, Solubility limit, Phases, Lever rule, Gibbs phase rule, Iron-Carbon equilibrium diagram. Mechanical properties and testing, Non-Destructive testing

UNIT IV

Heat Treatment: Introduction to heat treatment, different types of heat treatment processes, annealing, normalizing, quenching, tempering, case hardening, Time temperature transformation diagram, Recovery, Recrystallization, Ductile to brittle transition. Micro-structure of various metals and alloys, Micro structure of steel treated with different cooling media.

Text Book:

1. Callister Jr, W. D., Rethwisch, D. G., "Materials Science and Engineering: An Introduction", 8th Edition, John Wiley and Sons.

Reference Books:

1. Raghvan, V., "Materials Science and Engineering", 5th Edition, Prentice Hall India Learning Private Limited, 2005.
2. Ghosh, A., and Malik, A. K., "Manufacturing Science", 2nd Edition, Pearson India, 2010.

Subject: Non-Traditional Machining and Automation (Code: MET254)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

- **CO1:** Analyse and assess the importance of automation and industrial automated systems
- **CO2:** Identify and analyse functions and functioning of CNC machines
- **CO3:** Recognize the need of non-traditional machining processes and understand the working of high energy beam machining
- **CO4:** Illustrate underlying mechanisms in non-traditional machining processes along with their applications

Detailed Syllabus:

UNIT I

Introduction to automation and manufacturing automation, types of automation, Introduction to Flexible manufacturing systems (FMS), Elements, types and advantages of FMS, Cellular manufacturing, Types of flexibilities in FMS, test of flexibility, Product processing strategies. Introduction to robotics, Elements of Robotic Systems

UNIT II

Computer numeric control (CNC) machines, Open loop & closed loop CNC machines. Classification, advantages and applications of CNC machines, Introduction to CNC programming, G-codes and M-codes. Absolute and Incremental coordinate system, Adaptive control, Material Handling Equipment, Automated Guided vehicles (AGVs), Analysis of AGVs

UNIT III

Introduction to machining processes. Limitations of traditional machining processes. Introduction, need and applications of non- traditional machining processes. Classification of non- traditional machining processes. Mechanical machining, thermal machining, electrochemical machining. Introduction, working and applications of high energy beam machining processes. Virtual machining

UNIT IV

Introduction, working, process parameters and applications of Abrasive Jet Machining (AJM), Abrasive water jet machining (AWJM), Ultrasonic machining (USM), Electric Discharge Machining (EDM), Electrochemical machining (ECM). Introduction to Wire Electric Discharge Machining (WEDM). Effect of input parameters on material removal in AJM, USM and EDM.

Text Books:

1. Groover, M. P., "Automation, Production Systems and Computer Integrated Manufacturing", Prentice Hall Press, United States, 2007.
2. Ghosh, A., and Mallik, A.K., "Manufacturing Science", 2nd Edition, East-West Press, New-Delhi.

Reference Books:

1. Kumar, K., Zindani, D., Davim, J. P., "Advanced Machining and Manufacturing Processes", Springer, Switzerland.
2. Groover, M. P., "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", 5th Edition, Wiley Publication.

Subject: Basic Electronics (Code: ECT254)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

CO1: Explain the basic principles associated with semiconductor electronics
CO2: Explain the behavior of different types of diodes and transistors at the circuit level
CO3: Analyze and explain the behavior of operational amplifiers and their applications
CO4: Apply the knowledge of digital logic gates and blocks in designing digital electronic circuits

Detailed Syllabus:

UNIT I
Introduction to semiconductors: Intrinsic and extrinsic semiconductors transport mechanism of charge carriers, electric properties, temperature dependence, and p-n junction diode: current components in p-n junction, characteristics-piece wise linear approximation, and diode circuit's half wave, full wave rectifiers, photo diodes

UNIT II
BJT: Operation and characteristics: CE, CB and CC configuration input, output characteristics biasing and bias stability, low frequency, h-parameter model, analysis and design of transistor amplifier circuits using h-parameters. Multistage amplifiers, transistor as a switch. Introduction to feedback and sinusoidal oscillators, FET's operation and characteristics, JFET model, application at low and high frequency, amplifiers, switching circuits, MOSFET types, operation and characteristics

UNIT III
Operational Amplifier: Operational amplifiers stages, differential amplifier, CMRR, cascade amplifier, ideal and practical operational amplifier characteristics and properties OP-amp applications, inverting and non-inverting amplifiers, difference amplifier, summer differentiator and integrator, rectifiers etc. Instrumentation amplifier

UNIT IV
Digital Logic: Introduction to Boolean theorems and codes, code conversion; Logic gates, combinatorial and sequential blocks

Text Books:

1. Millman, J., Halkias, C., Jit, Satyabrata, "Milman's Electronics Devices and Circuits", Tata McGraw Hill Education, 2010
2. Mano, M Morris, "Digital logic and computer design", Pearson Education India, 2017

Reference Books:

1. Behzad Razavi, "Fundamentals of Microelectronics", Wiley, 2008
2. Mottershed, A., "Electronic Devices and Circuits: An Introduction", Prentice Hall India, 1979.
3. Uyemura, J., "Digital System Design An Integrated Approach", Nelson Engineering, 1999.

Subject: Thermo-Fluids Lab (Code: MEL255)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Continuous Assessment	End-Term		
	40 Marks	60 Marks		

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

CO1: Calibrate flow and discharge measuring devices like the venturimeter and orifice meters
CO2: Determine fluid flow properties and characterize laminar and turbulent flows
CO3: Prepare heat balance sheet for steam boilers
CO4: Determine COP of a refrigerator and identify various parts of a cooling tower

List of Experiments:

Thermal:

1. Determination of calorific value using a Bomb Calorimeter.
2. Study of Various Types of Boilers, Boiler Mountings and Accessories
3. Performance and Energy Balance Test on a Fire Tube/ Water Tube Boiler.
4. Study of Refrigeration System and determination of its COP.
5. Study of a cooling tower.

Fluid Mechanics:

1. To determine the viscosity of a fluid by falling sphere (ball) viscometer.
2. To study the flow through a variable area duct and verify Bernoulli's energy equation.
3. To determine the coefficient of discharge for an obstruction flow meter (Venturimeter/orifice meter).
4. To study the transition from laminar to turbulent flow and to ascertain lower critical Reynolds number.
5. To determine the friction coefficient for pipes of different diameters.
6. To determine the velocity distribution for pipeline flow with a Pitot static probe and to measure pressure with pressure sensors.
7. To study the flow visualization through wind tunnel.

Subject: Non-Traditional Machining and Automation Lab (Code: MEL256)	Year & Semester: B. Tech Mechanical Engineering 2nd Year & 4th Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Continuous Assessment	End-Term		
	40 Marks	60 Marks		

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

CO1: Explain the working and use of various components of CNC machines.
CO2: Identify the sequence of codes to process a job
CO3: Create CNC programs for turning and milling operations
CO4: Perform machining operation on Wire Electric Discharge Machine

List of Experiments:

1. To Study the fundamentals of CNC Machine
2. To Study the different codes used in CNC Machine
3. To perform drilling operation on CNC Milling Machine
4. To perform slotting operation on CNC Milling machine
5. To perform turning operation on CNC Lathe Machine
6. To produce given profile using CNC Milling Machine
7. To perform machining operation on Wire Electric Discharge Machine (WEDM)
8. To investigate the effect of WEDM process parameters on the surface roughness of the machined component.

Reference Book:

1. Overby, A., "CNC Machining Handbook: Building, Programming and Implementation", McGraw-Hill, 2010.

DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING

<table>
<tr><td rowspan="2">Subject: Electric, Magnetic and Dielectric Materials (Code: MMT201)</td><td rowspan="2" colspan="2">Year & Semester: B. Tech Metallurgical and Materials Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td rowspan="2"></td><td>3</td><td>1</td><td>0</td></tr>
<tr><td>Mid-Term</td><td>Class Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td></td><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
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Course Outcomes:

- **C01:** Understanding about the nature of electrical conduction in metals and semiconductors.
- **C02:** Insight about the modern techniques for fabrication / synthesis of semiconductor materials.
- **C03:** Understanding about the various important semiconductor devices such as metal oxide semiconductors, PN junctions, transistors like BJT's and FET'S.
- **C04:** Understanding of magnetic properties of materials and their applications.
- **C05:** Knowledge about the latest dielectric materials and their applications.
- **C06:** Insight about the latest developments/ trends of electronic, magnetic and dielectric materials in various fields particularly Energy sector and Bio-medical applications.

Module 1

Free electron theory and its limitations, Metallic conduction and factors affecting conductivity, semi conductor materials, p and n- type semiconductors and techniques of processing semi conductors. Oxidation, diffusion, ion and electron beam, ion implantation, plasma technology etc. MOS, MNOS and SOS, etc. technologies, I.C. technologies etc., Doping, Hall effect, p-n junctions, etc., Ionic and super-ionic conduction, single crystal growth.

Module 2

Magnetic materials; dia, para, ferro, ferri, anti-ferro, ceramic magnetic materials. Magnetism, theory of magnetism, Hard and soft Magnetic materials, their classification and applications, technology of their production, precipitation hardening of magnetic alloys, permanent magnetic materials.

Module 3

Di-electric materials, Piezo-electric and ferro-electric materials, doping and electric breakdowns, ferrites, transformer and switching materials, Optical materials, lasers etc.

Module 4

General discussion on the performance of materials in the development and growth of: Electrical, electronics and telecommunication equipment/ system, Energy sector, and Bio-Medical.

Text Books:

1. Introduction to Solid State Physics, Kittel, Wiley, 2004.
2. Physical Metallurgy Principles, Reed Hill, Affliliated East West Press Pvt Ltd. 2006.
3. Principles of Electronic Materials and Devices, SO Kasap, McGrawHill, 2007.
4. Materials Science & Engineering, Callister, Wiley, 2008.

Reference Books:

1. Theoretical Structural Metallurgy, Cottrell, Arnold, 1962.
2. Structure and properties of materials, Vol. IV, John Wiley, 1966
3. Semiconductors, Smith, R.A**,** Cambridge University Press, 1986

<table>
<tr><td rowspan="2">Subject: Thermodynamics of Materials
(Code: MMT202)</td><td colspan="2" rowspan="2">Year & Semester: B. Tech Metallurgical and Materials Engineering
2nd Year & 3rd Semester</td><td colspan="3">Total Course Credit: 4</td></tr>
<tr><td>L</td><td>T</td><td>P</td></tr>
<tr><td rowspan="2">Evaluation Policy</td><td colspan="2" rowspan="2"></td><td>3</td><td>1</td><td>0</td></tr>
<tr><td>Mid-Term</td><td>Class Assessment</td><td colspan="3">End-Term</td></tr>
<tr><td></td><td>30 Marks</td><td>10 Marks</td><td colspan="3">60 Marks</td></tr>
</table>

Course Outcomes:

- **C01:** Explain various terms and fundamental laws of thermodynamics.
- **C02:** Estimate enthalpy, entropy, Free energy changes and thermodynamic properties for various metallurgical processes.
- **C03:** Predict feasibility of reactions using chemical equilibrium constant.
- **C04:** Apply phase rule and phase equilibrium criterion to predict phase stability at particular temperature and composition.
- **C05:** Explain the electrochemical technique to measure thermodynamic quantities.
- **C06:** Solve numericals of thermodynamic systems applicable to Metallurgical Processes.

Module-1

Introduction: Basic concepts, postulates, and basic problems of thermodynamics, Reversible and irreversible reactions. First law of thermodynamics: Enthalpy, Heat capacity.

Module-II

Thermochemistry: Hess's law. Flame temperature, Second law of Thermodynamics: Entropy and its change, Free energy and Gibb's Helmholtz equation, Third law of Thermodynamics, Fugacity, activity and equilibrium constant, Free energy calculations, Activity measurement, Ellingham diagram

Module-III

Solutions: Introduction – Le Chatelier principle. Partial molal quantities. Gibb's Duhem equation, Ideal, non-ideal and dilute solutions, Raoult's and Henry's laws, Alternative/standard states, Sievert's law, mixing excess functions.

Module-IV

Regular solutions: Classius-clapeyron equation, Phase rule, liquid-vapor, solid-liquid, solid-vapor equilibria, Troutons rule. The thermodynamics of electro-chemical reversible cells. Introduction to statistical thermodynamics

Text Books

1. Metallurgical Thermodynamics, Kinetics and Numericals, S.K. Dutta, A.B. Lele, S.Chand, 2011
2. Problems in Metallurgical Thermodynamics & Kinetics, G.S Upadhyay& R.K Dube, Pergamon Press, 1985
3. Introduction to the Thermodynamics of Materials, Sixth Edition [6th ed.], David R. Gaskell, David E. Laughlin, CRC Press, 2018

References

1. Physical Chemistry of Metals, Darken &Gurry, CBS, 2002
2. Text Book of Materials and Metallurgical Thermodynamics, Ahindra Ghosh, PHI, 2003
3. Physical Chemistry of Metallurgical Processes, Shamsuddin Mohammad John Wiley & Sons Inc., 2016
4. Physical Chemistry of Iron and Steel making, C. Bodsworth, English Longman's Books Society & Longman's Green & Company, 1972
5. Principles of Extractive Metallurgy, Rosenquist, McGraw-Hill, 1983
6. Physical Chemistry of Metallurgical. Processes, A.K. Biswas and G.R. Bashforth, Asia Publishing House, New Delhi, 2005

Subject: Physical Metallurgy (Code: MMT203)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcome:

- **C01:** Illustrate the various aspects of crystallography for determination of crystal structure and analysis of the defects and their influence on the properties of the materials.
- **C02:** Discuss the concepts of solid solution formation and solidification behaviour of the metals.
- **C03:** Identify the importance of phase diagrams to predict the phase formation and use in development of materials.
- **C04:** Understanding of diffusion mechanisms and factors governing the diffusion process.
- **C05:** Knowledge of physical metallurgical aspects of important engineering alloys.

Module 1:

Structure of metals: Crystal structure, systems and Bravais lattices, symmetry elements; Indexing of crystallographic planes and directions; Co-ordination number and effective number of atoms for common crystalline structure, atomic packing factor and theoretical density, linear and planar densities; stereographic projections, interplanar spacing and angles, zone axis; concept of texture.

Module 2:

Crystal Imperfections: Point defects; dislocations, burgers vector and its representation, dislocation in FCC metals- Shockley partials, stacking faults; Grain boundaries-small and high angle boundaries, tilt and twist boundaries, twin boundaries; methods of grain size determination; defects and their influence on the properties of materials, effect of temperature on defects- recovery, recrystallization and grain growth.

Module 3:

Principles of Alloy formation: Solid solutions and its types, primary and intermediate phase formation, Hume-Rothery rules, electron compounds, intermetallic compounds.

Module 4:

Solidification of metals and alloys: Concept of free energy, entropy, surface energy, under cooling and cooling curves; Nucleation & Growth - homogeneous & heterogeneous nucleation, growth of solid- smooth, stable interface growth; Temperature inversion in pure metals; dendritic growth in pure metals and alloys, constitutional supercooling, directional solidification, freezing of ingots.

Module 5:

Phase diagrams: Equilibrium phase diagrams of various binary alloys involving- isomorphous, eutectic, eutectoid, peritectic, peritectoid, monotectic, and precipitation reactions; Application of Phase rule & lever rule; Iron carbon equilibrium diagram and the critical phenomenon; Isothermal transformation of Fe-C system; Ternary phase diagram- Gibbs triangle.

Module 6:

Diffusion: Diffusion in solid state and its mechanism; Laws of diffusion, Kirkendal effect, Factors governing diffusion.

Module 7:

Introduction to important alloys: Specifications of ferrous and non-ferrous alloys; Steels, stainless steels, cast irons, aluminum alloys, magnesium alloys, titanium alloys, copper base alloys, super alloys.

Text Books

1. Introduction to Physical Metallurgy, S. Avner, Tata Mc Graw Hill, 2008
2. Principles of Physical Metallurgy, Reed Hill, CT: Cengage Learning, 2008
3. Physical Metallurgy- Principles and Practice, V.Raghavan, Prentice Hall of India, 2007
4. Material Science And Engineering, W D Callister, John Wiley And Sons, 2000.
5. Physical Metullurgy, Vijendra Singh, Standard Publisher Distributors, 2017.

Reference Books

1. Physical Metallurgy, Hansen Peter, Cambridge University Press, 1987
2. Engineering Physical Metallurgy, Y. Lakhtin, MIR Publishers, 1998
3. Physical Chemistry of Metals, Darken &Gurry, CBS, 2002
4. Physical Metullurgy, Principles and Design , Gregory N. Haidemenopoulos, Taylor & Francis Group, 2018.

Subject: Principles of Process Metallurgy (Code: MMT204)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcomes:

- **C01:** Understand the scope of extractive metallurgy in metal industries and the concept of mineral processing.
- **C02:** Know the application of pyrometallurgy in metal extraction and the use of Kellogg's and Ellingham diagram.
- **C03:** Understand the use of hydrometallurgy in the extraction of lean ores and use of Pourbaix diagram.
- **C04:** Understand the importance of electrometallurgy in the extraction and refining of metals.
- **C05:** Perform heat and material balance in metal extraction.

Module 1

Introduction: Scope of extractive metallurgy, occurrence of metals in nature, minerals and ores. Elementary concepts of Mineral processing and extraction of metals.

Module 2

Pyrometallurgy: Drying and calcination, roasting & derivation of roasting conditions by Kellogg's diagram, relevance of Ellingham diagram in metal extraction, reduction of metal oxides, matte smelting and converting, metal refining processes: fire-refining, liquation and distillation.

Module 3

Hydrometallurgy: Leaching and its methods, construction & use of Pourbaix diagram, bioleaching, solution purification and concentration: solvent extraction and ion exchange. Recovery of metals from leach solutions.

Module 4

Electrometallurgy: Principles of electrolysis, electrolytic systems, electro-refining, electrowinning and other electro-metallurgical processes.

Module 5

Process Flow Sheets: Production of iron and steel, aluminium, copper, zinc and lead.

Module 6

Analysis of unit processes: Reactor kinetics, heat and material balance.

Text books

1. J. Newton: Extractive Metallurgy, Wiley.
2. W.H. Dennis: Extractive Metallurgy- Principles and Applications, Pitman.
3. J.D. Gilchrist: Extraction Metallurgy, Pergamon.
4. R.D. Pehlke: Unit Processes in Extractive Metallurgy, Elsevier.
5. T. Rosenqvist: Principles of Extractive Metallurgy, McGraw Hill.
6. C.B. Gill: Nonferrous Extractive Metallurgy, Wiley-Interscience.
7. H.S. Ray and A. Ghosh: Principles of Extractive Metallurgy, New Age International Publishers.
8. H.S. Ray, R. Sridhar and K.P. Abraham: Extraction of Non-ferrous Metals, Affiliated East West.
9. F. Habbashi, Principles of Extractive Metallurgy, Vol 1-4, McGraw-Hill

Subject: Metallurgical and Instrumental Analysis (Code: MMT205)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

Course Outcomes:

At the end of the course students will acquire;

1. The basic knowledge about the chemical and metallurgical analysis methods and techniques in general.
2. The basic concepts of classical but widely used methods like volumetry and gravimetry.
3. The understanding of the principles involved and the practical application of purely instrumental methods like potentiometry/pH-metry, conductometry, chromatography, thermal analysis etc.
4. The insight about the principles and practical application of the most modern methods of spectrophotometry and to understand the changes taking place in atoms, molecules and ionic species on the absorption of EMR, electromagnetic radiations.

Details of the Course:

Principles involved, procedures and applications of following experimental/instrumental and spectrophotometric methods of chemical and metallurgical analysis

Module 1

Volumetry, Gravimetry, Conductometry, Electrogravimetry, Potentiometry, pH of buffer solutions and its determination. Fire assaying for analysis of bullion.

Module 2

Spectroscopy-- Absorptimetry and Emission spectrophotometry, Changes taking place in atoms, molecules and ions by absorption of UV-Visible and IR radiations. Colorimetry, Flame photometry, Atomic Absorption Spectrophotometry (AAS), and X-ray fluoresence.

Module 3

Introduction to Thermal Analysis (TGA, DTA, DSC, TMA etc.), Chromatography-types and applications and Radio-chemical methods- Carbon dating, etc.

Module 4

Applications of the above analytical methods to the assessment and evaluation of solutions, alloys, ores, slags, ceramics, glass and refractories, etc.

References:

S. No.	Name of the Book	Author(s)	Publisher	Year of Publications
1.	Instrumental Methods of Analysis	Williard H.H., Merritt L.L., and Dean J.A.	Wadsworth	1981
2.	Standard Methods of Chemical Analysis, Vol: III A	Welcher F.J.	Van Nostrand	1962
3.	Instrumental methods of Chemical Analysis	Ewing G.W.	McGraw-Hill	1985
4.	Metallurgical Analysis	Jain and Agarwal,	Khanna Publishers, New Delhi	1985
5.	Problems in Quantitative Analysis	A. Musakin,	Mir	1984
6.	A brief introduction to modern chemical Analysis	D.G.Peters, J.H.Hayes and G.M. Hieftje	Saunders	1976
7.	Quantitative chemical Analysis 5th Ed.	Vogel's	Longman, Harlow	1989
8.	Vogel's Text Book of Quantitative chemical Analysis 6th Ed. (Low Priced Edition)	Mendham, Denny, Barnes, Thomas	PEARSON Education	2000 (7thReprint 2005)

Subject: Numerical Techniques & Computer Programming (Code: MAT206)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term	Class Assessment	End-Term		
	30 Marks	10 Marks	60 Marks		

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

CO1	Error estimate and Solve algebraic and transcendental equations using numerical techniques
CO2	Construction of Interpolating polynomial and finding intermediate value
CO3	Solve ordinary differential equations by numerical techniques
CO4	Apply Numerical techniques in metallurgical and materials engineering problems
CO5	Solve real life problems by using numerical techniques with the help of MATLAB programming.

Module I: (10 hours)

Finite differences: Difference table and its usage. The difference operators ▲, ▼ and the operator E. Interpolation: Interpolation with equal intervals. Newton's advancing difference formula. Newton's backward differences formula. Interpolation with unequal intervals. Newton's divided differences formula. Lagrange's interpolation formula. Central Differences: The central difference operator and the averaging operator μ, Relations between these operators.

Module II: (5 hours)

Numerical Solution of Algebraic and Transcendental equations. Graphic Method, Regula- Falsi Method, Balzano's Bisection Method, Newton - Raphson Method and its geometrical significance.

Module III: (6 hours)

Numerical Integration: Numerical integration. General Quadrature Formula, Trapezoidal rule. Simpson's one-third and three-eight rules.

Module IV: (5 hours)

Numerical solution of ordinary differential equations. Numerical solution of ordinary differential equations, Picard's method, Taylors series methods, Euler's method, Runge-Kutta method.

Module V: (7 hours)

The application of Computer, Digital computer organization. Flow charts and decision tables. MATLAB programming, simulation and modelling, Computing methods in Engineering problem solving in general and Metallurgical engineering Problems in particular.

References:

Text Books:

1. Numerical Methods for Scientists and Engineering M.K. Jain, S. R. Iyengar & R.K. Jain, Wiley Eastern Ltd New age international publishers, 7th Edition, 2019, ISBN: 9789387477254, 9387477258..
2. Introductory methods in Numerical Analysis, S.S. Sastry, 5th Edition, Prentice Hall India learning Pvt Ltd, ISBN: 9788120345928, 9788120345928.
3. Elementary Numerical Analysis, Kendall E. Atkinson, Han , 3rd Edition, 2006, Wiley India Pvt Ltd, ISBN-13: 978-9754142747
4. Getting Started with MATLAB: A Quick Introduction for Scientists & Engineers, Rudra Pratap, South Asia edition, Oxford; Edition (2010), ISBN-13**:** 978-0198069195.

Reference Books

1) S. D. Conte and C. de Boor, Elementary Numerical Analysis An algorithmic approach, McGraw-Hill, 1980, ISBN-13**:** 978-0070124479.
2) Mathematical Numerical Analysis J.B. Scarborough, Oxford and IBH Publishers, 6th Edition, 2020, ISBN: 9788120417595, 9788120417595
3) Numerical Methods for Mathematics, Sciences and Engg. J. H. Mathews, Publishers: Prentice hall college division, 2nd Edition, 1992, ISBN: 9789387477254, 9387477258.

Subject: Laboratory Practice in Physical Metallurgy (Code: MML206)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcome:

- **C01:** Identification of crystal structures using models.
- **C02:** Describe the primary components of a Metallurgical Optical Microscope.
- **C03:** Prepare the metallographic sample preparation of ferrous and non-ferrous specimens and examine microstructural observation under optical microscope.
- **C04:** Analyze the grain size and phase fraction by using standard measurement methods.

List of Experiments:

1. To study the crystal structure (SC, BCC, FCC and HCP) using a hard sphere model.
2. To study the various components of an optical microscope.
3. To prepare the metallic sample for metallographic examination.
4. To determine the grain size of a given metallic sample by quantitative metallography.
5. To study the microstructure of various steel samples.
6. To study the microstructure of various cast iron samples.
7. To study the microstructure of various copper base alloys.
8. To study the microstructure of aluminium and its alloys.
9. To study the microstructure of Pb and Sn alloys.
10. Stereographic projections - construction ofWulff net.

Subject: Laboratory Practice in Thermodynamics (Code: MML207)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes:

- **C01:** Estimate the specific heat of substances.
- **C02:** Compute the calcinations of $CaCO_3$ and its importance.
- **C03:** Evaluate the kinetics of roasting of CuS.
- **C04:** Understand and analyze the importance of cementation process of extraction of copper from $CuSO_4$ bath.

List of Experiments

1. Determination of Specific Heat by Bomb calorimeter (Adiabatic)
2. Determination of Specific Calorimetry (Isothermal)
3. Measurement of Partial Molar Volume
4. Study of Thermo - Analytical Techniques of Dissociation of Carbonates
5. To study the calcination of $CaCO_3$ and calculate the percentage decomposition by varying time and temperature.
6. To study the effect of time and temperature on the kinetics of roasting of CuS.

Subject: Laboratory Practice in Metallurgical and Instrumental Analysis (Code: MML208)	Year & Semester: B. Tech Metallurgical and Materials Engineering 2nd Year & 3rd Semester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes (COs):

To acquire knowledge of equipments and become familiar practically with the basic analytical methods like,

1.Volumetry
2.Gravimetry
3.Spectrophotometry, and
4.Thermal Analysis (TGA)

List of experiments:

S. No.	Experiments
1.	Determination of Cu^{2+} ions volumetrically, (Iodometric Titration)
2.	Gravimetric estimation of Aluminum(III)
3.	Determination of $Barium^{+2}$ as Barium sulphate gravimetrically.
4.	Distribution coefficient of Iodine between water &CCl_4
5.	Determination of acid value of an oil sample.
6.	Determination of Iron (II) Spectrophotometrically, (1,10-Phenanthroline method)
7.	**Demonstration Expt**; (at CRFC) Obtain Thermogram (TG curve) of Calcium oxalate monohydrate **or** Copper sulphate pentahydrate.

METALLURGICAL AND MATERIALS ENGINEERING DEPARTMENT

Subject: Phase Transformation & Heat Treatment (Code: MMT250)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcome:

- **C01:** Understand the mechanism of phase transformations from the perspective of thermodynamics and kinetics.
- **C02:** Describe some important phase transformations.
- **C03:** Demonstrate the heat treatment processes required to achieve the microstructures with varying mechanical properties using TTT diagrams.
- **C04:** Understand the different types of surface hardening methods.
- **C05:** Illustrate the heat treatment processes applicable to ferrous and non-ferrous alloys.

Module 1:

Fundamentals of Phase Transformations: Introduction to Phase transformation and its classifications; Phase stability and free energy of mixing; free energy-composition diagrams and phase diagrams; Theory of nucleation and growth kinetics.

Module 2:

Solid state transformations: Overall transformation kinetics: TTT diagrams; TTT diagrams of eutectoid, hypo-eutectoid and hyper-eutectoid steels; continuous cooling transformations (CCT); Eutectoid, Bainitic and martensitic phase transformations, precipitation in age hardening alloys; Order-disorder transformation, and spinodal decomposition.

Module 3:

Heat Treatment of steels: Introduction to heat treatment; types of heat treatment furnaces and furnace atmospheres; Different types of heat treatment processes and their application - Annealing, Normalizing, Spheroidizing, Hardening, Tempering, Austempering and Martempering; Role of alloying elements and their effect on Fe-Fe_3C system; Hardenability of steels, methods of determining hardenability, effect of alloying elements on hardenability, factors affecting hardenability; Quenching- mechanism of heat removal during quenching, types and characteristics of quenchants.

Module 4:

Surface hardening and Chemical heat treatment of steels: Induction hardening, Flame hardening, laser hardening, Electron beam hardening, Carburizing, Nitriding, Cyaniding and Carbonitriding.

Module 5:

Heat treatment processes of some important ferrous and non-ferrous metals and alloys: Plain carbon steels, alloy steels (Mn, Si, Ni and Mo steels), structural steels (tool steel & stainless steel), cast iron; Al, Mg, Ti, Cu and Ni alloys.

Text Books

1. Phase transformations in metals and alloys, Porter &Easterling, Chapman and Hall, London, 2015
2. Solid State Phase Transformations, V. Raghavan, Prentice Hall of India (P) Ltd, 1992.
3. Phase transformations in materials, Sharma R.C., CBS Publishers and Pvt. Ltd 2002
4. Heat Treatment Principles and Techniques, Rajan T.V., Sharma C.P, Sharma A., Prentice Hall of India (P) Ltd, 2004
5. Heat Treatment of Metals, Vijendra Singh, Standard Publishers Distributors, 1998
6. Steel and its Heat Treatment, Karl-Erik Thelning, Butterworths London, 1984

Reference Books

1. Principles of Physical Metallurgy, Reed Hill, CT: Cengage Learning, 2008
2. Handbook of Heat Treatment of Steels, Prabhudev, K H., Tata-McGraw Hill Publishing Co.2000
3. Heat Treatment, Metals Handbook Vol.4, American Society for Metals, ASM Metals Parks, Ohio, USA, 2001

Subject: Kinetics of Metallurgical Processes (Code: MMT251)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes:

- **C01:** Understand the basics of Kinetic rate equations of different Metallurgical Processes
- **C02:** Evaluate kinetics of nucleation and growth of materials
- **C03:** Apply the diffusion kinetic principles to various metallurgical processes
- **C04:** Provide a working knowledge of rate theory to various processes of Metallurgical and Materials Engineering
- **C05:** Formulate and solve rate equations for various reactions

Module-I

Basics of Kinetics: Thermodynamics vs Kinetics, Importance of metallurgical kinetics, Characteristic features of rate processes, Activation energy, Rate of a thermally activated process. Arrhenius Law, Effect of activation energy on reaction rate, Empirical and Semi-Empirical Kinetic, General rate equation

Module-II

Kinetic Approaches: Metallurgical systems and approaches in Kinetic analysis, Factors determining rate, Approaches towards Rate Laws, Examples of Empirical and Semi-empirical Approaches, Johnson-Mehl equation and applications

Module-III

Kinetic Models: Kinetic model for nucleation and growth, Reduced time plots and their examples, Kinetic analysis of chemically controlled reactions, Reaction steps and rate-controlling step, Solid-fluid reactions, Kinetic law for topo chemical reactions, Diffusion through product layer, Jander's equation, Smelting Reduction processes, Homogeneous and Heterogeneous Nucleation rate, Examples, Non-isothermal Kinetics, Example-Decomposition of $CaCO_3$

Module-IV

Kinetics applied to mass transfer: Solid State Diffusion - Fick's Law, Mechanism of diffusion, Uphill diffusion, Kirkendall effect, Steady and transient diffusion; Kinetics of heterogeneous metallurgical operations: viz Gas-solid, slag-metal, and other such systems.

Text Books

1. A Textbook of Metallurgical Kinetics, Ahindra Ghosh and Sudipto Ghosh, PHI Learning, 2014
2. Kinetics of Metallurgical Processes, Hem Shanker Ray, Saradindukumar Ray, Springer. 2017
3. Metallurgical Thermodynamics, Kinetics and Numericals, S.K. Dutta, A.B. Lele, S.Chand, 2011
4. Problems in Metallurgical Thermodynamics & Kinetics, G.S Upadhyay& R.K Dube, Pergamon Press, 1985
5. Physical Chemistry of Metallurgical. Processes, A.K. Biswas and G.R. Bashforth, Asia Publishing House, New Delhi, 2005

References

1. Physical Chemistry of Metals, Darken &Gurry, CBS, 2002
2. Text Book of Materials and Metallurgical Thermodynamics, Ahindra Ghosh, PHI, 2003
3. Physical chemistry of metallurgical processes, Shamsuddin, Mohammad John Wiley & Sons Inc., 2016
4. Physical Chemistry of Iron and Steel making, C. Bodsworth, English Longman's Books Society & Longman's Green & Company, 1972
5. Principles of Extractive Metallurgy, Rosenquist, McGraw-Hill, 1983.

Subject: Mechanical Behaviour of Materials (Code: MMT252)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 4		
			L	T	P
			3	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes:

CO-1. To outline, examine and implement the constitutive equations for an elastic solid.

CO-2. To discuss the theory of plasticity for understanding the mechanism of plastic deformation

and designing the elements/structures and forming of metals.

CO-3. To classify fracture of materials and relate it with stress state, temperature and strength.

CO-4. To find basic design information on strength of materials by testing them for different conditions.

CO-5. To assess the relationship between dynamic loading (fatigue) and strength of a material.

CO-6. To inspect the response of a material to high-temperature loading and recommend the measures to prevent the degradation at high temperatures.

Module 1

Stress and Strain - Index Notation, Analysis of Stresses and Strains – Two (Plane Stress/Strain)/Three-dimensional state, Sign Convention, Transformation of Axes, Principle stresses/strains, Mohr's Circles for stress/strain, Hydrostatic and Deviator Components of stress/strain, Elastic constants and their relationships, Isotropic Elasticity, Elastic Anisotropy, true Stress/Strain, Flow curve, Yield Criteria.

Module 2

Dislocation Theory 1 - Deformation by Slip and Twinning, critically resolved shear stress for slip, Dislocation Geometry and Energy, Dislocation Mechanics-Frank-Read Sources, Dislocation Pile-ups, Movement of Dislocations, Force on and between dislocations-Peach-Koehler equation, Dislocation Interactions.

Module 3

Dislocation Theory 2 - Yield-Point Phenomenon, Strain Hardening, Strain Aging, Strengthening from Grain Boundaries, Solid-Solution Strengthening, Strengthening from Fine Particles, Bauschinger Effect, Texture.

Module 4

Fracture of Materials - Types of Fracture, Stress-Intensity Factor, Theoretical Cohesive Strength of Materials, Griffith's Theory and Orowan's modification.

Module 5

Fatigue And Creep - Introduction to Fatigue – Surface observations, Nomenclature, S-N curve, Fatigue Design Considerations, LCF, HCF, Crack Propagation, Prevention and Creep – Creep curve, Structural Changes, Mechanisms, Extrapolation Schemes, Alloys for High Temperature use.

Module 6

Mechanical Testing of Materials - Principles and its significance, Tensile Test- stress-strain curves (Engineering/True), Effect of strain rate, temperature on Flow Properties; Compression Test; Hardness Test-Rockwell, Brinell, Vicker, Microhardness Tests, Hardness-Conversion Relationships; Impact Test-Izod, Charpy, Ductile to Brittle Transition Temperature.

Text Books

1. Mechanical Metallurgy, Dieter G. E., Mc Graw Hill, 1988.
2. Mechanical Behaviour of Materials, William F. Hosford, Cambridge University Press, 2010.
3. Mechanical Behavior of Materials, T.H. Courtney, McGraw Hills, 1990.

Reference Books

1. Introduction to Dislocations, D. Hull &D.J. Bacon, Butterworth Heinemann, 2001.
2. Physical Metallurgy Principles, Robert E. Reed-Hill, Affiliated E-W Press Pvt. Ltd., 2008.
3. Mechanical Behavior of Materials, M. A. Meyers & K. K. Chawla, Prentice Hall, 1999.
4. Materials Science & Engineering: An Introduction, William D. Callister, Jr., John Wiley &Sons, Inc., 2007**.**

Subject: Non-Ferrous Metal Extraction (Code: MMT253)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			3	0	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes:

- **C01:** Know the sources of common non-ferrous metals and their occurrence in India.
- **C02:** Understand the basic approaches and principles of extraction of various metals from their oxide ores such as magnesium, aluminum, tin.
- **C03:** Design pyro-metallurgical and hydro-metallurgical processes for the extraction of various metals from their sulphide ores such as copper, lead, zinc, nickel, etc.
- **C04:** Understand the extraction of various metals from their halides such as titanium, rare earths, uranium, thorium, plutonium, beryllium, zirconium, etc.
- **C05:** Know the methods of extraction of precious metals such as gold, silver and platinum.
- **C06:** Know how to utilize the wastes, energy and environmental issues related to non-ferrous metal industries.

Module 1

Sources of non-ferrous metals (sources in land and sea, exploration methods, methods of beneficiation, nonferrous metals wealth in India), nonferrous metals in Indian history, uses of nonferrous metals.

Module 2

Extraction of metals from oxide ores (basic approaches and special features of specific extraction processes, extraction of metals such as magnesium, aluminum, tin).

Module 3

Extraction of metals from sulphide ores (pyro-metallurgy and hydro-metallurgy of sulphides, production of metals such as copper, lead, zinc, nickel, etc.).

Module 4

Extraction of metals from halides, (Production of halides and refining methods, production of reactive and reactor metals. Methods of extraction of metals such as titanium, rare earths, uranium, thorium, plutonium, beryllium, zirconium, etc.).

Module 5

Production of precious metals (Methods applied for gold, silver and platinum group of metals), Secondary metals and utilization of wastes, Energy and environmental issues in nonferrous metals extraction.

Text Books

1. Extraction of Non-ferrous Metals, H. S. Ray, R. Sridhar, K. P. Abraham.
2. K. Grjortheim and B.J. Welch: Aluminium Smelter Technology, Aluminium-Verlag.
3. A.K.Biswas and W.G. Davenport: Extractive Metallurgy of Copper, Pergamon.
4. S.W.K Morgaon: Zinc and its Alloy, Mac Donald and Evans.

Reference Books

1. A.R. Burkin (ed.): Production of Aluminium and Alumina Wiley.
2. A.R. Burkin (ed.): Extractive Metallurgy of Nickel, Wiley.
3. C.D.Harrington and AE. Reuhle: Uranium Production Technology, Van Naostrand.
4. N. Sevryukov, B. Kuzumin and Y. Chelishchev: General Metallurgy, Mir.
5. FathiHabashi; Principles of Extractive metallurgy, vol 1, 2, 3 and 4; Gordon and Breach

Subject: Powder Metallurgy (Code: MMT254)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes:

- **C01:** Discuss the importance of Powder Metallurgy and identify various powder manufacturing processes.
- **C02:** Investigate the effect of particle size and shape on compressibility and consolidation of powders
- **C03:** Identify various characterization techniques for the determination of oxygen content, refractory elements content, surface area measurement, particle shape and size measurement, Apparent density, Tap density, and flow rate measurements
- **C04:** Outline treatment of metal powders prior to compacting.
- **C05:** Describe the various powder compaction techniques utilized in various industries-automotive and aerospace industries, jewels & decorative industries
- **C06:** Justify the importance of sintering, sintering atmosphere & factors influencing sintering in powder metallurgy
- **C07:** Design various powder products –Metallic filters, carbide tools, magnetic, refractory, bearing & composite materials

Module 1

Production of Metal Powders: The importance of Powder Metallurgy. Various methods of producing metal powders. Characteristics of metal powders and their correlation with the various methods of production. Hazards in metal powder production.

Module 2:

Testing of Metal Powders: Testing and classification of powders. Treatment of metal powders prior to compacting - Mixing and conditioning of metal powders.

Module 3

Compaction Techniques: Cold and hot compaction and their limitations. Design of dies.Rolling, slip casting, forging and extrusion of metal powders.Explosive compaction.Factors influencing the properties of compacts.

Module 4

Sintering: Sintering - its significance in powder metallurgy, sintering environments, importance of controlled atmosphere for sintering. Sintering equipment and their classification. Factors influencing sintering of metal powders. Techniques of activated sintering. Post sintering operations and the properties of sintered products/ compacts.

Various powder products including dense, porous, hard, refractory, magnetic, dispersion strengthened and composite materials

Text Books

1. Powder Metallurgy: Science Technology and Applications**,** Angelo P C & Subramanian, PHI, 2012
2. Powder Metallurgy**,** Sinha A K, Dhanpat Rai & Sons**,** 1982
3. Powder Metallurgy Applications, Advantages and Limitations, Erhard Klar, American Society for Metals, 1983
4. Powder Metallurgy Opportunities for Engineering Industries, Ramakrishnan , Oxford and IBH Publishing Co PvtLd, 1987
5. Metals Handbook, Vol.7, Powder Metallurgy, Metals Park, Ohio, USA
6. Powder Metallurgy by B.K.Datta, An advanced Technique of Processing Engineering, Second edition, PHI Learning Private Limited, Delhi-2014

Subject: Mineral Dressing (Code: MMT255)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester		Total Course Credit: 3		
			L	T	P
			2	1	0
Evaluation Policy	Mid-Term (30 Marks)	Class Assessment (10 Marks)	Final-Term (60 Marks)		

Course Outcomes:

- **C01:** Know the origin of different minerals and their characteristics
- **C02:** Design processes for the reduction in size depending on mineral characteristics
- **C03:** Understand the working principles of different equipment used for screening, sizing and classification
- **C04:** Know different techniques used for the up-gradation of ore concentrates such as gravity concentration and froth floatation
- **C05:** Understand the principles of electrostatic and magnetic separation and their practice in industries
- **C06:** Calculate recovery and reduction ratio and perform mass balance calculations in ore dressing

Module 1

Mineralogy: Studies of important metallic and non metallic minerals and their characteristics, origin, etc., application of non-metallic minerals. Sea as a source of minerals.Status of mineral beneficiation industry in India. Study of some representative beneficiation practices with flowsheets. Sampling methodology and equipments.

Module 2

Communition: Primary, secondary and special crushers and their performances. Cylindrical and cylindro-conical ball mills. Rod mill, Tube / Pot mills and their performances, capacities, reduction ratios, etc. Dry and Wet Grinding. Open and closed circuit grinding. Laws of crushing and grinding. Work index calculations. Interlocking and liberation of materials.

Module 3

Screening, Sizing and Classification: Standard screening tests and graphical representations of the results. Practical size distribution. Sorting, Sizing and pneumatic classifiers and their performances. Thickeners, Hydrocyclones, etc.Theory and practice of sedimentation and filtration. Working of Rotary vacuum filters.

Module 4

Gravity Concentration Techniques: Principles of Jigging, Tabling and Heavy Media Separation. Processes with equipments used, importance of controlling factors in operation and application. Beneficiation practice for arsenopyrite containing scheelite.

Module 5

Froth Flotation: Natural and Artificial Flotability of minerals, frothers, Collectors, Depressants, Activators / Deactivators, PH Modifiers, etc. flotation machines, Study of representative sulphide and non sulphide minerals and non metallic ores. Conditioning in flotation, multistage flotation and Column Flotation.

Module 6

Electrostatic and Magnetic Separation: Principles of Electrostatic and Magnetic Separation (Dry and Wet Type). Separation units used in practices and examples in the industries. Calculation of recovery and reduction ratio and Mass balance calculations in ore dressing. Industrial set up of Ore Dressing Plant.

Text / Reference Books:

1. Gaudin A.M.: Principles of Mineral Dressing; McGraw Hill Boo, TMH Edition, 1971.
2. Taggart A.F.: Elements of Ore Dressing; J.Wiley& Sons, 1951, London / NY.
3. Jain S.K.: Ore Processing; Oxford & IBH Publishing Company, 1986.
4. Taggart; Handbook of Mineral Dressing, Wiley Handbook

Subject: Laboratory Practice in Heat Treatment (Code: MML256)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcome:

- **C01:** Illustrate the effect of heat treatment process on the mechanical properties by studying microstructural evolution and hardness measurements.
- **C02:** Ability to identify the microstructures of different heat treated steels.
- **C03:** Understanding of the phase evolution in steels by using TTT and CCT diagrams.
- **C04:** Identification of suitable heat treatment process for the improvement in mechanical behaviour of materials.

List of Experiments:

1. Comparative study of microstructure and hardness of the annealed, normalized and quenched steel samples.
2. To study the microstructure and hardness of tempered (High and low temperature) steel sample
3. To study the hardness and microstructure of steel samples in different quenching media- Water, oil and brine solution.
4. To determine the hardenability of steel using Jominy-end-Quench test.
5. Study of the isothermal transformations in Fe-C systems
6. To study the effect of case carburizing on microstructure and hardness of steel samples
7. Precipitation hardening of aluminium-4%Cu alloy.
8. Heat Treatment of Cast Iron- Malleabilization treatment of white cast Iron.
9. To study the microstructure and hardness of stepped quenched (Austempering and Martempering) steel samples
10. Comparison of microstructure and hardness of cold worked and annealed sample (Steel, Aluminium)

Subject: Laboratory Practice in Mechanical Behaviour of Materials (Code: MML257)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes

- **C01:** Determine the Rockwell, Brinell and Vickers hardness of ferrous and non-ferrous materials.
- **C02:** Perform the tension and compression test, and determine all significant points from the stress-strain diagram.
- **C03:** Determine the impact strength of a material by Izod and Charpy test.
- **C04:** Find out the cupping index of GI sheet from cupping test.
- **C05:** Analyse the fracture surfaces from tensile and impact tests.

List of Experiments

1. Preparation of specimen for Rockwell, Brinell and Vicker Hardness Test.
2. Determination of Rockwell Hardness of some alloys/steel specimens.
3. Measurement of BrinellHardness of some alloys/steel specimens.
4. Measurement of Vicker Hardness of some alloys/steel specimens.
5. Cupping Test of a given sheet metal.
6. Determination of the impact strength of a given sample by Izod method.
7. Determination of the impact strength of a given sample by Charpy method.
8. Tensile testing of a Mild Steel Specimen using Universal Testing Machine.
9. Compression Test using Universal Testing Machine.
10. Study of various types of fractures occurring in different materials.

Subject: Laboratory Practice in Powder Metallurgy (Code: MML258)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes: The student should be able:

- **C01:** To fabricate powders of metals and composites
- **C02:** To characterize & evaluate the powders of metals and composites
- **C03:** To compare & contrast the conventional and microwave sintering of compacts

List of Experiments

1. Fabrication of metals and composites powders by High energy ball mills
2. Study various characteristic of given metal and composite powders and evaluate green density as well as strength characteristics (hardness) of cold compacted and sintered (conventional) powder.
3. Study the behavior of metal and composite powder during conventional and microwave sintering of particular compacts..

Subject: Laboratory Practice in Mineral Dressing (Code: MML259)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester	Total Course Credit: 1		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

Course Outcomes:

1. Design processes for the size reduction of different ore materials.
2. Apply different methods to classify particles according to their size.
3. Design commonly-used methods to beneficiate (separate) coal and minerals from less valuable gangue material, including density, magnetic, and surface-chemistry based approaches.

List of Experiments

1. To study the parts of a Jaw Crusher and to operate it using different ore materials and various gape settings, and determine the reductionratios.
2. To study the size reduction of an ore by a roll crusher using different roll settings.
3. Use a laboratory ball mill to reduce a given crushed ore to a - 200 µm size fraction using different milling times and changing the weight of the grinding medium. Make energy calculations. Compare the energy efficiency of attritor with ballmill.
4. To perform Sieve Analysis on a given dry milled Ore for 1/2, 1 and 2 hrs and to calculate i) percentage loss in screening, ii) the average size of particles and iii) plot various sizing curves.
5. To study the effect of any one of the following grinding variables on the performance of the ball mill or rod mill; i) Ball load or rod load ii) time of grinding.
6. Conduct the Classification of a mill product usinga) Spiral Classifier b) A Cyclone.
7. Concentrate a given Ore using: a) Shaking Tables b) Magnetic Separator, andc)Jigs.
8. Pelletisation of iron ore fines.

Subject: Vocabulary and Group Discussion (Compulsory Audit) (Code: HSA250)	Year & Semester: B. Tech Metallurgical & Materials Engineering 2nd Year & 4thSemester	Total Course Credit: 0		
		L	T	P
		0	0	2
Evaluation Policy	Mid-Term/Class Assessment (40 Marks)	Final-Term (60 Marks)		

English has had many influences in its linguistic history. Among these, ancient Greek and Latin hold a lasting influence on almost every aspect of our day-to-day, artistic, and scientific expressions. Through this course, students will acquire knowledge of the roots of English in Greek and Latin and will enhance their vocabulary. This course is designed for those students who are preparing themselves for recruitments by a company or a firm and who wish to maximize their potential and get the job they really want. It will enable participants to explore their own values, experience, qualifications, and potential and position themselves for achieving success. This course comprises essential Dos and Don'ts of Group Discussion.

Course Objectives:

The course aims to:

1. Familiarize students with the roots of English in Greek and Latin.
2. Acquaint the students with the patterns and processes in the formation of the lexicon.
3. Enhance vocabulary through learning the Greek and Latin components of English.
4. Help students recognize Greek and Latin roots in words and use these to decipher word meaning.
5. Improve oral communication skills of students.
6. Develop critical thinking and problem-solving skills in students during Group Discussion.
7. Develop listening skills in students during Group Discussion.
8. Facilitate a healthy academic environment for group discussions on various topics.

Course Outcomes:

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

C01: Define, root word, suffix, and prefix
C02: Differentiate root word, suffixes, and prefixes
C03: Recognize Greek and Latin roots in words and use these to decipher word meaning.
C04: Create words using Greek and Latin roots, suffixes, and prefixes
C05: Derive verbs from nouns, nouns and verbs from adjectives, adjectives from nouns, etc. using Greek and Latin roots, suffixes, and prefixes.
C06: Show the key skills and behaviors required to facilitate a group discussion
C07: Exhibit the dos and don'ts of group discussion
C08: Express opinions fluently, confidently, effectively, and clearly.
C09: Display the skill of analyzing different aspects of a problem.

Syllabus Components:

1. Word Construction: Root word, Prefixes, Suffixes
2. Change in meaning of the words by adding prefixes and suffixes.
3. Greek and Latin Roots
4. Greek and Latin Suffixes and Prefixes
5. Derivation and creation of words using Greek and Latin roots, suffixes, and prefixes.
6. Group Dynamics and Purposes of Group Discussion
7. Do's & Don'ts to follow in Group Discussion
8. Body Language and its role in Group Discussion
9. Initiating and planning the discussion
10. Listening others during Group Discussion
11. Expressing views, agreement, and disagreement
12. Hints for self-improvement

Suggested Readings:

1. *Word Power Made Easy: The Complete Handbook for Building a Superior Vocabulary*. By Norman Lewis. Published by Pocket Books, 1978.
2. 2. *An Etymology of Latin and Greek*. By Charles S. Halsey, A.M. Published by Ginn & Company, 1889.
3. 3. A Dictionary of English Etymology. By Hensleigh Wedgwood, M.A. Published by John Childs & Son, Printers, 1859. Republished by University of Illinoi at Urbana-Champaign, 2009.
4. *Professional Speaking Skills*. By Aruna Koneru. Oxford University Press, 2015.
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