DAYANANDA SAGAR COLLEGE OF ENGINEERING

(An Autonomous Institute Affiliated to VTU, Belagavi, Approved by AICTE & ISO 9001:2015 Certified)
Accredited by National Board of Accreditation (NBA) & National Assessment Accreditation Council (NAAC) with 'A' grade,
Shavige Malleshwara Hills, Kumaraswamy Layout, Bengaluru-560078

SCHEME AND SYLLABUS OF INSTITUTION ELECTIVES OFFERED

for 6th semester students during the academic year

2020-2021

for Bachelor of Engineering programme

Shavige malleshwara hills,
Kumaraswamy layout, bengaluru-560078

VISION OF THE INSTITUTE

To impart quality technical education with a focus on Research and Innovation emphasizing on Development of Sustainable and Inclusive Technology for the benefit of society.

MISSION OF THE INSTITUTE

1) To provide an environment that enhances creativity and Innovation in pursuit of Excellence.
2) To nurture teamwork in order to transform individuals as responsible leaders and entrepreneurs.
3) To train the students to the changing technical scenario and make them to understand the importance of Sustainable and Inclusive technologies.

LIST OF INSTITUTION ELECTIVES OFFERED IN 6TH SEMESTER (2018 SCHEME)

INTRODUCTION TO FLIGHT VEHICLES AND AIRPORT MANAGEMENT

Sub Code: 18AE6IEIFV	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To study the different types of aircraft configuration.
2) To understand the basics of aerodynamics.
3) To get exposure to various types of aircraft propulsion systems.
4) To study the Basic aircraft structures.
5) To understand the Helicopter configuration.
6) To understand the Airport requirements and facilities.

COURSE OUTCOMES:

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

CO1	Describe the basic components and various types of aircraft configuration
CO2	Discuss the basics of aerodynamics
CO3	Outline the types of gas turbine engines used in aircraft
CO4	Discuss the basics of aircraft structure and materials used
CO5	Discuss the working principle of Helicopter.
CO6	Discuss about the airport formation requirements, management, facilities and airport operations.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1										
CO2	3	1	1									
CO3	2				1							
CO4	2		1									
CO5	1											
CO6	2					1				1	1	1

COURSE CONTENTS

UNIT	Course Content	Hrs	COs
1	**INTRODUCTION TO AIRCRAFT:** Classification of aircrafts; Types of Aircrafts: Lighter than Air/ Heavier than Air aircrafts ; Conventional Design configurations based on power plant location, Wing vertical location, intake location, tail unit arrangements, landing gear arrangements. Unconventional configurations- Monoplane, Biplane, Tri-plane and Quadra-plane, sea planes, STOL and STOVL configurations.	**8**	**CO1**

2	**BASICS OF AERODYNAMICS:** Atmosphere and its properties, significance of speed of sound; airspeed and groundspeed; Airfoil Nomenclature, Types of Airfoil, Aspect Ratio, Pressure Distribution over a airfoil, Center of Pressure, Aerodynamic Center, Bernoulli's equation and its application for generation of lift and measurement of airspeed; Lift, Drag, Pitching Moments, Basic components of an Aircraft, Aircraft Axis system, Control surfaces and high lift devices. Forces on an aircraft in flight; Definition of static and dynamic stability.	**8**	**CO2**
3	**INTRODUCTION TO AIRCRAFT PROPULSION SYSTEMS:** Principles of aircraft propulsion, Types of power plants, basic components in Gas turbine engines. Types of power plants, ramjets, scramjets and pulse jet engines; Use of propellers and jets for production of thrust; comparative merits and limitations of different types of propulsion engines. **Helicopters:** Single rotary wing, contra-rotating types, parts of helicopter and their purpose.	**8**	**CO3** **CO5**
4	**BASIC AIRCRAFT STRUCTURE:** Airframe material properties, Materials used in airframe construction, Basic structure types: Fuselage, wing structure and empennage structures, Trusses, monocoque and semi-monocoque arrangements. Basic structural members.	**8**	**CO4**
5	**INTRODUCTION TO AIRPORT:** Size of runways required for most airliner to land, Ground roll, take off distance, Gross weight (Airplane + Pay load), wing span based on civil aviation safety regulations. Management, facilities, airport operations, environment control and sustainability, military airbase,	**8**	**CO6**

SELF-STUDY COMPONENT:

Unit-2: necessary conditions for stability.
Unit-4: Wing pod mount and Fuselage mount.
Unit-5: Airport designation.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Shevel, "Fundamentals of Flight", Prentice Hall, 1989.
2) Lalit Gupta and Dr. O. P. Sharma: "Fundamentals of Flight Vol-I to Vol-IV", Himalayan Books, 2006

REFERENCE BOOKS:

1) John D. Anderson, "Introduction to Flight", McGraw-Hill Education, 2011. ISBN 9780071108059.
2) Treager, S., "Gas Turbine Technology", McGraw Hill 1997

ASSESSMENT PATTERN:

CIE -Continuous Internal Evaluation: 50 Marks

Bloom's Category	Tests	Assignments	AAT
Marks (Out of 50)	**30**	**10**	**10**
Remember	--	--	03
Understand	10	--	02
Apply	10	05	01
Analyse	05	05	04
Evaluate	05		
Create			

*AAT- Alternate Assessment Tool

SEE -Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory (50)
Remember	10
Understand	10
Apply	10
Analyse	10
Evaluate	10
Create	

FUNDAMENTALS OF AUTOMOBILE ENGINEERING

Course code: 18AU6IEFAE	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To make the students understand with the basic concepts of automotive engineering and current trend in the industry.
2) To discuss the various components related to the functioning of automobile.
3) To inculcate the awareness complying with the environmental standards for usage of automotive.

COURSE CONTENTS

Unit	Course Content	Hours	COs
1	**Engines:** Heat Engines & their classification. IC Engines -Basic Engine Components & Nomenclature, Principle of engine operation, Comparison of SI & CI Engines, Comparison of Two Stroke & Four Stroke Engines, Classification of I C engines, Principles of engine operation (SI & CI), Relative merits & demerits of petrol & diesel engines, Classification/types, function, materials, construction details.	**8**	**CO1 CO2**
2	**Engine Auxiliary Systems:** Gasoline Fuel Systems: Carburetor principle, Petrol Injection Systems. MPFI, GDI, Diesel Fuel Injection Systems, CRDI, Ignition system, Cooling System, Lubrication System, Supercharging and Turbo charging, Types, constructional features and operation	**8**	**CO2 CO4**
3	**Transmission Systems:** Clutch, Necessity of clutch in an automobile, operation, Gear Box, need of gear box, working principle, Drive Line and Differential, Construction details, General arrangement & description of transmission.	**8**	**CO3 CO4**

Unit	Course Content	Hours	COs
4	**Automotive Chassis and Safety:** General consideration relating to chassis layout, power location, types of automobiles, Layout of an automobile with reference to power plant, Axle, Steering Systems, Power steering, Brakes, Necessity, Classification of brakes, Anti-lock braking systems, Suspensions, Active and passive safety, airbags, seat belt tightening system, forward collision warning system.	8	CO4
5	**Hybrid and Electric Vehicles:** Introduction to electric vehicles, Electric Vehicles comparison with IC engine vehicles, Sustainable Transportation-Population, Energy, Environment, Economic Growth and Emission Requirement. Configuration, Architectures of BEV and types of HEVs, Energy sources, Batteries, Fuel Cell, Super capacitors.	8	CO5 CO6

TEXT BOOKS:

1) M L Mathur and R P Sharma "Internal Combustion Engine" Dhanpat Rai Publications, 1st Edition, 2014, ISBN 978-81-89928-46-9.
2) Thomas D Gillespie "Fundamentals of Vehicle Dynamics" SAE International Publisher, ISBN 978-1560911999.
3) Hybrid Electric Vehicles, Principles and Applications with practical perspective: Chris Mi, Wiley publications.
4) Modern Electric, Hybrid Electric and Fuel cell vehicles, Fundamentals, theory and Design: Mehrdad Ehasani. CRC press.

REFERENCE BOOKS:

1) Ramalingam,K.K, Internal Combustion Engine, Scitech Publication (India) Pvt.Ltd.2000.
2) Domkundwar, V.M, A Course in Internal Combustion Engines, Dhanpat Rai and Co., 1999.
3) Ljubo Vlacic, Michel Parent and Fumio Harashima, "Intelligent Vehicle Technologies", Butterworth-Heinemann publications, Oxford, 2001.
4) Electric and Hybrid Vehicles by Tom Denton, Routledge, 2016.

COMPUTATIONAL BIOLOGY

Sub Code: 18BT6IECPB	**Credits: 03**
L: T: P: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total hours: 40	

OBJECTIVES:

1) To make graduates aware of the role of computer in biology and understand the relevance of multidisciplinary research in engineering.
2) To make graduates learn the fundamental concepts of database management system and importance of text mining in science and engineering.
3) To equip the graduates with the basic concepts of prediction of genes and proteins present in living systems and understand the life processes in molecular level.
4) To create biological databases and 3D molecular models using algorithms, programming and soft wares.
5) To provide recent perspectives of various 3D visualizing tools and softwares in molecular and image analysis for multidisciplinary areas of science and Engineering.
6) To equip gradates with fundamental concepts of BioJAVA, BioPERL, Biopython and R and their role in interdisciplinary research.

COURSE OUTCOMES:

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

CO1	Apply their knowledge of computer in life sciences
CO2	Implement database management applications towards mining data from bio databases
CO3	Design tools involving gene and protein related research. Apply their skill in solving biological problems
CO4	Develop algorithms related to biological applications
CO5	Create a biological database and 3D molecular model using programming and softwares
CO6	Asses various programming applications for multidisciplinary research domains

COURSE CONTENTS

Unit	Course Content	Hours
1	**Biology and computer: scope and challenges:** Basic of computer, Internet: Biological Data, Data Integration, and Challenges Faced in the Integration of Biological data: Data sources in Life Sciences, Challenges in information integration. Aims and tasks of computational biology, challenges and opportunities, Database management system; Database browsing and Data retrieval, Human genome project, Various file formats for biological sequences, Data mining.	08
2	**Introduction to Bio-database:** Importance of Bio-database, Types of Biological data; primary sequence databases, Composite sequence databases, Secondary databases, nucleic acid sequence databases, Protein sequence data bases, structure databases, Metabolic pathway databases, Genome Browsers (Ensembl, NCBI map viewer, UCSC Genome Browse). Bioinformatics Database search engines: Bibliographic specialized genomic resources; data analysis packages, Taxonomic databases and biodiversity databases. Protein-protein network database(STRING)	08
3	**Predictive methods:** Genes and proteins, Importance of single letter code, analysis of biological data-Significance of sequence alignment pair wise sequence alignment algorithms: Use of scoring matrices and gap penalties in sequence alignments-software and application of multiple sequence alignment. Gene predictions strategies, protein prediction strategies, molecular visualization tools, phylogenetic analysis: Concept of trees-evolutionary trees.	8
4	**Algorithms in DNA Computing:** The European Molecular Computing Consortium, Cellular Computing, Introduction to DNA computing, Principles of DNA computing, Methods and Future of DNA computing. Biological algorithms versus computer algorithms, Algorithm design techniques and the different types of algorithms. Motif Finding problem, Search Trees - Finding a Median String, Genome Rearrangements, Applications of HMMs and Artificial Neural Networks.	8
5	**3D modeling and computer simulation:** Importance of 3D analysis in drug discovery and molecular science, overview of computer aided drug discovery and *insilico* animal model. 3D gene and protein modeling, conversion of 2D to 3D molecular structure of drugs. QSAR. Structure based drug design:- Docking, De Novo Drug Design. 3D visualizing softwares: PyMoL, Rasmol, VMD, Chimera and Chemsketch3D. Molecular simulation:	8

	GROMACS, AMBER, CHARM. Installation and applications of BioJAVA, Bioperl, Biopython and R (Bioconductor).	

SELF-STUDY COMPONENT:

UNIT-1: Importance of biological database in drug designing
UNIT-3: Computer simulation of macro molecules

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
2) S.C. Rastogi & others, "Bioinformatics- Concepts, Skills, and Applications",CBS Publishing, 2003.
3) Neil C. Jones and Pavel A. Pevzner, "An Introduction to Bioinformatics Algorithms", MIT Press, First Indian Reprint 2005 Gary Benson Roderic, "Algorithms in Bioinformatics", Springer International Edition, First Indian Reprint, 2004.
4) Jürgen Bajorath, "Chemoinformatics: Concepts, Methods, and Tools for Drug Discovery", Humana press, 2004.

REFERENCE BOOKS:

1) David W.Mount "Bioinformatics sequence and genome analysis", Cold spring harbor laboratory press, 2004.
2) Gusfields G, "Algorithms on strings, trees and sequences- Computer Science and Computational Biology", Cambridge University Press, 1997.
3) Steffen Schulze-Kremer, "Molecular Bioinformatics: Algorithms and Applications", Walter de Gruyter, 1996.
4) Garland R Marshall, "Chemoinformatics in Drug Discovery",John Wiley & Sons, 2006.

INDSUTRIAL SAFETY & RISK ANALYSIS

Course code: 18CH6IEIRA	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

To develop highly qualified professional manpower the basic requirement lies on systematic quality based coaching and training in Advanced Science and Technologies. Therefore, the course is designed to train and provide expert human resource to safety management and expected to bring direct benefits to industry and society. The course is based on following objectives

1) Different industrial safety parameters.
2) Explain various process safety analysis methods.
3) Elaborates on emergency preparation and its assessment plan.
4) Elaborates on personnel protection and equipments used for protection.
5) To make the student aware about safety auditing and management systems.

COURSE OUTCOMES:

On completion of course, students will be able to

CO1	Understand the basic safety norms.
CO2	Understand various occupational Toxicology
CO3	Analyses various safety techniques and risk factors.
CO4	Summarize emergency situation and preparedness.
CO5	Display and execute different PPE's used in process industries and analyze Environmental Management System in Industry.
CO6	Analyses Environment Impact Assessment, Safety audits and related Legislation.

Mapping of Course outcomes to Program outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	-	-	2	-	2	2	1	2	2	1	1	2	-	3
CO2	1	1	-	2	-	2	2	1	2	2	2	-	2	1	3
CO3	2	1	-	2	-	2	2	1	2	2	2	1	2	-	3
CO4	2	2	-	1	-	2	2	1	2	1	1	-	2	-	3
CO5	1	-	-	-	-	2	2	-	1	2	-	-	2	-	3
CO6	1	-	-	-	-	2	2	-	1	2	-	1	2	2	3

COURSE CONTENTS

Module	Contents of Module	Hours
1	**Introduction to Safety:** Introduction, major accidents due to: process (chemicals), Mechanical, Electrical, Civil (Construction),/ecological, biological and miscellaneous, **Occupational Toxicology:** Toxicity, TLV and its types. Routes of entry lethal dose, LD50, LC50. Intrinsic and Extrinsic Safety, Behavioral safety.	**08**
2	**Hazard and Risk assessment Techniques:** Definition, Hazards and risk assessment, Hazards, Risk & detection techniques, Hazards and risk progression chart. Risk analysis assessment and management, and hazard analysis (HAZAN), Hazards and operability (HZOP) study, Fault tree analysis (FTA), Event tree analysis (ETA), Safety Check List. Case Studies: Major industrial accidents, such as Bhopal gas tragedy, Chernobyl disaster.	**08**
3	**Emergency Preparation:** Introduction, concept, Identification and Assessment of Hazards, on-site emergency plan, offsite emergency plan. **Biological Disaster Management:** Definition, Classification, Bio hazards, Bacteria, Viruses, Corona Virus prevention of Biological disasters.	**08**
4	**Personal Protective Equipments:** Legal requirements, selection guidelines, head protection, eye and face protection, hand protection, Foot and Leg protection. Body protection, Respirators, training, fire extinguishers, types of fire extinguishers and uses. MSDS and its applications.	**08**
5	**Safety Audit:** Introduction, Essentials of Safety Audit. The factories Act 1948, Environmental Protection Act, Manufacture, Storage & impact of Hazardous Chemical Rules 1989. Auditing programs in classified areas, Audit procedures, Audit benefits.	**08**

SELF-STUDY COMPONENT:

1) Explosions, Sources of Ignition. Industrial Hygiene
2) Types of Pressure relief valves, Classification and Transportation of hazardous chemicals
3) Basic Prevention and protective measures
4) Special Process hazards, Pipe line safety.

5) The Mines Act, 1952, The Employees' Provident Funds and Miscellaneous Provisions Act, 1952,The Plantation Labor Act, 1951.The Employees State Insurance Act

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component.

TEXT BOOKS:

1) Industrial Hygiene and Chemical Safety. M H Fulekar, IK International
2) Chemical Engineering – Vol.6, Coulson and Richardson's, 3rd Edition.

REFERENCE BOOKS:

1) Chemical Engineers Handbook, Perry, 8th Edition, 2007.
2) Plant Safety and Maintenance D B Dhone, Niraliprakshan, 2015.
3) Environmental Engineering and Disaster Management , Sanjay K Sharma 2015
4) Hazardous Chemicals Handbook Second edition Oxford Amsterdam Boston London New York Paris San Diego San Francisco Singapore Sydney Tokyo 2002

ASSESSMENT PATTERN

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT
Marks (Out of 50)	**30**	**10**	**10**
Remember	05	--	05
Understand	05	05	01
Apply	10	05	02
Analyze	05	--	02
Evaluate	--	--	--
Create	05	--	--

***AAT 1– Alternate Assessment Tool 1: Quiz**
AAT 2 - Alternate Assessment Tool 2: Self Study Component.

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory(50)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	--
Create	10

CHARECTERISATION TECHNIQUES FOR ENGINEERING MATERIALS

Course code: 18CM6IECTQ	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

To provide students with knowledge of engineering materials for building technical competence in industries, research and development in the following fields.

1) To acquire basic concepts, principles, techniques and methods of characterization.
2) To understand the qualitative or quantitative information about the chemical composition through modern characterization techniques.
3) To appreciate the methodology and processes involved in the characterization of engineering materials.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1	Identify the modern techniques for the characterization of engineering materials.
CO2	Describe the process involved in the characterization of engineering materials.
CO3	Explain the basic aspects of material characterization and applications in the field of engineering technology.
CO4	Apply the core concepts of chemistry for the characterization of modern materials in engineering practice.
CO5	Analyze the data, processes, techniques and skills involved in the characterization of materials.
CO6	Appraise the characterization techniques in recognizing the properties and structure of materials.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	---	---	---	---	---	---	1	1	---	---
CO2	3	1	---	---	---	---	---	---	1	1	---	---
CO3	3	1	---	---	---	---	---	---	1	1	---	---
CO4	3	1	---	---	---	---	---	---	1	1	---	---
CO5	3	1	---	---	---	---	---	---	1	1	---	---
CO6	3	1	--	---	---	---	--	---	1	1	---	---

COURSE CONTENTS

Unit	Course Content	Hrs	COs
1	UNIT I - Introduction to Characterization techniques: Introduction to instrumental methods of characterization, importance and Classification of Characterization techniques with examples, Advantages - disadvantages and Basic components in instrumental methods of characterization Basics of Measurements : Errors – Definition Classification & Examples, Precision and accuracy – Definition & comparison Signals and Noise in analytical instruments: Definition, sources of noise, Signal to noise ratio, signal to noise enhancement. Amplification in analytical instruments: Definition, Classification, Construction and working of operational amplifiers. Readout systems in analytical instruments: Definition, Construction and working of Cathode ray tube and alpha numeric displays. Calibration methods in analytical instruments: Definition, Method of Standard addition and Least square analysis.	08	CO1 -6

2	UNIT II – Spectroscopic techniques: Introduction to electromagnetic radiation, Interaction of electromagnetic radiation with matter, energies corresponding to various kinds of radiations, energies associated with the molecules, Types of spectroscopy, Factors affecting the intensity and position of spectral lines, selection rules, origin of atomic and molecular spectra, representation of a spectrum. Atomic Absorption spectroscopy and Flame Emission Spectroscopy: Introduction, principle of AAS and FES, types of flames used in AAS, Comparative study of flame emission spectroscopy (FES) and Atomic absorption spectroscopy (AAS). Instrumentation of AAS. Applications–Qualitative and Quantitative determination of alkali and alkaline earth metals.	08	CO1-6
3	UNIT III – Optical techniques Ultraviolet spectroscopy: Introduction, principle, Beer-Lambert's law definition and limitations, (derivation excluded), Types of electronic transitions in organic molecules. Chromophores and Auxochromes, Bathochromic shift, Hypsochromic shift. Hyperchromic effect and Hypochromic effect. Effect of solvent and extent of conjugation on λmax, Instrumentation, Applications Application of UV Spectroscopy in the analysis isoprene and Phenol formaldehyde. Infrared Spectroscopy: Introduction, requirement of IR absorption. Theory of IR absorption. Fundamental modes of vibrations – linear and nonlinear molecules. Types of vibrations - stretching vibrations and bending vibrations. Factors affecting the group frequencies – coupled interactions, electronic effects and hydrogen bonding. Instrumentation - FTIR Instrument and its advantages, sample handling techniques – solution, nujol mull and KBr pellet, Applications Application of IR spectroscopy in the analysis of PMMA and silicone rubber.	08	CO1-6
4	UNIT IV –Magnetic field based technique 1H NMR: General introduction, theory of NMR, types of nuclei, Theory of population of nuclear spin levels, spin spin relaxation, spin lattice relaxation, Identification of equivalent and non-equivalent protons, Chemical shift-Definition, causes, measurement. TMS as a reference compound and its advantages, factors affecting chemical shift, shielding and deshielding, Spin-spin interaction, coupling constant, intensity ratio of multiplet by Pascal's triangle method, Chemical exchange, Effect of deuteration, Instrumentation, Applications, Representation of 1H NMR spectra of Polyacrylamide, Polythene, Polystyrene, Poly(n-butyl acrylate), Polypropylene and PMMA.	08	CO1-6
5	UNIT V – Electroanalytical techniques Potentiometry: Definition, theory, Classification of electrodes, Instrumentation, Applications, Analysis of gold in an alloy using potentiometry. Electrogravimetry: Definition, theory, Terms used in Electrogravimetry, Instrumentation, Applications, Analysis of copper in brass using electrogravimetry Voltammetry: Definition, Classification, theory, Instrumentation, Analysis of corrosion using cyclic voltammetry, Applications. Polarography: Definition, theory of polarography, dropping mercury electrode (DME) construction and working, polarographic analysis of metal ions, Applications.	08	CO1-6

SELF-STUDY COMPONENT:

Unit 1: Comparison of modern characterization techniques with conventional methods.
Unit 2: Variation of emission intensity with flame, role of temperature on absorption emission.
Unit 3: Applications of IR to structural elucidation of simple organic molecules.
Unit 4: First order and second order NMR spectral presentation of simple organic molecules.
Unit 5: Analysis of Cyclic voltammogram of $K_3[Fe(CN)_6]$

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

REFERENCE BOOKS:

1) Douglas.A.Skoog, F.James Holler, Timothy.A.Nieman, Principles of Instrumental Analysis, 5th Edn., Saunders college publishing, London, 1998.
2) Jaffery, Gill, Basset. J, Vogel's Text Book of Quantitative Inorganic analysis, et al 5th Edn., ELBS,1998
3) Willard, H.H., Merritt, L.L., Dean, J.A. and Settle, F. A, Instrumental Methods of Analysis, CBS Publishers, 7th Edition, 1988.
4) Chatwal, A., Instrumental Methods of Chemical Analysis, Himalaya Publishing House.
5) Sharma, K., Instrumental Methods of Chemical Analysis, Goel Publishing House Meerut 2000
6) Joseph Wang, Analytical electrochemistry, John Wiley and sons.Inc. Publishers, 3rd edition, 2006.

BENEFITS OF THE COURSE:

1) Multidisciplinary area of study with exciting job opportunities.
2) Provides knowledge catering to Academics, Research and Industry.
3) Provides exposure to characterization techniques involved in the manufacturing, quality control and assessment of engineering materials.

ASSESSMENT PATTERN:

CIE –Continuous internal evaluation theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT
Marks (Out of 50)	30	10	10
Remember	10	--	02
Understand	10	05	04
Apply	05	05	04
Analyze	05	--	--
Evaluate	--	--	--
Create	--	--	--

SEE –Semester end examination theory (50 Marks)

Bloom's Category	Marks Theory (50)
Remember	15
Understand	15
Apply	10
Analyze	10
Evaluate	--
Create	--

DATA STRUCTURES WITH C

Course code: 18CS6IEDSC	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) Explain fundamentals of data structures and their applications essential for programming / problem solving
2) Analyze Linear Data Structures: Stack, Queues, Lists
3) Analyze Non-Linear Data Structures: Trees, Graphs
4) Assess appropriate data structure during program development / problem solving

COURSE OUTCOMES:

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

CO1	Discuss types of data structures, operations and algorithms. -Sorting and searching operations.
CO2	Understand time and space efficiency of algorithms
CO3	Apply various data structures and its properties to illustrate storage of data efficiently.
CO4	Analyze the performance of - Stack, Queue, Lists, Trees, Graphs, Searching and Sorting Techniques.
CO5	Design and apply appropriate data structures for solving computing problems.
CO6	Implement programs using Data structures in a high-level language.

COURSE CONTENTS

Unit	Contents of the Unit	Hours	COs
1.	**BASIC CONCEPTS:** Review of C programming fundamentals, Introduction to Data Structure and its classification, the need for Data structure Algorithm Concepts: Specification, performance analysis & measurements, Sparse Matrices.	8	CO1
2.	**STACKS:** Introduction to Stacks, Stacks Using Dynamic Arrays, Evaluation of Expressions and conversion of expressions.	8	CO2, CO3, CO4
3.	**QUEUES:** Introduction to Queues, Types of Queue: Ordinary queue, Circular Queues & Double ended queue, Application of stacks and Queues.	6	CO3, CO4
4.	**LINKED LISTS:** Definition of Linked lists and Chains, Representing Chains in C, Types of Linked List: Singly Linked List, Circular Singly Linked List, Doubly Linked Lists & Circular doubly linked list, Application of Linked List.	10	CO4, CO5, CO6
5.	**TREES:** Introduction to Binary Search Trees (BST), Properties of Binary Tree, Operation on BST, Traversals in Binary Trees, Heaps.	8	CO4, CO5, CO6

TEXT BOOKS:

1) Horowitz, Sahni, Anderson-Freed: Fundamentals of Data Structures in C, 2nd Edition, Universities Press, 2007.

REFERENCE BOOKS:

1) Yedidyah, Augenstein, Tannenbaum: Data Structures Using C and C++, 2nd Edition, Pearson Education, 2003.
2) Richard F. Gilberg and Behrouz A. Forouzan: Data Structures A Pseudocode Approach with C, Cengage Learning, 2005.
3) A.M Padma Reddy," Approach of Data Structures", Person Publication, 5th Edition, 2015
4) Reema Theraja " Data Structure using C. 1st Edition , 2014

RURAL INFRASTRUCTURE & COMMUNITY DEVELOPMENT

Course code: 18CT6IERIC	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) Understand the importance of protected water supply, selection of water sources, water borne disease, drinking water quality standards.
2) To provide knowledge about eco-sanitation, water disposal methods, rain water harvesting.
3) Summarize waste collection methods, waste disposal & dung disposal.
4) Focus on the importance of rural road network to be provided.
5) Understand different local materials, special techniques & also importance of IRC, NRRDA & MORD.
6) Explain different Government schemes.

COURSE OUTCOMES:

CO1	Importance of utilization of water
CO2	Understanding the Eco-sanitation & rain water harvesting.
CO3	Exposure to different Government schemes regarding roads & Water Supply Systems
CO4	Importance of IRC, NRRDA & MORD.
CO5	To be able to analyze waste & dung disposal methods.
CO6	To be able to understand the improvising the rural roads and infrastructures importance.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	-	-	-	-	1	2	3	-	-	-	3	2	3	1
CO2	-	-	-	-	-	2	2	3	-	-	2	3	1	3	1
CO3	-	-	-	-	-	2	3	3	-	-	2	2	1	2	1
CO4	-	-	-	-	-	3	3	3	-	-	1	2	1	1	1
CO5	-	-	2	2	-	3	3	3	2	2	2	3	2	2	-
CO6	2	-	2	-	-	2	2	2	2	2	2	2	2	2	1

COURSE CONTENTS

MODULE	CONTENTS	HOURS	CO	PO
1	**RURAL WATER SUPPLY** Introduction, need for a protected water supply, investigation & selection of water sources, water borne disease, drinking water quality standards, Water supply system, ground water contamination & control.	08	1, 2, 3, 4	6, 7, 8

2	**RURAL SANITATION** Public latrine, concept of eco- sanitation, trenching & composting methods, W.C, Septic tank, Soak pit, Storm water & Sullage disposal	08	3,4,5	6,7,8, 11,12
3	**SOLID WASTE MANAGEMENT** Waste collection methods, transportation, Disposal- Salvaging, dumping, manure pits, dumping in low lands, composting, Dung disposal- digester, biogas plant.	08	4,5	3,4,6, 7,8, 11,12
4	**RURAL ROADS** Scope for use of alternate marginal/low cost/waste/stabilized local materials in rural road works, Choice of pavement type/pavement materials, IRC, NRRDA and MORD, Construction using special techniques/materials.	08	3,4,6	3,4,6, 7,8,9, 10,11, 12
5	**GOVERNAMENT SCHEMES** Nirmal Sauchalay Yojana, PMGSY, KSHIP, Swatch Bharat, Skill India, Start-up India, Make-in India	08	3,4	6,7,8, 9

SELF STUDY COMPONENT

MODULE 1: Water treatment methods.
MODULE 2: Rain water harvesting & uses.
MODULE 3: Hierarchy of different top organizations of India.
MODULE 4: Use of other eco-waste materials.
MODULE 5: Present Government Schemes & Status of previous schemes.

NOTE:

1) Questions for CIE and SEE not to be set from Self Study Component
2) Assignment Questions should be from Self Study Component only.

TEXT BOOKS:

1) Environmental sanitation- Joseph A Solveto
2) Water supply & sanitary Engineering – E W Steel

REFERENCES:

1) Indian Roads Congress (IRC) "**Rural Roads Manual"-** Special Publication 20 – 2002, Indian Roads Congress.
2) IRC SP: 58-2001, "**Guidelines for Use of Fly Ash in Road Embankments"-** Indian Roads Congress
3) MORD "Specification for Rural roads"
4) IRC SP:72 –2006, "**Guidelines on Gravel Road**"- Indian Roads Congress
5) Water supply & sanitary Engineering – S K Garg.

ENVIRONMENTAL IMPACT ASSESSMENT

Course code: 18CV6IEEIA	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) Develop Step-by-step procedures for conducting EIA.
2) Overview of the concepts, methods, issues and various forms and stages of the EIA Process

COURSE OUTCOMES:

CO 1	Develop Step-by-step procedures for conducting EIA.
CO 2	Assess and Predict Impacts on different Attributes.
CO 3	Develop frame work of Impact Assessment.
CO 4	Discuss the different steps within environmental impact assessment
CO 5	Analyse how to liaise with and the importance of stakeholders in the EIA process
CO 6	Identify the major principles of environmental impact assessment in India

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	1									
CO2	3	3	1									
CO3	3	3	1									
CO4	3	3	1									
CO5	3	1	1									
CO6	3	1	1									

COURSE CONTENTS

Module	Content	Hours	Co's
1	Development Activity and Ecological Factors EIA, Rapid and Comprehensive EIA, EIS, FONSI. Baseline Information, Step-by-step procedures for conducting EIA, Limitations of EIA.	8	**CO1 CO2 CO3**
2	Frame work of Impact Assessment. Development Projects-Environmental Setting, Objectives and Scope, Contents of EIA, Methodologies, Techniques of EIA. Assessment and Prediction of Impacts on Attributes Air, Water, Noise, Land Ecology, Soil, EIA guidelines for Development Projects, Rapid and Comprehensive EIA.	8	**CO2 CO3**
3	Public Participation in Environmental Decision making. Practical Considerations in preparing Environmental Impact Assessment and Statements.	8	**CO2 CO3 CO4**
4	Salient Features of the Project Activity-Environmental Parameter Activity Relationships- Matrices.	8	**CO5**
5	EIA for Water resource developmental projects, Highway projects: Nuclear- Power plant projects, Mining project (Coal, Iron ore), Infrastructure Construction Activities.	8	**CO6**

SELF STUDY COMPONENT

Unit	Contents of the unit
1	Need for EIA Studies
2	Cultural and Socio-economic Environment.
5	EIA for Thermal Power Plant

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

3) Environment Impact Assessment. - Anjaneyalu. Y.

REFERENCES BOOKS:

1) Environmental Impact Analysis-Jain R.K.-Van Nostrand Reinhold Co.
2) Guidelines for EIA of developmental Projects Ministry of Environment and Forests, GOI.
3) Environment Impact Assessment - Larry W. Canter – McGraw Hill Publication.

FUNDAMENTALS OF COMPUTER VISION

Course code: 18EC6IE1CV	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To understand the concepts of image processing techniques for computer vision
2) To gain knowledge about types of image acquisition techniques
3) To study spatial domain image enhancement and image analysis
4) To expose the students to various applications of image processing

COURSE OUTCOMES:

CO 1	Relate human visual system with the fundamentals of IP techniques and discuss the fundamental components and steps in IP
CO 2	Illustrate the process of image acquisition using image sensors and CCD's
CO 3	Demonstrate and analyze the different relationships between the pixels
CO 4	Apply and analyze spatial filtering techniques on images for enhancement.
CO 5	Categorize various point processing techniques, image data types and image file formats.
CO 6	Analyze the various applications of Computer Vision

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	-	-	-	2	-	-	-	2	1	-	-
CO2	3	2	-	-	2	-	-	-	2	1	-	-
CO3	3	2	-	-	2	-	-	-	2	1	-	-
CO4	3	2	-	-	2	-	-	-	2	1	-	-
CO5	3	2	-	-	2	-	-	-	2	1	-	-
CO6	3	1	-	-	-	-	-	-	-	-	-	-

COURSE CONTENTS

Module	Content of the module	Hours	COs
1	**Fundamentals of vision**: Light and electromagnetic spectrum, Elements of visual perception: Image formation in the eye, Brightness adaptation and Discrimination, image display, Fundamental Steps, Components.	8	CO1
2	**Image Sensing and acquisition**: CCD sensor, Four- phase CCD, CCD formats, Architecture of CCD, scanning mechanisms, photo conductive cameras, camcorder, Image acquisition using single sensor, sensor strips, sensor Arrays, Image formation model, Representation of digital images, Spatial and Grey level resolution.	8	CO1 CO3 CO5
3	**Image fundamentals**: Basic relationship between pixels, Different Image data types, Types of images, Image file formats.	7	CO1 CO3 CO4
4	**Image Enhancement**: Background, Image negative, contrast stretching, gray level slicing, bit plane slicing, smoothing spatial filters: averaging filters, order statistic filters, sharpening spatial filters.	8	CO2 CO4 CO5
5	**Applications :** Photo album – Face detection – Face recognition – Eigen faces – Active appearance and 3D shape models of faces. Application: Surveillance – foreground-background separation – particle filters – Chamfer matching, tracking, and occlusion – combining views from multiple cameras – human gait analysis & Vehicular detection in tolls.	9	CO6

PRE-REQUISITES :

Knowledge of subjects like: Image Processing, Computer Vision, Mobiles, Cameras, Images, Videos

SELF STUDY COMPONENTS:

UNIT 1 : Image storage mechanism.
UNIT 2 : Image sampling and quantization, Aliasing effects, analog color TV camera.
UNIT 3 : Intensity and range images, satellite images.
UNIT 4 : Image Enhancement in frequency domain.
UNIT 5 : Application In-vehicle vision system.

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) R.C. Gonzalez, R.E. Woods, "Digital Image Processing", 3rd edition, *Pearson Education*, 2009.
2) S. Nagabhushushana, "Computer Vision and Image Processing", *1st Edition*, 2006.
3) S Jayaraman, S. Esakkirajan, T., Veerakumar,'' Digital Image Processing', 1st edn. *McGraw Hill Education* 2009.

REFERENCE BOOKS:

1) R.Szeliski, "Computer Vision: Algorithms and application", *Springer,* 2011.
2) Dhananjay Theckadath, "Image Processing", *Nandu Publishers*, 2015.

3) Vipula Singh, "Digital Image Processing with MATLAB and LABVIEW", *Sapna Publications*, Publications, 2013.

SCHEME OF EVALUATION OF THE CIE & ASSESSMENT PATTERN:

Assignment : Only one assignment (open book test normally) will be of 10 marks & conducted in the class during the course of the semester (normally midway thro' the semester or in between 2nd & 3rd test). Generally, 2- 4 questions can be given which has to be solved in 1 hour duration, the assignment question has to be from the self-study component or it can be a coding demo done in the laptop & shown on the spot to the teacher in the class, the questions has to be set according to easy, medium, tough & severe and evaluation has to be done as per the assignment evaluation rubrics.

Quiz : There will be 1 quiz of 10-30 questions of 1 mark each, which may be conducted along with the 2nd CIE test or at the appropriate time during the course of the semester and written in the answer booklet at the end (may be conducted on-line also) or which may be conducted along with the 2nd CIE test or at the appropriate time during the course of the semester.

CIE : There will be 3 CIE tests in a semester conducted for 50 marks with 10 Marks MCQs, remaining 40 Marks descriptive (with theory & problems). Finally, each CIE will be reduced to 10 Marks and totalled up for 30 Marks. There will be choices in the descriptive questions and evaluation has to be done as per the scheme of evaluation rubrics given. There has to be choices in the descriptive questions & the questions have to be set module/unit-wise. Total CIE marks for 50 will be finally rounded off to the nearest integer if the sum turns out to be a fraction.

CIE – Continuous Internal Evaluation Theory (50 Marks) :

Bloom's Category	**Tests -3 CIEs**	**Assignment - 1 No.**	**Quiz – 1 No.**
Marks (Out of 50)	**30**	**10**	**10**
Remember	05		
Understand	10	05	
Apply	10	05	
Analyze	05		
Evaluate			
Create			

SEE –Semester End Examination Theory (50 Marks) :

Bloom's Category	**Theory Marks (50)**
Remember	10
Understand	10
Apply	10
Analyze	20
Evaluate	
Create	

HIGHLIGHTS OF COMPUTER VISION:

1) Computer vision is a discipline that covers various sensors, cameras and different operations that can be performed on an image for various image processing applications.

2) This field includes methods for acquiring, processing and understanding images from the computers point of view.
3) The ultimate goal is to emulate perceptual capability of human eye and assist the human in different ways in the 2D environments.
4) Applications of computer vision in processing of a scene or an object for automatic machine perception.
5) Application of computer vision in the Improvement of pictorial information for human interpretation using software packages.

RENEWABLE ENERGY SOURCES

Course code: 18EE6IERES	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To make the students understand with the basic concepts of non-conventional energy sources and similar technological systems.
2) To discuss the power generation by different non-conventional energy sources.
3) To discuss the principles of OTEC and production of electricity.
4) To instil the basic knowledge about emerging technologies in renewable sector.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	List and explain the main sources of energy and their primary applications in the India, and the world.
CO2	Describe the challenges and problems associated with the use of various energy sources.
CO3	Discuss remedies/potential solutions to the supply and environmental issues associated with fossil fuels and other energy resources.
CO4	List and describe the primary renewable energy resources and technologies.
CO5	Explore and explain the need for emerging technologies.

PROGRAM OUTCOMES:

Engineering Knowledge, problem analysis, Engineer and Society, Environment and sustainability and Ethics

COURSE CONTENTS

Unit	Course Content	Hours	COs
1	**Introduction**: Types of energy sources, their availability, need of alternative energy sources, Non-conventional energy sources, Classification of alternative fuels. Scenario of conventional auto fuels, oil reserves of the world. Fuel quality aspects related to emissions. Technological up gradation required business driving Factors for alternative fuels. Implementation barriers for alternative fuels. Roadmap for alternative fuels.	**8**	**CO1 CO2 CO4**
2	**Solar Energy Basics**: Introduction, Basic principle of operation PV cell, Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Green Houses.	**8**	**CO2 CO4 CO5**

	Wind Energy: Introduction, principle of wind energy conversion. Types of wind machines, applications of wind energy. Site selection considerations. Advantages and disadvantages of WEC systems.		
3	**Biomass Energy**: Biogas or Biomethane. History, properties and production of Biogas, classification of biogas plants, biogas storage and dispensing system. Advantages of biogas, hazards and emissions of biogas. Methanol, Ethanol, Butanol, Straight vegetable oil, Biodiesel.	**8**	**CO4 CO5**
4	**Energy from Ocean**: Tidal Energy – Principle of Tidal Power, Components of Tidal Power Plant (TPP), Classification of Tidal Power Plants– Single basin and Double basin type, Advantages and Limitations of TPP. Ocean Thermal Energy Conversion (OTEC): Principle of OTEC system, Methods of OTEC power generation – Open Cycle (Claude cycle), Closed Cycle (Anderson cycle) and Hybrid cycle (block diagram description of OTEC); Site-selection criteria, Biofouling, Advantages & Limitations of OTEC	**8**	**CO3 CO4 CO5**
5	**Emerging Technologies**: Fuel Cell, Small Hydro Resources, Hydrogen Energy, and Wave Energy. (Principle of Energy generation using block diagrams, advantages and limitations). **Energy Storage**: Introduction, Necessity of Energy Storage, and Methods of Energy Storage-Battery storage, super capacitor storage, Superconducting Magnetic Energy Storage (SMES) (brief description using block diagram representation)	**8**	**CO5**

SELF STUDY COMPONENT:

Unit 2: Principle of Conversion of Solar Radiation into Heat, Solar Water Heaters (Flat Plate Collectors), Solar Cookers – Box type, concentrating dish type, Solar driers, Solar Still, Solar Furnaces, Solar Green Houses

TEXT BOOKS:

1) Mukund R Patel "Wind and Solar Power Systems Design, Analysis and Operation" Taylor and Francis publishers, 2nd Edition, 2006, ISBN 978-0-8493-1570-1.
2) G. D. Rai, "Non-Conventional Sources of Energy", Khanna Publishers, 4th Edition, 2007.
3) S.S.Thipse "Alternative Fuels". Jaico Publishing House; First edition (25 November 2010). ISBN-10: 8184950780

REFERENCE BOOKS:

1) Sukhatme, "Solar Energy", 2nd Edition, TMH, 2006.
2) Renewable Energy Sources- Twiddle Elbs, 3rd Edition, 2006, ISBN-10: 0419253203.
3) Solar Energy Hand Book – edited by William. C. Dikkinson ASISES, Network, ISBN -13: 978-0865716216.
4) Partain, L. D., "Solar Cells and Their Applications". John Wiley & Sons, 3rd edition, 2003, ISBN: 9780470539675.
5) Green, M.A., et al. Solar Cell Efficiency Tables (Version 30). 2007. Prog. Photovolt: Res.

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10		02	01
Understand	15	05	01	02
Apply	05	05	02	02
Analyze				

Evaluate				
Create				

***AAT 1– Alternate Assessment Tool 1: Quiz**
AAT 2 - Alternate Assessment Tool 2: Surprise Test

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	20
Apply	20
Analyze	
Evaluate	
Create	

ABOUT RENEWABLE ENERGY SOURCES:

Climate change is giving a major setback in daily life of living things. There is an urgent need for shift of utilization of energy towards renewable energy. This subject helps the students in understanding the global scenario of energy utilization and how the shift from non renewable to renewable energy will cause the potential changes for sustainable world.
The expected global growth in the renewable energy sector will be a crucial need for qualified and skilled engineers with specialist knowledge of the relevant technology. This subject focuses on viable sustainable and renewable sources of energy conversion based on systems using solar, wind and other sources.

INDUSTRIAL AUTOMATION

Course code: 18EI6IEIAN	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To analyze the need for industrial automation.
2) To comprehend various industrial control schemes
3) To identify the application of various hardware and software used in industries
4) To apply and analyse the automation concepts using relay logic
5) To use ladder logic for PLC programming
6) To develop a program for automated industrial application.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Analyse the need for industrial automation.
CO2	Comprehend various industrial control schemes
CO3	Identify the application of various hardware and software used in industries
CO4	Apply and analyse the automation concepts using relay logic
CO5	Use ladder logic for PLC programming
CO6	Develop a program for automated industrial application.

COURSE CONTENTS

Module	Contents of the Module	Hrs	Cos
1	**Introduction to Automation:** Expectations from automation- Basic functions-Historical development of control systems- Current trends in computer control of process plants	08	CO 1
2	**Computers in process control**: Functional requirements of Distributed control systems- System Architecture- Distributed control system example- Introduction to Supervisory Control & Data Acquisition System (SCADA).	08	CO 2
3	**Programmable Logic Controller (PLC):** Overview of PLC, PLC instructions, circuit representations and ladder logic. PLC block diagram, Types of PLC, Discrete input-output devices, PLC Input module-Output Modules. PLC Memory.	08	CO 3
4	**Basics of PLC Programming:** Conventional Ladder Versus PLC Ladder logic-Implementation and analysis of Logic functions- Basic Relay instructions- Relay instructions and the programmable controller input modules.	08	CO 4, CO 5
5	**PLC Instructions**: Timer and Counter instructions – Data transfer, Data Comparison and Data Handling Instructions- Sequencer instructions- Practical Applications	08	CO 4,CO6

SELF-STUDY COMPONENT:

Students will submit one case study report based on industrial automation.

NOTE:

1) Questions for CIE and SEE not to be set for self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Computer Based Industrial Control, Krishna Kant, PHI New Delhi, 2002
2) Introduction to Programmable Logic Controllers, Garry Dunning, Thomson Learning, 1998.

REFERENCES BOOKS:

1) Distributed Computer Control Systems in Industrial Automation, Dobrivojie Popovic, Vijay P. Bhatkar CRC Press, New York, 1990
2) Process Control Instrumentation Technology, Curtis D Johnson, 7th Edition, PHI, New Delhi, 2003

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)
SEE –Semester End Examination Theory (50 Marks)

CYBER LAW

Course code: 18HS6IECYL	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE CONTENTS

Unit	Course content	Hrs
1	**Fundamental of computer, internet and mobile technologies** • Introduction. Understanding a computer system, hardware, software, processing, and peripherals. • Understanding the concept of cyber space, internet system, origin, technical protocols, and domain name system. • Fundamentals of mobile technology, wireless communications, protocols, processing of calls and messages in MSP.	8
2	**Cyber Crimes- the technical perspective** • What is cybercrimes? Different types of cyber-crimes, hacking, denial of service, botnets. • Trojans and viruses, backdoors, remote access tools. • Cyber stalking, man in the middle attacks, spoofing, spamming, morning, steganography. • Identity theft, phishing, social engineering, salami attacks, financial frauds, piracy, we jacking, DNS poisoning, SQL injections, Cross site scripting.	8
3	**Technical aspects of digital evidence** • Technology intoxication. Basic principles. Types of evidentiary objects in cyber space. • Evidence in storage, processing transmission, cache, temporary internet files etc., • Forensics tools. • Legal recognition of electronic documents and signatures.	8
4	**Basic concepts of information security** • Concept of information security and its evolution. • Technical aspects of information security. Legal aspects of security. • Information security regulatory system in India. • Legal issues in securing a network. • Legal issues in cloud computing and E governance. • Legal compliance requirements under data protection laws in ITA 2000 and other laws.	8
5	**Cyber terrorism and cyber warfare issues** • Meaning of cyber warfare and cyber terrorism. • Techniques used in cyber-attack and impact of cyber warfare and cyber terrorism. • Understanding the E business technology. • E-payments, E taxation and E consumer protection. • Cyber law compliance as business strategy.	8

SELF STUDY COMPONENT:

Unit 1: Indian Evidence and amendments regarding digital evidence.
Unit 2: Difficulties in collection, preservation and presentation of digital evidence.
Unit 3: Indian Contract Act and companies laws and amendments and consumer protection.
Unit 4: Important case laws with respect to digital evidence.
Unit5: Penal law protection relates to cyber crimes.

NOTE:

1) Questions for CIE and SEE not to be set from Self Study Component.
2) Assignment Questions should be only from Self Study Component.

TEXT BOOKS:

1) CYBER LAWS & Information Technology by Dr. Jyoti Rattan & Vijay Rattan

REFERENCE BOOKS:

1) Law of Cyber Crimes in India (NLSIU) publication.
2) Cyber Law –Law of Information Technology and Internet. Anirudh Rastogi

PROJECT MANAGEMENT

Course code: 18IM6IEPMT	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) Identify project objectives and benefits.
2) Deliver project objectives within time, resource and budget constraints.
3) Sustain a sense of urgency around project critical paths and issues.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Execute the roles and responsibility of project leaders.
CO2	Evaluate the profitability of the projects.
CO3	Determine the resources required and project completion time
CO4	Organize the resources to execute a project
CO5	Modify the requirements in project execution.
CO6	Examine and analyze the performance of projects as per schedule.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1		1	1			2	
CO2	3	2	1		1		1	1			2	
CO3	3	2	1		1							
CO4	3	2	1	1	1							
CO5	3				1							
CO6	2	2	1	1				1			1	

COURSE CONTENTS

Unit	Course Content	Hrs	Cos
1	**CONCEPTS OF PROJECT MANAGEMENT:** Concepts of a Project, Categories of projects, Phases of project life cycle, Roles and responsibility of project leader, tools and techniques for project management. **PROJECT PLANNING AND ESTIMATING**: Feasibility report phased planning, Project planning steps, Objective and goals of the project, preparation of cost estimation.	9	**CO1 CO2**
2	**ORGANIZING AND STAFFING THE PROJECT TEAM:** Skills / abilities required for project manger Authorities and responsibilities of project manager, Project organization and types accountability in project execution, controls, tendering and selection of contractors.	8	**CO2 CO3**
3	**CO-ORDINATION AND CONTROL:** Project direction communication in a project, MIS project co-ordination, project control requirement for better control of project or role of MIS in project control, performance, control, schedule control, cost Control	7	**CO3**
4	**TOOLS & TECHNIQUES OF PROJECT MANAGEMENT:** GANTT chart, Networks, Critical Path Method, Project Evaluation and Review Technique, use of software package like MS projects.	8	**CO3 CO4**
5	**PROJECT SCHEDULING AND PERFORMANCE MEASURES:** Different scheduling techniques, Resource allocation method, Performance indicators, Performance improvement for the CM and DM companies for better project management.	8	**CO5 CO6**

SELF-STUDY COMPONENT

Unit 1: Evaluation of the project profitability
Unit 2: Effective time management
Unit 3: Project direction communication in a project
Unit 4: Schedule control
Unit 5: Software Project Management

NOTE :

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Project Management a System approach to Planning Scheduling & Controlling – Harold Kerzner - CBS Publishers and Distributors - 2002.
2) Project Execution Plan: Plan for project Execution interaction – Chaudhry. S – 2001.

REFERENCES BOOKS:

1) A Management Guide to PERT and CPM - WEIST & LeVY – Eastern Economy of PH 2002.
2) PERT & CPM.- L.S.Srinnath - Affiliated East West Press Pvt. Ltd. - 2002.
3) Project Management with PERT and CPM - Moder Joseph and Philips cerel R.
4) Project planning analysis selection implementation & review – Prasanna Chandra –ISBNO 07-462049-5 – 2002

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	Quiz
Marks (Out of 50)	**30**	**10**	**10**
Remember	--	--	5
Understand	10	--	5
Apply	10	05	--
Analyze	05	05	--
Evaluate	05	--	--
Create	--	--	--

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	Marks Theory(50)
Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	

INTRODUCTION TO JAVA

Course code: 18IS6IEJVA	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To provide an introduction to java and object oriented concepts of java programming.
2) Understand the use and creation of packages and interfaces.
3) Analyze and use exception handling in java.
4) A better understanding of string libraries.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Articulate classes, its members and the relationships among them needed for a specific problem.

CO2	Apply the basic concepts of object oriented programming in writing java programs.
CO3	Create and use packages/ interfaces in Java programs.
CO4	Analyze and implement exception handling in Java.
CO5	Use various Input/output packages effectively.
CO6	Design programs using String libraries.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	-	-	-	-	-	-	-	-	1	2	1	-
CO2	3	2	2	-	-	-	-	-	-	-	-	1	3	2	-
CO3	3	2	2	-	-	-	-	-	-	-	-	1	3	1	-
CO4	2	2	1	-	-	-	-	-	-	-	-	1	3	1	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1	3	1	1
CO6	3	2	2	-	-	-	-	-	-	-	-	1	3	2	2

COURSE CONTENTS

Unit	Contents of the Unit	Hours	CO's
1	**Introduction**: Creation of Java, Byte code, Java Buzzwords, Object Oriented Programming, A simple program, Two Control statements, Lexical Issues, Type conversion and casting, Arrays. **Operators:** Arithmetic operators, Bitwise operators, Relational operators, the assignment operator, The ? Operator, operator precedence. Control Statements: Selection statements, iteration statements, Jump statements.	9	CO1
2	**Classes:** Class fundamentals, declaring Objects, assigning object reference variables, introducing methods, constructors, this keyword, garbage collection, the finalize() method. **A Closer Look at Methods and Classes:** Overloading methods, using objects as parameters, returning objects, introducing access control, understanding static, introducing final.	9	CO2
3	**Inheritance:** inheritance basics, using super, creating multilevel hierarchy, method overriding, using abstract classes, using final with inheritance. **Interfaces:** Defining an Interface, Implementing Interface, Applying interfaces, Variables in interfaces. **Exception handling:** Fundamentals, Exception types, using try and catch, nested try statements, throw, throws, finally.	8	CO3 CO4
4	**Input/Output:** I/O Basics, Reading Console Input, Writing Console Output, Reading and Writing files. **Packages:** Defining a package, Access protection; importing packages.	7	CO5
5	**String handling:** String Constructors, String Length, Special string operators, Character extraction, String comparison, Searching Strings, Modifying a string,StringBuffer,StringBuffer Constructors.	7	CO6

SELF-STUDY COMPONENT:

Module 1: Data types and other tokens: Boolean Variables, int, long, char, white spaces, literals.

Module 2: nested and inner classes, using command line arguments
Module 3: Interfaces can be extended, multiple catch clauses, Java's built-in exceptions
Module 4: the Print Writer Class,
Module 5: StringBuffer, StringBuilder

Note: 1.Questions for CIE and SEE not to be set from self-study component.
2. Assignment Questions should include programming from self-study components.

TEXT BOOKS:

1) Herbert Schildt: Java The Complete Reference, 7th Edition, Tata McGraw Hill, 2007.

REFERENCES:

1) Y. Daniel Liang: Introduction to JAVA Programming, 6th Ed, Pearson Education, 2007.
2) Programming with Java E Balagurusamy,6th Ed, McGraw-Hill Education, 2019.

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember				
Understand				
Apply	10	05	01	01
Analyze	10		02	02
Evaluate			02	
Create	10	05		02

***AAT 1– Alternate Assessment Tool 1: Quiz**
AAT 2 - Alternate Assessment Tool 2: Develop a Java application related to their engineering major of study.

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	
Understand	10
Apply	10
Analyze	10
Evaluate	
Create	20

RELIABILITY ANALYSIS

Course code: 18MA6IERLA	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To introduce the concept of reliability in their proper perspective & present the fundamentals necessary to grasp the features about the reliability analysis.
2) To study the scope, characteristics, probability concepts for modeling the system reliability.

3) To combine the knowledge of mathematics, statistics with engineering for studying system reliability.
4) To understand and practice time series analysis.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Get an insight into the fundamentals of Operations Research, its scope, characteristics and phases
CO2	Learn the fundamentals of Reliability and probability distributions
CO3	Analyze the given information about components of reliability
CO4	Identify reliability of series, parallel, series-parallel and k out of n systems
CO5	To understand the concepts of Time Series Analysis

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	1	3	3	1	3	3	1	3	3	1
CO2	3	3	2	3	3	2	3	3	2	3	3	2
CO3	3	3	1	3	3	1	3	3	1	3	3	1
CO4	3	3	2	3	3	2	3	3	2	3	3	2
CO5	3	3	2	3	3	2	3	3	2	3	3	2

COURSE CONTENTS

Module	Contents of the Module	Hours	COs
1	**Introduction to Operational Research :** Definition, scope of operations research approach and limitations of OR models, characteristics and phases of OR. Structure of OR Model, Definition of Linear programming Problems (LPP) and Nonlinear programming problems (NLPP), Formulation of LPP, Solution by graphical method, Special cases of	8	CO1
2	**Introduction to Reliability:** Definition, Bathtub curve, Causes of Failures, Various phases in equipment life **Reliability Mathematics :** Introduction, Probability laws, Probability Distribution ,Discrete Distribution, Continuous Distribution	8	CO2
3	**Component Reliability and Hazard Model:** Introduction, Component reliability from test data, Difference between failure rate and Hazard rate. Time dependent hazard models, Mean time between Failures , Mean time to Failures (MTTF)	8	CO3
4	**Reliability of series and parallel Systems :** Reliability block diagram, Reliability of series systems, Reliability of parallel systems, Combined Series –Parallel Systems, Concepts of standby Redundancy, *k-out of –n* systems.	8	CO4
5	**Time Series Analysis :** Definition, time series components, Stationary and auto covariance , Models of stationary process:- Auto regressive process , Moving average process	8	CO5

SELF STUDY COMPONENT:

MODULE 1: Solve LPP by using Simplex Method
MODULE 2: Binomial and Exponential distribution
MODULE 3: Problems on probability of failure
MODULE 4: 3 – out – of – 5 systems

MODULE5: ARMA process

NOTE:

1) Questions for CIE and SEE not to be set from self-study component
2) Assignment Questions should be from self-study component only

TEXT BOOKS:

1) S.D. Sharma, "Operations Research", 15th revised edition, Kedarnath Ramnath, 2009-10
2) Dr . Brijendra Singh , "Quality Control and Reliability Analysis" ,1st edition 1998, Khanna Publishers
3) R H Shumway and D S Stoffer (2006) , "Time series and its application" , 2nd edition

REFERENCE BOOKS:

1) J K Sharma, "Operations Research: Theory and Applications", 6th Edition, 2016, Trinity press.
2) P J Brockwell and R A Davis (2002)," Introduction to Time Series forecasting"

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)

Bloom's Category	**Tests**	**Assignments**	**AAT1**	**AAT2**
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	10			01
Understand	10	05	01	01
Apply	10	05	02	01
Analyze			02	02
Evaluate				
Create				

***AAT** – Alternate Assessment Tool

SEE –Semester End Examination Theory (50 Marks)

Bloom's Category	**Marks Theory(50)**
Remember	10
Understand	20
Apply	5
Analyze	5
Evaluate	10
Create	

3-D PRINTING TECHNOLOGY

Course code: 18ME6IE3DP	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

C501.1	Able to understand the concept of product design, its growth and identify suitable 3D printing process for a particular application. Also utilize the principle of Stereo

	lithography system and its associative file and machine data preparation for product development.
C501.2	Illustrate the principles of Selective Laser Sintering and Fused Deposition Modeling for Product development encompassing the process parameters.
C501.3	Distinguish the materials suitable for LOM and Solid Ground curing and identify the various process parameters effecting the product development.
C501.4	Classify and compare the different types of toolings adapted in Laser Engineering Net Shaping
C501.5	Classify and understand the concept modelers based on their functionalities for synthesizing the products and optimize the factors influencing the RP process.
C501.6	Identify the various software's and apply the same for development of products for specific applications.

COURSE CONTENTS

UNIT	COURSE CONTENT	Hours	COs
1	**Module-1: Introduction:** Need for the compression in product development, History of RP systems, Survey of applications, Growth of RP industry, and Classification of RP systems. **Stereo Lithography Systems:** Principle, Process parameters, Process details, Data preparation, data files and machine details, Application. **Self study component:** Submit an article on Growth of RP industry.	**8**	CO1
2	**Module-2: Selective Laser Sintering:** Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications. **Fusion Deposition Modeling:** Principle, Process parameter, Path generation, Applications. **Solid Ground Curing:** Principle of operation, Machine details, Applications. **Laminated Object Manufacturing:** Principle of operation, LOM materials. Process details, applications. **Self study component:** Materials for LOM and SGC.	**8**	CO2, CO3
3	**Laser Engineering Net Shaping (LENS):** Rapid Tooling: Indirect Rapid tooling, Silicon rubber tooling, Aluminium filled epoxy tooling, Spray metal tooling, Cast kirksite, 3Q keltool, etc. Direct Rapid Tooling Direct. AIM, Quick cast process, Copper polyamide, Rapid Tool, DMILS, Prometal, Sand casting tooling, Laminate tooling soft Tooling vs. hard tooling. **Self study component:** Sand casting tooling and its applications.	**8**	CO4
4	**Concepts Modelers:** Principle, Thermal jet printer, Sander's model maker, 3-D printer, Genisys Xs printer HP system 5, Object Quadra systems. Rapid Manufacturing Process Optimization: Factors influencing accuracy. Data preparation errors, Part building errors, Error in finishing, influence of build orientation. **Self study component:** History of Sander's model maker.	**8**	CO5
5	**Module-5:** Typical Materials for 3D-Printing :	**8**	CO6

	Plastic(Properties of **Acrylonitrile butadiene styrene, Polyvinyl Alcohol Plastic, Polycarbonate**), Powders(**Polyamide, Alumide**), Resins, Metals for DMLS, Fibers and Papers. **Applications of RPT:** Applications in Aerospace, Automotive, Architecture Biomedical, Jewellery, Coin Industry, Tableware, Consumer Electronics, **Medical and Bio-Additive Manufacturing,** Home appliances. **Software for RPT:** STL files, Overview of Solid view, magics, imics, magic communicator, etc. Internet based software, Collaboration tools. **Self study component:** RP in Jewelry Design- its benefits and market potential.		

SELF STUDY COMPONENT:

NOTE:

1) Questions for CIE and SEE not to be set from self-study component.
2) Assignment Questions should be from self-study component only.

TEXT BOOKS:

1) Stereo Lithography and other RP & M Technologies, Paul F. Jacobs: SME, NY 1996.
2) Rapid Manufacturing, Flam D.T &Dinjoy S.S Verlag London 2001.

REFERENCE BOOKS:

3) Rapid Prototyping, Terry Wohler's Wohler's Report 2000" Wohler's Association 2000.
4) Rapid Prototyping Materials, Gurumurthi, IISc Bangalore.
5) Rapid Automated, Lament wood. Indus press New York.

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)
CIE-Continuous Internal Evaluation Theory (50)

ROBOTICS

Course code: 18ML6IEROB	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To impart the concepts and structure of industrial robots their kinematics, and its applications.
2) To provide an introduction to the mechanics of robots and spatial mechanics.
3) To understand the working of various vision and robotic controls in detail.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Understand the basic structure, the components and the working of the industrial and non-industrial robots.

CO2	Apply analytical techniques and basic principles of robotic design for solving the kinematics of a robot manipulator
CO3	Analyze the working of the articulated robots and its applications.
CO4	Compare and analyze robotics for various industrial applications
CO5	Make comparison between the various control systems used in the robotic systems.
CO6	Analyze the various industrial application of the robotic systems in iterative processing.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	-	-	-	-	-	-	-	-	-	2
CO2	1	2	1	2	-	-	-	-	-	-	-	1
CO3	2	2	2	1	1	-	-	-	-	-	1	1
CO4	2	1	-	2	-	-	2	-	-	-	1	-
CO5	2	1	-	2	-	-	1	-	-	-	1	-
CO6	2	1	-	1	2	-	1	-	-	-	-	-

COURSE CONTENTS

Unit	**Course Content**	**Hours**	**COs**
1	**Robotic Manipulation:** Introduction to robots, Robot classification – Drive technologies, work-envelope geometrics, motion control methods, Applications. Robot Specifications – Number of axes, capacity and speed, Reach and stroke, Tool orientation, Repeatability, precision and accuracy, Operating environment, An example – Rhino XR-3.	8	CO1
2	**Direct Kinematics: The arm equation:** Dot and cross products, coordinate frames, Rotations – Fundamental rotations, Composite rotations, Homogeneous coordinates – Homogeneous coordinate frames, Translations and rotations, Composite Homogeneous transformations, screw transformations, Link coordinates – Kinematic parameters, Normal, sliding and approach vectors, the Denavit-Hartenberg (D-H representation.	8	CO2
3	**Analysis and trajectory planning:** Workspace analysis, Work envelope of a five-axis articulated robot, Work envelope of a four-axis SCARA Robot, Workspace fixtures – Part feeders, Conveyers and carousels, Fixed tools, The pick and place operation – Paths and trajectories, Continuous path control of a five axis articulated robot, continuous path control of a four axis SCARA Robot.	8	CO3 CO4
4	**Robot control:** The control problem, State equations – A one axis robot, a two-axis planar articulated robot, A three-axis SCARA robot, Constant solutions – Liapunov's first method, Liapunov's second method, Linear Feedback systems – Transfer function, Steady state tracking, transient performance, Single axis PID control – DC motor and load, Torque regulator, PID transfer function.	8	CO5
5	**Robot vision:** Image representation, Template matching, Polyhedral objects – Edge detection, corner points, run-length encoding, shape analysis- line descriptors, area descriptors, principal angle, Segmentation – thresholding, region labeling, Iterative processing – shrink operators, swell operators, Euler number.	8	CO6

SELF STUDY COMPONENT:
UNIT 1: Problems
UNIT 2: An example robot – Rhino XR-3
UNIT 3: An example robot – Rhino XR-3
UNIT 4: Case study
UNIT 5: Case study

NOTE:

1) Questions for CIE and SEE not to be set from self-study component
2) Assignment Questions should be from self-study component only

TEXT BOOKS:

1) Fundamentals of Robotics, Robert J. Schilling, Prentice-Hall of India Private Limited, New Delhi-110001
2) Yoram Koren, Robotics for Engineers, McGraw Hill International. ISBN: 9780070353992

REFERENCES BOOKS:

1) Mikell P Groover, Industrial Robotics, Weiss, Nagel, McGraw Hill International ISBN: 9780071004428
2) Fu, Lee and Gonzalez, Robotics Control Vision and Intelligence, McGraw Hill International. ISBN: 0070226253.
3) King Sun Fu, Rafael C. González, C. S and George Lee, Robotics control, sensing, vision and intelligence, McGraw-Hill, 1987. ISBN: 0070226253, 9780070226258

ASSESSMENT PATTERN:

CIE –Continuous Internal Evaluation Theory (50 Marks)
SEE –Semester End Examination Theory (50 Marks)

TELECOMMUNICATION SYSTEMS

Course code: 18TE6IETCS	**Credits: 03**
L: P: T: S: 3: 0: 0: 0	**CIE Marks: 50**
Exam Hours: 03	**SEE Marks: 50**
Total Hours: 40	

COURSE OBJECTIVES:

1) To represent schematic of communication system model.
2) To understand various cabling specifications and standards from installation and manufacturability perspective.
3) To analyze different network topologies and principles.
4) To illustrate the role of optical communication system and its components.
5) To describe the features of wireless technologies and standards
6) To classify satellite orbits and sub-systems for communication.

COURSE OUTCOMES:

At the successful completion of the course, the students are expected to have/be able to:

CO1	Describe the fundamental concepts and applications of communication systems.
CO2	Understand the technicalities such as bandwidth, power levels, data rates in the cable networks with the awareness to adequate security, safety and cross talk

CO3	Understand the different types of Cables and identify the key test parameters for communications cables
CO4	Analyze the importance of modulation and multiple access schemes for communication model.
CO5	Understand various network topologies, testing procedures and prioritization on choosing network elements.
CO6	Comprehend the basics of wireless and satellite communication systems.

MAPPING OF COURSE OUTCOMES TO PROGRAM OUTCOMES:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3					2	2			3		
CO2	3	3										
CO3	3		2	2	2							
CO4	3	3	2			2	2					
CO5	3	3	2	2								
CO6	3	2	2	2	2							

COURSE CONTENTS

Module	Contents	Hours	CO's
1	**Introduction to Telecommunication:** The Significance of Human Communication, Communication System Model, Types of Electronic Communication, A Survey of Communication Applications. **Fundamentals of Communication**: Characteristic of Electromagnetic Spectrum, Wavelength and Frequency, Signals, Simplex, Half-Duplex, Full Duplex, Bandwidth, Sampling, Gain, Noise, Attenuation, Bit Error Rate, Channel Capacity, Decibels and Quality of Service.	**08**	**CO1, CO2**
2	**Copper Cable Media:** Types of copper cabling, Best practices for copper Installation, Coaxial Cable, Hybrid or Composite Cable, Installing Copper Cable, Avoiding Electromagnetic Interference, Copper Cable for Data Applications, Copper Cable for Voice Applications, Testing. **Fiber-optic Media:** Introducing fiber-optic transmission, Advantages of fiber optic cabling, Disadvantages of fiber optic cabling, Types of fiber optic cables, Fiber installation issues, the advantage of optical fiber over copper, basic fiber optic system considerations Link performance analysis.	**08**	**CO3**
3	**Modulation Schemes:** **Analog Modulation:** AM, FM and PM- brief review. **Digital Modulation:** ASK, FSK and PSK. **Multiplexing Techniques:** Frequency division multiplexing, Time division multiplexing. **Multiple Access Techniques:** FDMA, TDMA, CDMA.	**08**	**CO4**
4	**Communication System design and installation:** Cabling topologies, Choice of Media, Telecommunications rooms, Cabling Management, Data and Cabling Security, Cabling Installation Procedures.	**08**	**CO5**

	Network Equipment: Network Connectivity Devices, Workstation Ports, Repeaters and Hubs, Bridges, Switches, Gateways, Servers, and Routers.		
5	**Wireless Technologies:** Cellular concepts, Frequency allocation, Frequency reuse, 2 G, 2.5 G, 3G and 4G cell phone systems. **Satellite Communication:** Satellite Orbits, Satellite Communication Systems, Satellite Subsystems, Ground Stations, Satellite Applications, Global Positioning System.	**08**	**CO6**

SELF-STUDY COMPONENT

Module-1 Relationship between frequency range and bandwidth and give the frequency ranges for spectrum uses ranging from voice to ultra-high-frequency television.

Module-2 Basic principles of Light, Optical Fiber construction and theory.

Module-3 The role of Modulation and Multiplexing in facilitating signal transmission.

Module-4 Identify the basic active components of a Hierarchical Star Network for commercial buildings and networks

Module-5 Concept and Operation of the Global Positioning System.

Note : No questions from illustrative examples and from Self-study component

TEXT BOOKS

7) Louis E. Frenzel, "Principles of Electronic Communication Systems", Tata McGraw Hill 3rdEdition 2008, ISBN: 978-0-07-310704-2.
8) Andrew Oliviero and Bill Woodward, "Cabling - The Complete Guide to Copper and Fiber-Optic Networking", 4th Edition, Wiley publisher, 2014.

REFERENCES

9) Roy Blake, **"Electronic Communication Systems"**, Thomson/Delamar, 2nd edition, 2002, ISB: 978-81-315-0307-2.
10) George Kennedy, "**Electronic Communication Systems",** Tata McGraw Hill 3rdEdition 2008, ISBN: 0-02-800592-9.
11) Anu A. Gokhale **"Introduction to Telecommunications"**, Cengage Learning, 2nd Edition 2008, ISBN: 981-240-081-8.

ASSESSMENT PATTERN:

CIE : Continious Internal Evaluation Theory (50 Marks)

Bloom's Category	Tests	Assignments	AAT1	AAT2
Marks (Out of 50)	**30**	**10**	**05**	**05**
Remember	--	--	01	01
Understand	10	--	01	01
Apply	10	05	01	01
Analyze	05	05	01	01
Evaluate	05		01	01
Create				
				***AAT: Alternate Assessment Tool**

SEE –Semester End Examination Theory (50 Marks)	
Bloom's Category	**Marks Theory (50)**

Remember	10
Understand	10
Apply	10
Analyze	10
Evaluate	10
Create	