

K.L.N. COLLEGE OF ENGINEERING
POTTAPALAYAM – 630 612, Sivagangai District
(An Autonomous Institution, Affiliated to Anna University, Chennai)

LIST OF OPEN ELECTIVES OFFERED TO UG STUDENTS
FOR THE STUDENTS ADMITTED FROM THE AY 2021-2022 ONWARDS

Courses offered by Department of Mechanical Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE101	Mechatronics and Applications	1.	20OE105	Solar Photovoltaic Fundamentals and Applications
2.	20OE102	Solid free form Manufacturing	2.	20OE106	Fundamentals of Product Design
3.	20OE103	Refrigeration and Air Conditioning	3.	20OE107	Autonomous Electric Vehicles
4.	20OE104	Production and Operation Management	4.	20OE108	Industrial Safety Practices

Courses offered by Department of Electrical and Electronics Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE201	Fundamentals of Renewable Energy systems	1.	20OE205	Industrial Energy Auditing and Management
2.	20OE202	Principles of Measurements and Instrumentation	2.	20OE206	Fundamentals of Fibre Optics and Lasers
3.	20OE203	Introduction to Nanoscience	3.	20OE207	Electric Power Quality
4.	20OE204	Automotive Electric Machines	4.	20OE208	Electrical Drives and Control for Automation

Courses offered by Department of Electronics and Communication Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE301	Fundamentals of Communication Engineering	1.	20OE305	Fundamentals of Image Processing
2.	20OE302	Microprocessor and Embedded systems	2.	20OE306	Consumer Electronics
3.	20OE303	Fundamentals of Wireless Communication	3.	20OE307	Fundamentals of Digital Signal Processing
4.	20OE304	Satellite Communication Systems	4.	20OE308	Introduction to VLSI Technology

Courses offered by Department of Computer Science and Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE401	Fundamentals of Artificial Intelligence	1.	20OE405	Fundamentals of Machine Learning
2.	20OE402	Introduction to Database Management Systems	2.	20OE406	Java Scripting
3.	20OE403	Computer Communication Networks	3.	20OE407	Computer Graphics
4.	20OE404	Cloud Infra structure and Technologies	4.	20OE408	Essentials of Data Analytics

Courses offered by Department of Information Technology

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE501	Principles of Software Testing	1.	20OE505	Essentials of Information Security
2.	20OE502	Fundamentals of Web Technology	2.	20OE506	Principles of Cyber Physical System
3.	20OE503	Internet of Things and Applications	3.	20OE507	Concepts of Ethical Hacking
4.	20OE504	Cyber security	4.	20OE508	Introduction to User Interface design

Courses offered by Department of Automobile Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE601	Fundamentals of Electric Vehicles	1.	20OE605	Lean Manufacturing Practices
2.	20OE602	Supply Chain Management	2.	20OE606	Modern Technologies for Vehicles
3.	20OE603	Automotive Safety System	3.	20OE607	New Generation Hybrid vehicles
4.	20OE604	Basics of Automobile Engineering	4.	20OE608	Automotive Electrical and Electronics Systems

Courses offered by Department of Electronics and Instrumentation Engineering

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE701	Biomedical instrumentation and Measurements	1.	20OE705	Logic and Distributed Control System
2.	20OE702	Fundamentals of MEMS	2.	20OE706	Industrial computer Network
3.	20OE703	Energy Conversion Techniques	3.	20OE707	Modern Electronic Instrumentation
4.	20OE704	Instrumentation in steel industry	4.	20OE708	Instrumentation for Agro food industry

Courses offered by Department of Artificial Intelligence and Data Science

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OE901	Data Science using Python	1.	20OE905	Artificial Neural Network and applications
2.	20OE902	Introduction of Artificial Intelligence and Data Science	2.	20OE906	AI for robotics
3.	20OE903	Mobile app development and its applications	3.	20OE907	Fundamentals of Block chain Technologies
4.	20OE904	Foundation of Robotics	4.	20OE908	Introduction to Web Application Security

Courses offered by Department of Computer Science and Engineering (Cyber Security)

S.No.	COURSE CODE	COURSE TITLE	S.No.	COURSE CODE	COURSE TITLE
<u>VI Semester</u>			<u>VII Semester</u>		
1.	20OEA01	Fundamentals of Computer Networking	1.	20OEA05	Essentials of Network Security
2.	20OEA02	Cyber Security Basics	2.	20OEA06	Ethical Hacking Basics
3.	20OEA03	Introduction to Information Security	3.	20OEA07	Fundamental of Cyber Forensics
4.	20OEA04	Web Essentials	4.	20OEA08	Cyber Law and Policies

Courses offered by Department of Computer Science and Engineering (IoT)

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OEB01	IOT Device Programming	OE	3	3	0	0	3
2.	20OEB02	Artificial IOT	OE	3	3	0	0	3
3.	20OEB03	Data Science for IOT	OE	3	3	0	0	3
4.	20OEB04	IOT Security	OE	3	3	0	0	3

Courses offered by S & H Department

S.No.	COURSE CODE	COURSE TITLE	CATEGORY	CONTACT PERIODS	L	T	P	C
1.	20OE801	Linear Algebra and Number theory	OE	3	3	0	0	3
2.	20OE802	Communication and Employability Skills	OE	3	3	0	0	3
3.	20OE803	English for Research Paper Writing	OE	3	3	0	0	3

200E101

MECHATRONICS AND APPLICATIONS

L	T	P	C
3	0	0	3

OBJECTIVES

- To enable the students understand the basic concepts of mechatronics and measurement systems.
- To teach students about the various types of sensors and transducers.
- To enable the students understand the functions of various Signal Conditioning devices and Data Acquisition system.
- To develop the skills of students in describing the functions and applications of PLC and SCADA system.
- To enable the students understand the applications of Mechatronics system.

PREREQUISITE: NIL

UNIT - I INTRODUCTION TO MECHATRONICS AND MEASUREMENT SYSTEM 9

Introduction to Mechatronics – Systems – Concepts of Mechatronics approach – key elements of mechatronics system - Need for Mechatronics – Emerging areas of Mechatronics – Classification of Mechatronics. Generalized Measurement System – Performance Characteristics: Static and Dynamic Characteristics – Errors in Measurements – Statistical Analysis of errors - Calibration and Standards.

UNIT – II SENSORS AND TRANSDUCERS 9

Static and dynamic Characteristics of Sensor - Potentiometers – LVDT – Capacitance sensors – Strain gauges – Piezoelectric sensor - Eddy current sensor – Hall effect sensor – Temperature sensors – Light sensors- optical encoders – proximity sensors -Ultrasonic sensor.

UNIT - III SIGNAL CONDITIONING AND DATA ACQUISITION 9

Amplification, Filtering – Level conversion – Linearization - Buffering – Sample and Hold circuit – Quantization – Multiplexer / Demultiplexer – Analog to Digital converter – Digital to Analog converter I/P and P/I converter - Instrumentation Amplifier-V/F and F/V converter- Data Acquisition -Data Logging – Data conversion –Introduction to virtual instrumentation.

UNIT – IV PROGRAMMABLE LOGIC CONTROLLER AND SCADA SYSTEM 9

Introduction – Basic structure – Input and output processing – Programming – Mnemonics – Timers, counters and internal relays – Data handling – Selection of PLC. Introduction to SCADA – Typical SCADA System Architecture – Communication Requirements – Desirable properties of SCADA system – Applications of SCADA

UNIT - V APPLICATIONS OF MECHATRONICS SYSTEM 9

Traditional and Mechatronics design concepts – Case studies of Mechatronics systems – Pick and place Robot – Engine Management system – Automatic car park barrier – Washing machine system – Automatic camera.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.
2. W.Bolton, "Mechatronics, Electronic control systems in Mechanical and Electrical Engineering", Pearson Education, 2015.
3. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCES:

1. Michael B.Histand and Davis G.Alciaiore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International 4th Edition, 2011.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smali.A and Mrad.F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2008.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 2009.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : MECHATRONICS AND APPLICATIONS										Course Code : 20OE101					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO1	Describe the key elements, functions of mechatronics and measurement systems.									I	K3	1,2,3,4,10,12	1,2,3		
CO2	Describe the working principles and characteristics of various types of sensors.									II	K3	1,2,3,4,10,12	1,2,3		
CO3	Discuss about the functions of Signal Conditioning devices and Data Acquisition system.									III	K3	2,3,4,5,10,12	1,2,3		
CO4	Develop the ladder logic diagram for various automatic control operations with PLC.									IV	K3	2,3,4,5,10,12	1,2,3		
CO5	Describe the architecture, desirable properties and applications of SCADA system.									IV	K3	2,3,4,5,10,12	1,2,3		
CO6	Describe the industrial and domestics applications of various mechatronics system.									V	K3	1,2,3,4,10,12	1,2,3		
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PSO 3
CO1	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO2	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO3	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO4	3	3	1	1	1	-	-	-	-	1	-	1	3	2	1
CO5	3	3	1	1	1	-	-	-	-	1	-	1	3	2	1
CO6	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1

200E102	SOLID FREE FORM MANUFACTURING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the evolution of Solid Freeform Manufacturing proliferation into various fields.
- To gain knowledge on Design for Additive Manufacturing and its importance in quality improvement of fabricated parts.
- To impart knowledge in polymerization and sheet lamination processes and their applications.
- To know about material extrusion and powder bed fusion processes.
- To gain knowledge on jetting and direct energy deposition processes and their applications.

PREREQUISITE: NIL

UNIT - I INTRODUCTION 9

Need - Development of SFM systems – Hierarchical structure of SFM - SFM process chain – Classification – Applications. Case studies: Bio printing- Food Printing- Electronics printing – Rapid Tooling - Building printing. AM Supply chain. Economics aspect: Strategic aspect- Operative aspect.

UNIT – II DESIGN FOR ADDITIVE MANUFACTURING 9

Concepts and Objectives - AM Unique Capabilities - Part Consolidation - Topology Optimization - Lightweight Structures - DFAM for Part Quality Improvement - CAD Modeling - Model Reconstruction - Data Processing for AM - Data Formats - Data Interfacing - Part Orientation - Support Structure Design and Support Structure Generation - Model Slicing - Tool Path Generation. Design Requirements of Additive Manufacturing: For Part Production, For Mass Production, For Series Production. Case Studies.

UNIT - III VAT POLYMERIZATION AND SHEET LAMINATION PROCESSES 9

Stereo lithography Apparatus (SLA): Principles – Photo Polymerization of SL Resins - Pre Build Process – Part-Building and Post-Build Processes - Part Quality and Process Planning, Recoating Issues - Materials - Advantages - Limitations and Applications. Digital Light Processing (DLP) - Materials - Process - Advantages and Applications. Laminated Object Manufacturing (LOM): Working Principles - Process - Materials, Advantages, Limitations and Applications. Ultrasonic Additive Manufacturing (UAM) - Process - Parameters - Applications. Case Studies.

UNIT – IV MATERIAL EXTRUSION AND POWDER BED FUSION PROCESSES 9

Fused deposition Modeling (FDM): Working Principles - Process - Materials and Applications. Design Rules for FDM. Selective Laser Sintering (SLS): Principles - Process - Indirect and Direct SLS - Powder Structure – Materials - Surface Deviation and Accuracy - Applications. Multijet Fusion. Selective Laser Melting (SLM) and Electron Beam Melting (EBM): Principles – Processes – Materials – Advantages - Limitations and Applications. Case Studies.

UNIT - V JETTING AND DIRECT ENERGY DEPOSITION PROCESSES 9

Binder Jetting: Three dimensional Printing (3DP): Principles – Process - Physics of 3DP - Types of printing: Continuous mode – Drop on Demand mode - Process – Materials - Advantages - Limitations - Applications. Material Jetting: Multi Jet Modelling (MJM) - Principles - Process - Materials - Advantages and Limitations. Laser Engineered Net Shaping (LENS): Processes- Materials- Advantages - Limitations and Applications. Case Studies.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Ernest O Doebelin, "Measurement Systems – Applications and Design", Tata McGraw-Hill, 2009.
2. W.Bolton, "Mechatronics, Electronic control systems in Mechanical and Electrical Engineering", Pearson Education, 2015.
3. Sawney A K and Puneet Sawney, "A Course in Mechanical Measurements and Instrumentation and Control", 12th edition, Dhanpat Rai & Co, New Delhi, 2013.

REFERENCES:

1. Michael B.Histand and Davis G.Alciaiore, "Introduction to Mechatronics and Measurement systems", McGraw Hill International 4th Edition, 2011.
2. Bradley D.A, Dawson D, Buru N.C and Loader A.J, "Mechatronics", Chapman and Hall, 1993.
3. Smali.A and Mrad.F, "Mechatronics Integrated Technologies for Intelligent Machines", Oxford University Press, 2008.
4. Devadas Shetty and Richard A. Kolk, "Mechatronics Systems Design", PWS publishing company, 2007.
5. John Turner and Martyn Hill, "Instrumentation for Engineers and Scientists", Oxford Science Publications, 2009.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : SOLID FREE FORM MANUFACTURING											Course Code : 20OE102				
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Recognize the importance in the evolution of SFM, proliferation into the various fields and its effects on supply chain.										I	K3	1,2,3,4,10,12	1,2,3	
CO2	Evaluate the design for AM and its importance in the quality of fabricated parts.										II	K3	1,2,3,4,10,12	1,2,3	
CO3	Describe the principles and applications of polymerization and sheet lamination processes										III	K3	2,3,4,5,10,12	1,2,3	
CO4	Explain principles of material extrusion and powder bed fusion processes and design guidelines.										IV	K3	2,3,4,5,10,12	1,2,3	
CO5	Perceive jetting and direct energy deposition processes and their applications.										IV	K3	2,3,4,5,10,12	1,2,3	
CO6	Recognize the importance in the evolution of SFM, proliferation into the various fields and its effects on supply chain.										V	K3	1,2,3,4,10,12	1,2,3	
CO-PO Mapping															
CO	P01	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PS01	PS02	PS03
CO1	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO2	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO3	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1
CO4	3	3	1	1	1	-	-	-	-	1	-	1	3	2	1
CO5	3	3	1	1	1	-	-	-	-	1	-	1	3	2	1
CO6	3	3	1	1	-	-	-	-	-	1	-	1	3	2	1

200E103	REFRIGERATION AND AIR CONDITIONING	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the properties .Classification and Nomenclature of different Refrigerant.
- To understand the underlying principles of operations in different Refrigeration & Air Conditioning systems and components.
- To provide knowledge on design aspects of Refrigeration.
- To understand the psychrometric properties and processes.
- To provide knowledge on Air Conditioning Systems with Controls

PREREQUISITE: NIL

UNIT - I INTRODUCTION	9
Introduction to Refrigeration - Unit of Refrigeration and C.O.P.– Ideal cycles- Refrigerants Desirable properties – Classification - Nomenclature - ODP & GWP.	
UNIT – II VAPOUR COMPRESSION REFRIGERATION SYSTEM	9
Vapor compression cycle: p-h and T-s diagrams - deviations from theoretical cycle sub cooling and super heating- effects of condenser and evaporator pressure on COP- multipressure system – low temperature refrigeration - Cascade systems – problems. Equipments: Type of Compressors, Condensers, Expansion devices, Evaporators.	
UNIT – III OTHER REFRIGERATION SYSTEMS	9
Working principles of Vapour absorption systems and adsorption cooling systems – Steam jet refrigeration- Ejector refrigeration systems- Thermoelectric refrigeration- Air refrigeration - Magnetic - Vortex and Pulse tube refrigeration systems.	
UNIT – IV PSYCHROMETRIC PROPERTIES AND PROCESSES	9
Properties of moist Air-Gibbs Dalton law, Specific humidity, Dew point temperature, Degree of saturation, Relative humidity, Enthalpy, Humid specific heat, Wet bulb temperature Thermodynamic wet bulb temperature, Psychrometric chart; Psychrometric of air conditioning processes, mixing of air streams.	
UNIT - V AIR CONDITIONING SYSTEMS AND LOAD ESTIMATION	9
Air conditioning loads: Outside and inside design conditions; Heat transfer through structure, Solar radiation, Electrical appliances, Infiltration and ventilation, internal heat load; Apparatus selection; fresh air load, human comfort & IAQ principles, effective temperature & chart, calculation of summer & winter air conditioning load; Classifications, Layout of plants; Air distribution system; Filters; Air Conditioning Systems with Controls: Temperature, Pressure and Humidity sensors, Actuators & Safety controls.	

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Arora, C.P., "Refrigeration and Air Conditioning", McGraw Hill, 3rd edition, 2020.
2. R. S. Khurmi, J. K. Gupta, "A Text Book of Refrigeration and Air-conditioning", Eurasia Publishing House, 2019.
3. W F Stoecker, Refrigeration and Air Conditioning, Mcgraw Hill Higher Education, 2019.

REFERENCES:

1. Roy J. Dossat, "Principles of Refrigeration", Pearson Education Asia, 4th edition, 2019.
2. Stoecker, W.F. and Jones J. W., "Refrigeration and Air Conditioning", McGraw Hill, New Delhi, 2021.
3. ASHRAE Hand book, Fundamentals, 2010
4. Jones W.P., "Air conditioning engineering", Elsevier Butterworth-Heinemann, 5th edition, 2018
5. A. R. Trott, T C Welch , Refrigeration and air-conditioning, Butterworth Heinemann, 2018

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : REFRIGERATION AND AIR CONDITIONING										Course Code : 20OE103					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO1	Explain the principle of refrigeration, cycles, properties and its environment effects.									I	K2	1, 2, 3	1, 2, 3		
CO2	Calculate COP of vapor compression Cycle for different processes.									II	K3	1, 2, 3	1, 2, 3		
CO3	Explain the different types and working principle of refrigeration Equipment's.									II	K2	1, 2, 3	1, 2, 3		
CO4	Describe the working principle of various types of refrigeration systems.									III	K2	1, 2, 3	1, 2, 3		
CO5	Discuss psychrometric properties and processes, and air conditioning process									IV	K2	1, 2, 3	1, 2, 3		
CO6	Estimate cooling load factor, winter and summer air conditioning load and human comfort condition.									V	K3	1, 2, 3	1, 2, 3		
CO-PO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO2	3	2	1	-	-	-	-	-	-	-	-	-	3	2	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO4	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO6	3	2	1	-	-	-	-	-	-	-	-	-	3	2	1

200E104	PRODUCTION AND OPERATIONS MANAGEMENT	L	T	P	C
		3	0	0	3

OBJECTIVES

- To understand the concept of Production and Operations Management in creating and enhancing a firm's competitive advantages.
- To gain knowledge about forecasting techniques in both manufacturing and service industry.
- To know about the inputs, strategies and models for aggregate planning.
- To understand the concepts of MRP and ERP.
- To know about the tools for capacity planning.

PREREQUISITE: NIL

UNIT - I INTRODUCTION 9

Objectives of Operations Management, Scope of Operations Management, Relationship of Operations with other Functional areas, Manufacturing Vs Service sector, Operations Decision making, Phases in Product Design and Development, Product Life Cycle, Process Selection.

UNIT – II FORECASTING 9

Need, Determinants of Demand, Demand Patterns, Qualitative Forecasting Methods-Delphi techniques. Market Research, Nominal Group Technique. Quantitative Forecasting methods – Moving Average Methods, Exponential Smoothing Methods, Regression methods, Monitoring and Control of Forecasts, Requirements and Selection of Good forecasting methods.

UNIT - III AGGREGATE PLANNING 9

Role of aggregate Product planning, Managerial inputs to Aggregate planning, Pure and Mixed strategies, Mathematical Models for Aggregate planning – Transportation Method, Linear programming Formulation, Linear Decision Rues, Master Production Schedule(MPS), Procedure for developing MPS.

UNIT – IV MRP AND ERP 9

MRP -Lot sizing methods – Implementation issues, MRP – II.
ERP – evolution, comparison of ERP with traditional systems, benefits, need for ERP, overview of modules in ERP. ERP implementation: Requirement analysis, alternatives, life cycle, implementation methodology.

UNIT - V CAPACITY MANAGEMENT 9

Measures of capacity, Factors affecting capacity, Capacity Planning, Systematic approach to capacity planning, Long-term and short-term capacity decisions, Tools for capacity planning, Capacity Requirement Planning- Business Process Outsourcing.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Chase R.B, Nicholas J. Aquilano, F.and Jacobs R, "Production and Operations Management: Manufacturing and Services, Irwin/McGraw-Hill, 2010.
2. Panneerselvam. R, "Production and operations Management", PHI, 3rd Edition, 2012.
3. Mary Sumner, "Enterprise Resource Planning", 2nd Edition, Pearson Education, 2007.

REFERENCES:

1. Lee J. Krajewski, Manoj K. Malhotra, Larry P. Ritzman, "Operations Management: Processes and Supply Chains", Pearson Education, 11th Edition, 2015
2. Norman Gaither, Greg Frazier, "Operations Management", Thomson Learning, 9th Edition, 2002.
3. William J Stevenson, "Operations Management", McGraw Hill, 13th Edition, 2018.
4. Hiller and Liberman, "Introduction to Operations Research", McGraw Hill, 2015.
5. Jay Heizer, Barry Render, Chuck Munson, "Operations Management: Sustainability and Supply Chain Management", Pearson, 2017.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : PRODUCTION AND OPERATIONS MANAGEMENT										Course Code : 20OE104					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO1	Explain the different phases in product design and development.									I	K3	1,2,3,4,10,12	1,2		
CO2	Forecast demand for Production and Service Systems.									II	K3	1,2,3,4,10,12	1,2		
CO3	Formulate and Assess Aggregate Planning strategies and Material Requirement Plan									III	K3	2,3,4,5,10,12	1,2		
CO4	Determine the lot size of a product for the given conditions in an industry.									IV	K3	2,3,4,5,10,12	1,2		
CO5	Describe the ERP implementation methodology with an example.									IV	K3	2,3,4,5,10,12	1,2		
CO6	Calculate capacity requirements and developing capacity alternatives.									V	K3	1,2,3,4,10,12	1,2		
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	1	1	-	-	-	-	-	1	-	1	2	1	-
CO2	3	2	1	1	-	-	-	-	-	1	-	1	2	1	-
CO3	3	2	1	1	-	-	-	-	-	1	-	1	2	1	-
CO4	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
CO5	3	2	1	1	1	-	-	-	-	1	-	1	2	1	-
CO6	3	2	1	1	-	-	-	-	-	1	-	1	2	1	-

200E105	SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES

- To explain basics of solar photovoltaic.
- To explain basics of PV Systems.
- To explain basics of PV System grid connections.
- To explain basics of Hybrid systems
- To know in depth of its types and design of various PV-interconnected systems

PREREQUISITE: NIL

UNIT - I PHOTOVOLTAIC BASICS 9

Structure and working of Solar Cells - Types, Electrical properties and Behavior of Solar Cells – Cell properties and design - PV Cell Interconnection and Module Fabrication – PV Modules and arrays - Basics of Load Estimation.

UNIT – II STAND ALONE PV SYSTEMS 9

Schematics, Components, Batteries, Charge Conditioners - Balance of system components for DC and/or AC Applications - Typical applications for lighting, water pumping etc.

UNIT – III GRID CONNECTED PV SYSTEMS 9

Schematics, Components, Charge Conditioners, Interface Components - Balance of system Components - PV System in Buildings.

UNIT – IV HYBRID SYSTEMS 9

Solar, Biomass, Wind, Diesel Hybrid systems - Comparison and selection criteria for a given application.

UNIT - V DESIGN OF PV SYSTEMS 9

Radiation and load data - Design of System Components for different PV Applications – Sizing and Reliability - Simple Case Studies

TOTAL : 45 PERIODS

TEXT BOOKS:

1. CS Solanki: Solar Photovoltaics – Fundamentals, Technologies and Applications, PHI Learning Pvt. Ltd., 2015.
2. Martin A. Green, Solar Cells Operating Principles, Technology, and System Applications Prentice- Hall, 2008
3. Nelson, J the Physics of Solar Cells. Imperial College Press, 2017.

REFERENCES:

1. Thomas Markvart, Solar Electricit, John Wiley and Sons, 2015.
2. Stuart R. Wenham, Martin A. Green, Muriel E. Watt, Richard Corkish (Editors), Applied Photovoltaics, Earthscan, 2014.
3. Michael Boxwell, the Solar Electricity Handbook, Code Green Publishing, UK, 2015.
4. Rik DeGunther, Solar Power Your Home for Dummies, Wiley Publishing Inc, 2016.
5. Chetan Singh Solanki, Renewable Energy Technologies; A Practical Guide for Beginners, PHI School Books, 2014.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : SOLAR PHOTOVOLTAIC FUNDAMENTALS AND APPLICATIONS											Course Code : 20OE105				
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Summarize the basics of Photovoltaic systems.										I	K2	1, 2, 3	1, 2, 3	
CO2	Explain the component of stand- alone photovoltaic systems										II	K2	1, 2, 3	1, 2, 3	
CO3	Explain the component of grid connected photovoltaic systems										III	K2	1, 2, 3	1, 2, 3	
CO4	Summarize the basics of Hybrid systems.										IV	K2	1, 2, 3	1, 2, 3	
CO5	Explain the selection criteria for a given Photovoltaic application.										V	K2	1, 2, 3	1, 2, 3	
CO6	Design of various components of solar PV systems.										V	K3	1, 2, 3	1, 2, 3	
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO2	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO3	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO4	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO5	2	1	1	-	-	-	-	-	-	-	-	-	2	1	1
CO6	3	2	1	-	-	-	-	-	-	-	-	-	3	2	1

200E106	FUNDAMENTALS OF PRODUCT DESIGN	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To Understand various global trends and identify the scope of a new product design
- To translate conceptual idea into detailed design
- To understand the concept of new product design.
- To understand various Quality Concepts in product design
- To impart knowledge on various industrial design process

PREREQUISITE: NIL

UNIT - I PRODUCT PLANNING

9

Product Planning Process - Identify Opportunities - Evaluating and Prioritizing Projects - Allocating Resources and Timing - Identifying Customer Needs - Raw Data from Customers - Interpreting Raw Data in Terms of Customer Needs - Organizing the Needs into a Hierarchy - Establishing the Relative Importance of the Needs - Case study for motor driven nailer - Reflecting on the Results and the Process

UNIT – II CONCEPT GENERATION AND SELECTION

9

Task – Structured approaches – clarification – search – externally and internally – explore systematically – reflect on the solutions and processes – concept selection – methodology – benefits.

UNIT – III PRODUCT ARCHITECTURE

9

Implications – Product change – variety – component standardization – product performance –manufacturability – product development management – establishing the architecture – creation –clustering – geometric layout development – fundamental and incidental interactions – related system level design issues.

UNIT – IV QUALITY CONCEPTS

9

Design For Quality - Quality Function Deployment - Design Of Experiments - Failure Modes & Effect Analysis - TQM - Design For Six Sigma - Brain Storming Techniques - Design For Manufacturing - Design Ethics - Safety and Environmental Considerations in Product Design

UNIT - V INDUSTRIAL DESIGN

9

Integrate process design – Managing costs – Robust design – Need for industrial design – impact – design process – investigation of for industrial design – impact – design process– conceptualization – refinement – management of the industrial design process – technology driven products – user – driven products – assessing the quality of industrial design.

TOTAL : 45 PERIODS

TEXT BOOKS:

1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, “Product Design and Development”, Tata McGraw Hill Education, 4th Edition, 2009.
2. Kevin Otto, Kristin Wood, “Product Design”, Indian Reprint 2004, Pearson Education
3. George E Dieter, Linda C Schmidt, “Engineering Design”, Mc-Graw Hill International Edition, 5th Edition, 2012

REFERENCES:

1. David G.Ullman, "The Mechanical Design Process", Tata McGraw Hill , 2011
2. Stephen Rosenthal, Effective Product Design and Development, Business One Orwin, 1992,
3. Stuart Pugh, Tool Design -Integrated Methods for Successful Product Engineering, Addison Wesley Publishing, 1991.
4. Chitale A K and Gupta R C, "Product Design and Manufacturing", PHI 2007.
5. Yousef Haik, T. M. M. Shahin, "Engineering Design Process", Cengage Learning, 2nd Edition Reprint, 2010.

Course Name : FUNDAMENTALS OF PRODUCT DESIGN										Course Code : 20OE106					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO1	Explain the basic concepts of product design									I	K3	1,2,3,6,9,10	1,2,3		
CO2	Describe the basic concepts of concurrent Engineering									I	K3	1,2,3,6,9,10	1,2,3		
CO3	Generate various concepts for a product design and to select the best concept									II	K3	1,2,3,4,6,9,10	1,2,3		
CO4	Discuss the concepts and importance of product architecture									III	K3	1,2,3,6,9,10	1,2,3		
CO5	Apply the quality concepts to develop robust product									IV	K3	1,2,3,6,9,10	1,2,3		
CO6	Illustrate the importance of industrial design in view of aesthetics factors and ergonomic factors									V	K3	1,2,3,4,6,9,10	1,2,3		
CO-PO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	3	2	1	-	-	1	-	-	1	1	-	-	2	1	1
CO2	3	2	1	-	-	1	-	-	1	1	-	-	2	1	1
CO3	3	2	1	1	-	1	-	-	1	1	-	-	2	1	1
CO4	3	2	1	-	-	1	-	-	1	1	-	-	2	1	1
CO5	3	2	1	-	-	1	-	-	1	1	-	-	2	1	1
CO6	3	2	1	1	-	1	-	-	1	1	-	-	2	1	1

200E107	AUTONOMOUS AND ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES

- To Understand the technologies used in autonomous system
- To understand the perception, prediction and routing of autonomous driving
- To understand the planning and control of autonomous driving
- To understand the architecture of electric vehicle and energy storage device
- To understand the architecture of hybrid electric vehicle

PREREQUISITE: NIL

UNIT - I AUTONOMOUS DRIVING TECHNOLOGIES	9
Autonomous driving Technologies overview- Autonomous driving algorithms-Autonomous driving client system- Autonomous driving cloud platform	
UNIT – II PERCEPTION, PREDICTION AND ROUTING	9
Perception in Autonomous Driving – Detection – Segmentation – Stereo, optical flow and scene flow – Tracking. Prediction and Routing – Planning and control – Traffic Prediction- Lane level Routing.	
UNIT – III DECISION AND PLANNING	9
Decision, planning and control – Behavioral Decisions – Motion Planning – Feedback control.	
UNIT – IV ELECTRIC VEHICLE AND ENERGY STORAGE	9
Basics of Vehicle mechanisms, history of Electric vehicles (EV), Electric vehicle Architecture: Major components of electric vehicle. Energy storage-Battery, fuel cell and ultra capacitor.	
UNIT - V HYBRID ELECTRIC VEHICLE	9
Introduction to hybrid electric vehicle, Types- series, parallel and complex configuration- Architecture of hybrid electric vehicle-drive train-sizing of components.	
TOTAL : 45 PERIODS	

TEXT BOOKS:

1. Shaoshan Liu; Liyun Li; Jie Tang; Shuang Wu; Jean-Luc Gaudiot, “Creating Autonomous Vehicle Systems”, Morgan & Claypool, 2018.
2. A. Perillos, U. Hernandez-jayo, E. Onieva and I. Garcia-Zuazola (Eds.), Intelligent Transport Systems: Technologies and Applications, Wiley publications, 2015.
3. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, CRC Press, New York, 2003.

REFERENCES:

1. Danil Prokhorov, “Computational Intelligence in Automotive Applications”, Studies in Computational Intelligence book series, Springer, 2008.
2. H. Cheng, Autonomous Intelligent Vehicles: Theory, Algorithms, and Implementation, Berlin:Springer, 2011.
3. Andreas Herrmann, Walter Brenner, Rupert Stadler, Autonomous Driving: How the Driverless Revolution will Change the World Emerald Publishing, 2018
4. Michael E. McGrath, Autonomous Vehicles: Opportunities, Strategies, and Disruptions, Amazon, 2018.
5. Tom Denton, Electric and Hybrid Vehicles, 1st edition, Routledge Publishers, 2017

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : AUTONOMOUS AND ELECTRIC VEHICLE										Course Code : 200E107					
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Discuss the latest technologies in the design of autonomous systems.										I	K2	1, 2, 3, 4, 5-7	1, 2, 3	
CO2	Explain the perception of autonomous system.										II	K2	1, 2, 3, 4, 6, 7	1, 2, 3	
CO3	Explain the prediction and routing of autonomous system.										II	K2	1., 2, 3, 4, 6, 7	1, 2, 3	
CO4	Explain the planning and control of autonomous driving.										III	K2	1, 2, 3, 4, 6, 7	1, 2, 3	
CO5	Explain the importance of electric vehicle and energy storage system.										IV	K2	1, 2, 3, 4, 6, 7	1, 2, 3	
CO6	Discuss about the hybrid electric vehicles.										V	K2	1, 2, 3, 4, 6, 7	1, 2, 3	
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	1	1	1	1	1	2	-	-	-	-	-	2	1	1
CO2	2	1	1	1	-	1	2	-	-	-	-	-	2	1	1
CO3	2	1	1	1	-	1	2	-	-	-	-	-	2	1	1
CO4	2	1	1	1	-	1	2	-	-	-	-	-	2	1	1
CO5	2	1	1	1	-	1	2	-	-	-	-	-	2	1	1
CO6	2	1	1	1	-	1	2	-	-	-	-	-	2	1	1

20OE108

INDUSTRIAL SAFETY PRACTICES

L	T	P	C
3	0	0	3

OBJECTIVES

- To impart knowledge on safety engineering fundamentals.
- To gain knowledge on safety management practices.
- To understand about the chemical, fire, mechanical hazards.
- To understand about noise and vibration control.
- To gain knowledge in Factories Act.

PREREQUISITE: NIL

UNIT - I INTRODUCTION

9

Evolution of modern safety concepts – Fire prevention – Mechanical hazards – Boilers, Pressure vessels, Electrical Exposure.

UNIT – II CHEMICAL HAZARDS

9

Chemical exposure – Toxic materials – Radiation Ionizing and Non-ionizing Radiation - Industrial Hygiene – Industrial Toxicology.

UNIT - III ENVIRONMENTAL CONTROL

9

Industrial Health Hazards – Environmental Control – Industrial Noise - Noise measuring instruments, Control of Noise, Vibration, - Personal Protection.

UNIT – IV HAZARD ANALYSIS

9

System Safety Analysis –Techniques – Fault Tree Analysis (FTA), Failure Modes and Effects Analysis (FMEA), HAZOP analysis and Risk Assessment.

UNIT - V SAFETY REGULATIONS

9

Explosions – Disaster management – catastrophe control, hazard control, Factories Act, Safety regulations, Product safety – case studies.

TEXT BOOKS:

1. John V.Grimaldi, "Safety Management", AITB S Publishers, 2003.
2. David L. Goetsch, "Occupational Safety and Health for Technologists", Engineers and Managers, Pearson Education Ltd. 5th Edition, 2005.
3. Deshmukh L M, "Industrial Safety Management", Tata McGraw-Hill Publishing Company Ltd.,2005

REFERENCES:

1. Safety Manual, "EDEL Engineering Consultancy", 2000.
2. Charles D. Reese, "Occupational Health and Safety Management", CRC Press, 2003.
3. Philip E. Hagan, John Franklin Montgomery, James T. O'Reilly, "Accident Prevention Manual – NSC", Chicago, 2009.
4. John Davies, Alastair Ross, Brendan Wallace, "Safety Management: A Qualitative Systems Approach", CRC Press, 2003.
5. Anil Mital, "Advances in Industrial Ergonomics and Safety", Taylor and Francis Ltd, London, 1989

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INDUSTRIAL SAFETY PRACTICES										Course Code : 20OE108							
CO	Course Outcomes									Unit	K-CO	POs			PSOs		
CO 1	Illustrate the importance of safety in Boilers and Pressure vessels.									I	K3	1,2,3,4,6,10,12			1,2		
CO 2	Identify and prevent chemical, environmental mechanical, fire hazard.									II	K3	1,2,3,4,6,10,12			1,2		
CO 3	Collect, analyze and interpret the accidents data based on various safety techniques.									III	K3	1,2,3,4,5,6,10,12			1,2		
CO 4	Apply proper safety techniques on safety									IV	K3	1,2,3,4,5,6,10,12			1,2		
CO 5	Perform hazard analysis.									V	K3	1,2,3,4,5,6,10,12			1,2		
CO 6	Design the system with environmental consciousness by implementing safety regulation.									V	K3	1,2,3,4,6,10,12			1,2		
CO-PO mapping																	
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3		
CO 1	3	3	1	1	-	2	-	-	-	1	-	1	2	1	-		
CO 2	3	3	1	1	-	2	-	-	-	1	-	1	2	1	-		
CO 3	3	3	1	1	-	2	-	-	-	1	-	1	2	1	-		
CO 4	3	3	1	1	1	2	-	-	-	1	-	1	2	1	-		
CO 5	3	3	1	1	1	2	-	-	-	1	-	1	2	1	-		
CO 6	3	3	1	1	-	2	-	-	-	1	-	1	2	1	-		

200E201	FUNDAMENTALS OF RENEWABLE ENERGY SYSTEM	L	T	P	C
	(Qualitative Treatment only)	3	0	0	3

OBJECTIVES:

To impart knowledge on the following Topics

- Awareness about renewable Energy Sources and technologies.
- Adequate inputs on a variety of issues in harnessing renewable Energy.
- Recognize current and possible future role of renewable energy sources.

PRE-REQUISITE: NIL

UNIT-I RENEWABLE ENERGY SOURCES 9

Environmental consequences of fossil fuel use - Importance of renewable sources of energy - Sustainable Design and development - Types of Renewable Energy sources - Limitations of Renewable Energy sources - Present Indian and international energy scenario of conventional and Renewable Energy sources.

UNIT-II WIND ENERGY 9

Power in the Wind – Types of Wind Power Plants (WPPs) – Components of WPPs - Working of WPPs - Siting of WPPs - Grid integration issues of WPPs.

UNIT-III SOLAR PV AND THERMAL SYSTEMS 9

Solar Radiation - Radiation Measurement - Solar Thermal Power Plant - Central Receiver Power Plants, Solar Ponds - Thermal Energy storage system with PCM - Solar Photovoltaic systems : Basic Principle of SPV conversion – Types of PV Systems - Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.

UNIT- IV BIOMASS ENERGY 9

Introduction - Bio mass resources – Energy from Bio mass: conversion processes - Biomass Cogeneration - Environmental Benefits. Geothermal Energy: Basics, Direct Use, Geothermal Electricity. Mini/micro hydro power: Classification of hydropower schemes, Classification of water turbine, Turbine theory, Essential components of hydroelectric system.

UNIT-V OTHER ENERGY SOURCES 9

Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC) - Hydrogen Production and Storage- Fuel cell: Principle of working - various types - construction and applications. Energy Storage System - Hybrid Energy Systems.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Joshua Earnest, Tore Wizeliu, 'Wind Power Plants and Project Development', PHI Learning Pvt. Ltd, New Delhi, 2011.
2. D.P.Kothari, K.C Singal, Rakesh Ranjan, "Renewable Energy Sources and Emerging Technologies", PHI Learning Pvt. Ltd, New Delhi, 2013.
3. Scott Grinnell, "Renewable Energy & Sustainable Design", CENGAGE Learning, USA, 2016.

REFERENCES:

1. A.K.Mukerjee and Nivedita Thakur, 'Photovoltaic Systems: Analysis and Design', PHI Learning Private Limited, New Delhi, 2011
2. Richard A. Dunlap, 'Sustainable Energy', Cengage Learning India Private Limited, Delhi, 2015.
3. Chetan Singh Solanki, 'Solar Photovoltaics : Fundamentals, Technologies and Applications', PHI Learning Private Limited, New Delhi, 2011
4. Bradley A. Striebig, Adebayo A.Ogundipe and Maria Papadakis, 'Engineering Applications in Sustainable Design and Development', Cengage Learning India Private Limited, Delhi, 2016.
5. Godfrey Boyle, 'Renewable energy', Open University, Oxford University Press in association with the Open University, 2004.
6. Shobh Nath Singh, 'Non-conventional Energy resources' Pearson Education, 2015.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : FUNDAMENTALS OF RENEWABLE ENERGY SYSTEM						Course Code : 200E201								
CO	Course Outcomes					Unit	K-CO	POs	PSOs					
CO 1	Explain renewable Energy Sources and technologies.					I	K2	1,2	-					
CO 2	Describe the issues in harnessing renewable Energy.					I	K2	1,2	-					
CO 3	Explain the different types of wind power plant systems.					II	K2	1,2	-					
CO 4	Describe the principle of solar PV system.					III	K2	1,2	-					
CO 5	Explain basics about biomass energy.					IV	K2	1,2	-					
CO 6	Illustrate other renewable sources and its features.					V	K2	1,2	-					
CO-PO mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	-	-

200E202	PRINCIPLES OF MEASUREMENTS AND INSTRUMENTATION (Qualitative Treatment only)	L 3	T 0	P 0	C 3
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OBJECTIVES:

To impart knowledge on the following Topics

- To introduce the basic functional elements of instrumentation.
- To introduce the fundamentals of electrical and electronic instruments.
- To educate on the comparison between various measurement techniques.
- To introduce various storage and display devices.
- To introduce various transducers and the data acquisition systems.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Functional elements of an instrument – Static and dynamic characteristics – Errors in measurement – Statistical evaluation of measurement data – Standards and calibration.

UNIT- II ELECTRICAL AND ELECTRONICS INSTRUMENTS 9

Classification of measuring instruments - Essential requirements of an instrument - Construction, working principle and Torque equation of Permanent Magnet Moving Coil instruments - Attraction type and Repulsion type Moving iron instruments - Electrodynamometer type Wattmeter, Extension of Voltmeter and Ammeter range - Construction, working principle of Instrument transformers - 1 ϕ Induction type Energy meter.

UNIT-III COMPARISON METHODS OF MEASUREMENTS 9

D.C potentiometers - Crompton Potentiometer, D.C (Wheatstone, Kelvin, Kelvin double) bridges & A.C (Maxwell, Anderson, Hay's, Wein & Schering) bridges.

UNIT- IV STORAGE AND DISPLAY DEVICES 9

Magnetic disk and tape – Recorders, digital plotters and printers, CRT display, digital CRO, LED, LCD & Dot matrix display – Elements of data acquisition system - Data Loggers.

UNIT-V TRANSDUCERS AND DATA ACQUISITION SYSTEMS 9

Classification of transducers – Selection of transducers – Resistive Transducer – Strain gauge, Measurement of Temperature - RTD, thermistor & thermocouple, Capacitive transducer - Inductive Transducers – Linear Variable Differential Transducer (LVDT), Piezoelectric, Hall effect, optical and digital transducers

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.K. Sawhney, 'A Course in Electrical & Electronic Measurements & Instrumentation', Dhanpat Rai and Co, 2017.
2. J. B. Gupta, 'A Course in Electronic and Electrical Measurements', S. K. Kataria & Sons, Delhi, 2018.
3. H.S. Kalsi, 'Electronic Instrumentation', McGraw Hill, 4th Edition 2019.

REFERENCES:

1. E.O. Doebelin, Dhanesh N Manik, 'Measurement Systems', 7th Edition, McGraw Hill publishing company, 2019.
2. R.K. Rajput, 'Electrical and Electronics Measurements and Instrumentation', S. Chand Publications, New Delhi, 4th Edition, 2016.
3. Alan. S. Morris, 'Measurement and Instrumentation: Theory and Application', Prentice Hall of India, 2nd Edition, 2015.
4. David Bell, 'Electronic Instrumentation & Measurements', Oxford University Press, 2013.
5. D.V.S. Murthy, 'Transducers and Instrumentation', Prentice Hall of India Pvt Ltd, 2015

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Principles of Measurements and Instrumentation		Course Code : 20OE202												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO 1	Explain the characteristics of measuring Instruments systems.	I	K2	1,2	-									
CO 2	Explain the concepts of fundamentals of MC and MI Instruments	II	K2	1,2	-									
CO 3	Discuss various electrical and electronic measuring instruments, their construction, working principle and applications.	II	K2	1,2	-									
CO 4	Classify AC and DC bridges and formulate balance equation to calculate unknown resistance, inductance and capacitance.	III	K2	1,2	-									
CO 5	Explain the various storage and display devices.	IV	K2	1,2	-									
CO 6	Explain the construction and working of various types of transducer.	V	K2	1,2	-									
CO-PO mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	-	-

20OE203	INTRODUCTION TO NANOSCIENCE	L	T	P	C
	(Qualitative Treatment only)	3	0	0	3

OBJECTIVES:

- To learn about basis of nano material science
- To understand preparation method
- To explain various types and application.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 8

Nano scale Science and Technology - Implications for Physics, Chemistry, Biology and Engineering - Classifications of nano structured materials - nano particles - quantum dots, nano wires - ultra-thin films - multilayered materials. Length Scales involved and effect on properties: Mechanical, Electronic, Optical, Magnetic and Thermal properties. Introduction to properties and motivation for study.

UNIT- II GENERAL METHODS OF PREPARATION 9

Bottom-up Synthesis - Top-down Approach: Co-Precipitation, Ultrasonication, Mechanical Milling, Colloidal routes, Self-assembly, Vapour phase deposition, MOCVD, Sputtering, Evaporation, Molecular Beam Epitaxy, Atomic Layer Epitaxy, MOMBE.

UNIT-III NANOMATERIALS 12

Nano forms of Carbon - Buckminster fullerene - graphene and carbon nano tube, Single wall carbon Nano tubes (SWCNT) and Multi wall carbon nano tubes (MWCNT) - methods of synthesis (arc-growth, laser ablation, CVD routes, Plasma CVD), structure-property Relationships applications - Nano metal oxides-ZnO, TiO₂, MgO, ZrO₂, NiO, nano alumina, CaO, AgTiO₂, Ferrites, Nano clays - functionalization and applications - Quantum wires, Quantum dots-preparation, properties and applications.

UNIT- IV CHARACTERIZATION TECHNIQUES 9

X-ray diffraction technique, Scanning Electron Microscopy - environmental techniques, Transmission Electron Microscopy including high-resolution imaging, Surface Analysis techniques- AFM, SPM, STM, SNOM, ESCA, SIMS - Nano indentation.

UNIT-V APPLICATIONS 7

Nano InfoTech: Information storage - nano computer, molecular switch, super chip, nano crystal, Nano biotechlogy: nano probes in medical diagnostics and biotechnology, Nano medicines, Targetted drug delivery, Bio imaging - Micro Electro Mechanical Systems (MEMS), Nano Electro Mechanical Systems (NEMS) - Nano sensors, nano crystalline silver for bacterial inhibition, Nano particles for sun barrier products - In Photostat, printing, solar cell, battery.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.S. Edelstein and R.C. Cammearata, eds., "Nano materials: Synthesis, Properties and Applications", Institute of Physics Publishing, Bristol and Philadelphia, 1996.
2. N John Dinardo, "Nano scale Charecterisation of surfaces & Interfaces", 2nd edition, Weinheim Cambridge, Wiley-VCH, 2000.

REFERENCES:

1. G Timp, "Nanotechnology", AIP press/Springer, 1999.
2. Akhlesh Lakhtakia, "The Hand Book of Nano Technology, Nanometer Structure, Theory, Modeling and Simulations". Prentice-Hall of India (P) Ltd, New Delhi, 2007.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INTRODUCTION TO NANOSCIENCE		Course Code : 20OE203												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO 1	Explain the concepts of Nano science.	I	K2	1,2	-									
CO 2	Describe the process involved in the preparation of Nano materials.	II	K2	1,2	-									
CO 3	Illustrate the methods of synthesis of Nano materials.	II	K2	1,2	-									
CO 4	Describe the characteristics of Nano materials.	III	K2	1,2	-									
CO 5	Explain the applications of Nano materials.	IV	K2	1,2	-									
CO 6	Describe Micro Electro Mechanical Systems (MEMS).	V	K2	1,2	-									
CO-PO mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	-	-

20OE204

AUTOMOTIVE ELECTRICAL MACHINES
(Qualitative Treatment only)

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the characteristics and modes of excitation of stepper motor.
- To understand the power controllers and understand the modes of operation of switched reluctance motor.
- To understand the construction and principle of operation of permanent magnet brushless dc motor.
- To understand and to design power controller circuit for permanent magnet synchronous motor.
- To understand the Construction and principle of operation of synchronous reluctance motor.

PRE-REQUISITE: NIL

UNIT- I STEPPER MOTORS

10

Construction and Principle of operation - Variable reluctance stepper motor - Permanent magnet stepper motor - Hybrid stepper motor - Static and dynamic characteristics - Driver circuit - Applications and advantages.

UNIT- II SWITCHED RELUCTANCE MOTORS

9

Constructional features - Principle of operation - Torque equation - Power controllers - Control circuits for SRM - Torque speed Characteristics - Microprocessor based controller.

UNIT- III PERMANENT MAGNET BRUSHLESS DC MOTORS

10

Permanent Magnet materials - Characteristics - construction and principle of operation - Types - Difference between mechanical and electronic commutators - EMF and torque equations - torque speed characteristics - Hall sensors - optical position sensors - Microprocessor Based controller.

UNIT- IV PERMANENT MAGNET SYNCHRONOUS MOTORS

9

Principle of operation - EMF and Torque equations - self-control - vector control - Torque speed Characteristics - Microprocessor based control – Applications.

UNIT-V SYNCHRONOUS RELUCTANCE MOTORS

7

Construction and operating principle, Axial and radial air gap motors, Phasor diagram, Voltage and torque equation - Characteristics and its Applications.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K.Venkataratnam, 'Special Electrical Machines', Universities Press (India) Private Limited, 2008.
2. T. Kenjo, 'Stepping Motors and Their Microprocessor Controls', Clarendon Press London, 2009
3. E.G. Janardanan, 'Special electrical machines', PHI learning Private Limited, Delhi, 2014.

REFERENCES:

1. Miller T J E, 'Brushless Permanent Magnet and Reluctance Motor Drives', Clarendon Press, Oxford, 2008.
2. Kenjo T and Nagamori S, 'Permanent Magnet and Brushless DC Motors', Clarendon Press, London, 1986.
3. R.Krishnan, 'Switched Reluctance Motor Drives - Modeling, Simulation, Analysis, Design and Application', CRC Press, New York, 2014.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : AUTOMOTIVE ELECTRICAL MACHINES										Course Code : 200E204				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO 1	Describe the performance characteristics of stepper motor and examine the closed loop operation.									I	K2	1,2	-	
CO 2	Describe torque prediction of stepper motor from the fundamental principle.									II	K2	1,2	-	
CO 3	Explain the characteristics of switched reluctance motor and design the closed loop control of SRM for suitable applications.									II	K2	1,2	-	
CO 4	Explain the principle of operation of permanent magnet brushless DC motor and compute EMF and torque equation.									III	K2	1,2	-	
CO 5	Discuss the power controller circuit of permanent magnet synchronous motor to enhance the performance characteristics.									IV	K2	1,2	-	
CO 6	Explain the performance of synchronous reluctance motor and compute the voltage and torque equation.									V	K2	1,2	-	
CO-PO mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	-	-

20OE205	INDUSTRIAL ENERGY AUDITING AND MANAGEMENT	L	T	P	C
		3	0	0	3

(Qualitative Treatment only)

OBJECTIVES: To impart knowledge on the following Topics

- Awareness about importance of energy management and auditing..
- Understanding the Energy management on various electrical motors.
- Understanding the Energy management on electric lighting systems.
- Apply the different types of metering methods of energy management and auditing
- Provide the economic models for energy and load management.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Basics of Energy – Need for energy management – Energy accounting – Energy monitoring, targeting and reporting – Energy audit process.

UNIT - II ENERGY MANAGEMENT FOR MOTORS AND COGENERATION 9

Energy management for electric motors – Transformer and reactors – Capacitors and synchronous machines, energy management by cogeneration – Forms of cogeneration – Feasibility of cogeneration – Electrical interconnection.

UNIT - III LIGHTING SYSTEMS 9

Energy management in lighting systems – Task and the working space – Light sources – Ballasts – Lighting controls – Optimizing lighting energy – Power factor and effect of harmonics, lighting and energy standards..

UNIT - IV METERING FOR ENERGY MANAGEMENT 9

Metering for energy management – Units of measure – Utility meters – Demand meters – Paralleling of current transformers – Instrument transformer burdens – Multi tasking solid state meters, metering location vs requirements, metering techniques and practical examples.

UNIT - V ECONOMIC ANALYSIS AND MODELS 9

Economic analysis – Economic models – Time value of money – Utility rate structures – Cost of electricity – Loss evaluation, load management – Demand control techniques – Utility monitoring and control system – HVAC and energy management – Economic justification.

TOTAL: 45PERIODS

TEXT BOOKS:

1. Barney L. Capehart, Wayne C. Turner, and William J. Kennedy, Guide to Energy Management, Fifth Edition, The Fairmont Press, Inc., 2006
2. Eastop T. D & Croft D. R, Energy Efficiency for Engineers and Technologists, Logman Scientific & Technical, ISBN-0-582-03184, 1990.

REFERENCES:

1. Reay D.A, Industrial Energy Conservation, 1st edition, Pergamon Press, 1977.
2. IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities, IEEE, 1996.
3. Amit K. Tyagi, Handbook on Energy Audits and Management, TERI, 2003.
4. Electricity in buildings good practice guide, McGraw-Hill Education, 2016.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INDUSTRIAL ENERGY AUDITING AND MANAGEMENT		Course Code : 20OE205												
CO	Course Outcomes	Unit	K – CO	POs	PSOs									
CO 1	Explain the importance of energy management and auditing	I	K2	1,2	-									
CO 2	Describe energy management on different types of electrical equipment.	II	K2	1,2	-									
CO 3	Explain the Forms and feasibility of cogeneration	II	K2	1,2	-									
CO 4	Discuss the energy management on different types of lighting system and light sources.	III	K2	1,2	-									
CO 5	Describe the different types of metering methods of energy management and auditing.	IV	K2	1,2	-									
CO 6	Explain the economic models for energy and load management.	V	K2	1,2	-									
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	1	-

20OE206	FUNDAMENTALS OF FIBRE OPTICS AND LASERS	L	T	P	C
	(Qualitative Treatment only)	3	0	0	3

OBJECTIVES:

- To expose the students to the basic concepts of optical fibres and their properties.
- To provide adequate knowledge about the Industrial applications of optical fibres.
- To expose the students to the Laser fundamentals.
- To provide adequate knowledge about Industrial application of lasers.
- To provide adequate knowledge about holography and Medical applications of Lasers.

PRE-REQUISITE: NIL

UNIT - I OPTICAL FIBRES AND THEIR PROPERTIES 9

Construction of optical fiber cable: Guiding mechanism in optical fiber and Basic component of optical fiber communication, –Principles of light propagation through a fibre: Total internal reflection, Acceptance angle (θ_a), Numerical aperture and Skew mode – Different types of fibres and their properties: Single and multimode fibers and Step index and graded index fibers – fibre characteristics: Mechanical characteristics and Transmission characteristics, – Absorption losses – Scattering losses– Dispersion – Connectors and splicers – Fibre termination – Optical sources: Light Emitting Diode(LED) – Optical detectors: PIN Diode.

UNIT - II INDUSTRIAL APPLICATION OF OPTICAL FIBRES 9

Fibre optic sensors: Types of fiber optics sensor, Intrinsic sensor- Temperature/ Pressure sensor, Extrinsic sensors, Phase Modulated Fibre Optic Sensor and Displacement sensor (Extrinsic Sensor) – Fibre optic instrumentation system: Measurement of attenuation (by cut back method), Optical domain reflectometers, Fiber Scattering loss Measurement, Fiber Absorption Measurement, Fiber dispersion measurements, End reflection method and Near field scanning techniques – Different types of modulators: Electro-optic modulator (EOM) – Interferometric method of measurement of length –Moire fringes – Measurement of pressure, temperature, current, voltage, liquid level and strain.

UNIT - III LASER FUNDAMENTALS 9

Fundamental characteristics of lasers – Level Lasers: Two-Level Laser, Three Level Laser, Quasi Three and four level lasers – Properties of laser: Monochromaticity, Coherence, Divergence and Directionality and Brightness – Laser modes – Resonator configuration – Q-switching and mode locking – Cavity damping – Types of lasers – Gas lasers, solid lasers, liquid lasers and semiconductor lasers.

UNIT - IV INDUSTRIAL APPLICATION OF LASERS 9

Laser for measurement of distance, Laser for measurement of length, Laser for measurement of velocity, Laser for measurement of acceleration, Laser for measurement of current, voltage and Laser for measurement of Atmospheric Effect: Types of LIDAR, Construction And Working, and LIDAR Applications – Material processing: Laser instrumentation for material processing, Powder Feeder, Laser Heating, Laser Welding, Laser Melting, Conduction Limited Melting and Key Hole Melting –Laser trimming of material: Process Of Laser Trimming, Types Of Trim, Construction And Working Advantages – Material Removal and vaporization: Process Of Material Removal.

UNIT - V HOLOGRAM AND MEDICAL APPLICATIONS 9

Holography: Basic Principle, Holography vs. photography, Principle Of Hologram Recording,

Condition For Recording A Hologram, Reconstructing and viewing the holographic image– Holography for non-destructive testing – Holographic components – Medical applications of lasers, laser-Tissue Interactions Photochemical reactions, Thermalisation, collisional relaxation, Types of Interactions and Selecting an Interaction Mechanism – Laser instruments for surgery, removal of tumors of vocal cards, brain surgery, plastic surgery, gynaecology and oncology.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. J.M. Senior, 'Optical Fibre Communication – Principles and Practice', Prentice Hall of India, January 2014.
2. Eric Udd, William B., and Spillman, Jr., "Fiber Optic Sensors: An Introduction for Engineers and Scientists ", John Wiley & Sons, 2011.
3. J. Wilson and J.F.B. Hawkes, 'Introduction to Opto Electronics', Prentice Hall of India, 2001.

REFERENCES:

1. G. Keiser, 'Optical Fibre Communication', McGraw Hill, 1995.
2. M. Arumugam, 'Optical Fibre Communication and Sensors', Anuradha Agencies, 2002.
3. John F. Ready, "Industrial Applications of Lasers", Academic Press, Digitized in 2008.
4. Monte Ross, 'Laser Applications', McGraw Hill, 1968.
5. John and Harry, "Industrial lasers and their application", McGraw-Hill, 2002.
6. Keiser, G., "Optical Fiber Communication", McGraw-Hill, 3rd Edition, 2000.
<http://nptel.ac.in/courses/117101002>

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : FUNDAMENTALS OF FIBRE OPTICS AND LASERS		Course Code : 20OE206												
CO	Course Outcomes	Unit	K –CO	POs	PSOs									
CO 1	Explain the principle, transmission, dispersion and attenuation characteristics of optical fibers	I	K2	1,2	1									
CO 2	Explain the principle of Fibre Optical sources and Optical detectors.	I	K2	1,2	1									
CO 3	Describe the Fiber Scattering loss Measurement, Fiber Absorption Measurement and Fiber dispersion measurements	II	K2	1,2	1									
CO 4	Summarize the Fundamental characteristics and types of lasers	III	K2	1,2	1									
CO 5	Discuss the Construction and Working of industrial application of lasers	IV	K2	1,2	1									
CO 6	Explain the Basic Principle of Hologram and medical applications of laser.	V	K2	1,2	1									
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	1	-

20OE207

**ELECTRIC POWER QUALITY
(Qualitative Treatment only)**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the various power quality issues.
- To understand the causes, impacts and mitigation of Voltage sag and interruptions in power system.
- To understand the causes, impacts and mitigation of over voltages in power system with PSCAD and EMTP.
- To understand the concept of harmonics in power system with their causes, effects and control techniques.
- To understand the various types of conventional and modern power quality monitoring devices/methods.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Terms and definitions – Overloading – Under voltage – Sustained interruption - Sags and Swells – Waveform distortion – Total Harmonic Distortion (THD) – Computer Business Equipment Manufacturers Associations (CBEMA) curve.

UNIT - II VOLTAGE SAGS AND INTERRUPTIONS 9

Sources of sags and interruptions – Estimating voltage sag performance – Motor starting sags – Estimating the sag severity – Mitigation of voltage sags – Active series compensators – Static transfer switches and fast transfer switches.

UNIT - III OVERVOLTAGES 9

Sources of over voltages – Capacitor switching – Lightning – Ferro resonance – Mitigation of voltage swells – Surge arresters – Low pass filters – Power conditioners – Lightning protection – Shielding – Line arresters – Protection of transformers and cables – Computer analysis tools for transients – PSCAD and EMTP.

UNIT - IV HARMONICS 9

Harmonic distortion – Voltage and current distortion – Harmonic indices – Harmonic sources from commercial and industrial loads – Locating harmonic sources – Power system response characteristics – Resonance – Harmonic distortion evaluation – Devices for controlling harmonic distortion – Passive filters – Active filters – IEEE and IEC standards.

UNIT - V POWER QUALITY MONITORING AND CUSTOM POWER DEVICES 9

Power line disturbance analyzer - Harmonic/Spectrum analyzer - Flicker meters - Rectifier supported DVR – DC Capacitor supported DVR – DVR Structure – voltage Restoration – Series Active Filter – Unified power quality conditioner.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. R.C. Duggan , “Power Quality”, McGraw-Hill Education, 2012.(2nd edition)
2. A.J. Arrillaga, “Power system harmonics”, Wiley, 2003 (2nd edition)

REFERENCES:

1. G.T.Heydt, “Electric Power Quality”, Stars in a Circle Publications, 1994 (2nd edition)
2. Derek A. Paice, “Power Electronic Converter Harmonics”, Wiley-IEEE Press-1st Edition-1999

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : ELECTRIC POWER QUALITY										Course Code : 200E207				
CO	Course Outcomes										Unit	K –CO	POs	PSOs
CO1	Explain power quality disturbances, their causes, detrimental effects and Power quality standard.										I	K2	1,2	1
CO2	Describe the impact of voltage sag and interruptions in power systems.										II	K2	1,2	1
CO3	Analyze the over voltage phenomena using PSCAD and EMTP.										III	K2	1,2	1
CO4	Describe the impact of Harmonics in power systems.										IV	K2	1,2	1
CO5	Explain the different types of monitoring devices/methods for power quality in power system.										IV	K2	1,2	1
CO6	Discuss the different types of custom power devices for enhancement of power quality in power system.										V	K2	1,2	1
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	1	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-	1	-

200E208	ELECTRICAL DRIVES AND CONTROL FOR AUTOMATION	L	T	P	C
	(Qualitative Treatment only)	3	0	0	3

OBJECTIVES:

- To understand the DC drive control.
- To study and analyze the Induction motor drive control.
- To study and understand the Synchronous motor drive control.
- To study and analyze the SRM and BLDC motor drive control.
- To analyze and design the Digital control for drives.

PRE-REQUISITE: NIL

UNIT - I CONTROL OF DC DRIVES 9

Losses in electrical drive system, Energy efficient operation of drives, block diagram /transfer function of self, separately excited DC motors --closed loop control-speed control current control - constant torque/power operation - P, PI and PID controllers--response Comparison.

UNIT - II CONTROL OF INDUCTION MOTOR DRIVE 9

VSI and CSI fed induction motor drives-principles of V/f control-closed loop variable frequency PWM inverter with dynamic braking- static Scherbius drives- power factor considerations-- modified Kramer drives-principle of vector control- implementation-block diagram, Design of closed loop operation of V/f control of Induction motor drive systems.

UNIT - III CONTROL OF SYNCHRONOUS MOTOR DRIVES 9

Open loop VSI fed drive and its characteristics--Self-control--Torque control --Torque angle Control --Power factor control--Brushless excitation systems--Field oriented control --Design of closed loop operation of Self-control of Synchronous motor drive systems.

UNIT - IV CONTROL OF SRM AND BLDC MOTOR DRIVES 9

SRM construction - Principle of operation - SRM drive design factors-Torque controlled SRM- Block diagram of Instantaneous Torque control using current controllers and flux Controllers. Construction and Principle of operation of BLDC Machine -Sensing and logic switching scheme,-Sinusoidal and trapezoidal type of Brushless dc motors -- Block diagram of current controlled Brushless dc motor drive.

UNIT - V DIGITAL CONTROL OF DC DRIVE 9

Phase Locked Loop and micro-computer control of DC drives--Program flow chart for constant constant torque and constant horse power operations Speed detection and current sensing circuits and feedback elements.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Gopal K.Dubey, Fundamentals of Electrical Drives, Narosa Publishing House, Second Edition, 2015.
2. Krishnan R., " Electric Motor & Drives: Modelling, Analysis and Control", Pearson Education, 2015

REFERENCES:

1. Bin Wu, High-Power Converters and AC Drives, Wiley-IEEE Press
2. Bimal K Bose, "Modern Power Electronics and AC Drives" Pearson Education, 2016.
3. R. Krishnan, Switched Reluctance Motor Drives: Modeling, Simulation, Analysis, Design, and Applications, CRC press, 2001.
4. Werner Leonhard, Control of Electrical Drives, 3rd Edition, Springer, Sept., 2001.
5. R. Krishnan, Permanent Magnet Synchronous and Brushless DC Motor Drives, CRC press, 2001.
6. Murphy, J.M.D, Turnbull F.G, Thyristor control of AC motors, Pergamon press, Oxford, 1988

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : ELECTRICAL DRIVES AND CONTROL FOR AUTOMATION										Course Code : 20OE208					
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO 1	Explain the various control strategies and controllers for DC Motor Drive systems.										I	K2	1,2	1	
CO 2	Discuss the various control strategies and controllers for Induction Motor Drive systems and develop the closed loop operation of V/f control of Induction motor drive systems.										II	K2	1,2	1	
CO 3	Describe the various control strategies and controllers for Synchronous Motor Drive systems.										III	K2	1,2	1	
CO 4	Explain the various control strategies and controllers for SRM Motor Drive systems.										IV	K2	1,2	1	
CO 5	Discuss the various control strategies and controllers for BLDC Motor Drive systems.										IV	K2	1,2	1	
CO 6	Explain the various Digital control for DC Motor Drive systems.										V	K2	1,2	1	
CO-PO mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	1	-	
CO 2	2	1	-	-	-	-	-	-	-	-	-	-	1	-	
CO 3	2	1	-	-	-	-	-	-	-	-	-	-	1	-	
CO 4	2	1	-	-	-	-	-	-	-	-	-	-	1	-	
CO 5	2	1	-	-	-	-	-	-	-	-	-	-	1	-	
CO 6	2	1	-	-	-	-	-	-	-	-	-	-	1	-	

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Fundamentals of Communication Engineering		Course Code : 20OE301													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO 1	Explain the concepts of analog modulation techniques.	1	K2	1,2,8,9											
CO 2	Explain the concepts of pulse modulation techniques.	2	K2	1,2,8,9											
CO 3	Explain the concepts of digital modulation techniques.	3	K2	1,2,8,9											
CO 4	Apply various source-coding techniques to compute efficiency of the code.	4	K3	1,2,3,8,9											
CO 5	Apply various error control coding techniques to identify/correct errors.	4	K3	1,2,3,8,9											
CO 6	Explain the concepts of spread spectrum and multiple access techniques.	5	K2	1,2,8,9											
CO-PO Mapping															
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1						2	2						
CO 2	2	1						2	2						
CO 3	2	1						2	2						
CO 4	3	2	1					2	2						
CO 5	3	2	1					2	2						
CO 6	2	1						2	2						

20OE302	MICROPROCESSOR AND EMBEDDED SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the Architecture of 8086 microprocessor.
- To learn the design aspects of I/O and Memory Interfacing circuits.
- To interface microprocessors with peripherals.
- To understand the concepts of embedded system design and analysis.
- To learn the architecture and programming of ARM processor.

PRE-REQUISITE: NIL

UNIT - I THE 8086 MICROPROCESSOR 9

Introduction to 8086 - Microprocessor architecture - Addressing modes - Instruction set and assembler directives - Assembly language programming - Modular Programming - Linking and Relocation - Stacks - Procedures - Macros - Interrupts and interrupt service routines - Byte and String Manipulation.

UNIT - II 8086 SYSTEM BUS STRUCTURE 9

8086 signals - Basic configurations - System bus timing - System design using 8086 - I/O programming - Introduction to Multiprogramming - System Bus Structure - Multiprocessor configurations - Coprocessor - Closely coupled and loosely Coupled configurations - Introduction to advanced processors.

UNIT - III I/O INTERFACING 9

Memory Interfacing and I/O interfacing - Parallel communication interface - Serial communication interface - D/A and A/D Interface - Timer - Keyboard/display controller - Interrupt controller - DMA controller - Programming and applications Case studies: Traffic Light control, LED display and Alarm Controller.

UNIT - IV INTRODUCTION TO EMBEDDED SYSTEM DESIGN 9

Complex systems and microprocessors - Embedded system design process - Design example: Model train controller - Design methodologies - Design flows - Requirement Analysis - Specifications - System analysis and architecture design - Quality Assurance techniques - Designing with computing platforms - consumer electronics architecture - platform-level performance analysis.

UNIT - V ARM PROCESSOR AND PERIPHERALS 9

ARM Architecture Versions - ARM Architecture - Instruction Set - Stacks and Subroutines - Features of the LPC 214X Family - Peripherals - The Timer Unit - Pulse Width Modulation Unit - UART - Block Diagram of ARM 9 and ARM Cortex M3 MCU.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Yu-Cheng Liu and Glenn A.Gibson, "Microcomputer Systems: The 8086 / 8088 Family - Architecture, Programming and Design", Prentice Hall of India, Second Edition, 2007.
2. Marilyn Wolf, "Computers as Components: Principles of Embedded Computing System Design", Morgan Kaufmann Publisher, Third Edition, 2012.

REFERENCES:

1. M.Senthilkumar, M.Saravanan and S.Jeevananthan, "Microprocessors and Microcontrollers", Oxford University Press 2013.
2. D.V.Hall, "Microprocessors and Interfacing: Programming and Hardware", Tata McGraw Hill, 2012.
3. A.K.Ray and K.M.Bhurchandi, "Advanced Microprocessors and Peripherals: Architectures, Programming and Interfacing", Tata McGraw Hill, Second Edition, 2006.
4. Lyla B. Das, "Embedded Systems: An Integrated Approach", Pearson Education, 2013.
5. K.V.Shibu, "Introduction to Embedded Systems", Tata Mc Graw Hill, Second Edition 2017.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Microprocessor and Embedded Systems		Course Code : 20OE302													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO 1	Explain the architecture of 8086 and its addressing modes.	1	K2	1, 2, 8, 9											
CO 2	Construct 8086 Assembly language Programs.	2	K3	1, 2, 3, 8, 9											
CO 3	Illustrate I/O and Memory interfacing circuits.	3	K3	1, 2, 3, 8, 9											
CO 4	Build the Interfacing of microprocessors with various input output devices.	3	K3	1, 2, 3, 8, 9											
CO 5	Explain the concepts of embedded system design.	4	K2	1, 2, 8, 9											
CO 6	Explain the architecture of ARM processor.	5	K2	1, 2, 8, 9											
CO-PO Mapping															
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3
CO 1	2	1						2	2						
CO 2	3	2	1					2	2						
CO 3	3	2	1					2	2						
CO 4	3	2	1					2	2						
CO 5	2	1						2	2						
CO 6	2	1						2	2						

200E303	FUNDAMENTALS OF WIRELESS COMMUNICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various wireless communication system.
- To understand the design of a cellular system.
- To study the various digital signaling techniques.
- To study the various multipath mitigation techniques.
- To understand the concepts of multiple antenna techniques.

PRE-REQUISITE: NIL

UNIT - I WIRELESS CHANNELS 9

Evolution of mobile Radio communication networks – Examples of wireless communication systems - Cellular network components - Setting up a call process - Trends in cellular communications: Second Generation networks – Third Generation networks - fourth generation

UNIT - II CELLULAR CONCEPTS 9

Cellular concept - Frequency reuse - channel assignment – hand off Strategies-practical handoff considerations - interference – co channel interference - adjust channel interference - system capacity - Coverage and capacity improvement.

UNIT - III DIGITAL SIGNALLING FOR FADING CHANNELS 9

Linear modulation techniques: binary PSK, DPSK, QPSK - Transmission ,detection - Principles of Offset QPSK- $\pi/4$ QPSK - Constant Envelop Modulation - Minimum Shift Keying - Gaussian Minimum Shift Keying.

UNIT - IV MULTIPATH MITIGATION TECHNIQUES 9

Equalization - Linear and Non-Linear equalization - Adaptive equalization - Zero forcing and LMS Algorithms. Diversity - Micro and Macro diversity - Diversity combining techniques - Rake receiver.

UNIT - V MULTIPLE ANTENNA TECHNIQUES 9

MIMO systems - spatial multiplexing - System model - Transmitter Precoding - Beam forming - transmitter diversity - receiver diversity.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. T.S.Rappaport, “Wireless communications”, Pearson Education, Second Edition, 2010.
2. Andreas.F. Molisch, “Wireless Communications”, John Wiley India, 2006.

REFERENCES:

1. Andrea Goldsmith, “Wireless Communication”, Cambridge University Press, 2011.
2. R.Van Nee and Ramji Prasad, “OFDM for wireless multimedia communications”, Artech House, 2000.
3. David Tse and Pramod Viswanath, “Fundamentals of Wireless Communication”, Cambridge University Press, 2005.
4. Upena Dalal, “Wireless Communication”, Oxford University Press, 2009.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Fundamentals of Wireless Communication										Course Code : 20OE303					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO 1	Explain cellular network evolutions.									1	K2	1, 2, 8, 9			
CO 2	Explain cellular system based concepts.									2	K2	1, 2, 8, 9			
CO 3	Identify suitable modulation signaling.									3	K3	1, 2, 3, 8, 9			
CO 4	Explain the equalization concept for wireless channel.									4	K2	1, 2, 8, 9			
CO 5	Describe the various diversity techniques to mitigate multipath effect in the wireless channel.									4	K2	1, 2, 8, 9			
CO 6	Explain the multiple antenna techniques.									5	K2	1, 2, 8, 9			
CO-PO Mapping															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1						2	2						
CO 2	2	1						2	2						
CO 3	3	2	1					2	2						
CO 4	2	1						2	2						
CO 5	2	1						2	2						
CO 6	2	1						2	2						

OBJECTIVES:

- To understand the basics of satellite orbits.
- To analyze the geo stationary and non geo stationary orbits.
- To acquire the knowledge about launching procedures.
- To study the satellite system engineering, orbital mechanism and effects.
- To study and analysis of multiplexing and multiple access techniques.
- To study and analysis of earth station antenna and equipment.

PRE-REQUISITE: NIL**UNIT - I SATELLITE ORBITS****9**

Kepler's Laws - Newton's law - orbital parameters - orbital perturbations - station keeping - geo-stationary and non geo-stationary orbits - Look Angle Determination - Limits of visibility – eclipse - Sub satellite point - Sun transit outage - Launching Procedures - launch vehicles and propulsion.

UNIT - II SPACE SEGMENT**9**

Spacecraft Technology: Structure, Primary power, Attitude and Orbit control - Thermal control and Propulsion - communication Payload and supporting subsystems - Telemetry - Tracking and command - Transponders - The Antenna Subsystem.

UNIT - III SATELLITE LINK DESIGN**9**

Basic link analysis - Link budget calculations - Uplink and Downlink of a satellite link - Atmospheric Losses Interference analysis - Rain induced attenuation and interference - Ionospheric characteristics - Effects - Link Design with and without frequency reuse.

UNIT - IV SATELLITE ACCESS AND CODING METHODS**9**

Modulation and Multiplexing: Voice, Data, Video - Analog and digital transmission system - Digital video Broadcast - Multiple access: FDMA, TDMA, CDMA, DAMA Assignment Methods - compression - encryption.

UNIT - V SATELLITE APPLICATIONS**9**

INTELSAT Series: INSAT, VSAT. - Mobile satellite services: GSM, GPS, INMARSAT, LEO, MEO, Satellite Navigational System. GPS Position Location Principles - Direct Broadcast satellites (DBS/DTH) - Indian Regional Navigation Satellite System (IRNSS).

TOTAL: 45 PERIODS**TEXT BOOKS:**

1. Dennis Roddy, "Satellite Communication", Mc Graw Hill International, Fourth Edition, 2006.
2. Timothy Pratt, Charles W. Bostain and Jeremy E. Allnutt, "Satellite Communication", John Wiley & Sons, Second Edition, 2003.

REFERENCES:

1. Wilbur L. Pritchard, Hendri G. Suyderhoud and Robert A. Nelson, "Satellite Communication Systems Engineering", Prentice Hall/Pearson, 2007.
2. N.Agarwal, "Design of Geosynchronous Space Craft", Prentice Hall, 1986.
3. Bruce R. Elbert, "The Satellite Communication Applications", Hand Book, Artech House Boston, London, 1997.
4. Tri T. Ha, "Digital Satellite Communication", McGraw-Hill Communications Series, Second Edition, 1990.
5. M.Richharia, "Satellite Communication Systems: Design Principles", Mac Millan, 2003.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Satellite Communication Systems								Course Code : 20OE304							
CO	Course Outcomes							Unit	K-CO	POs	PSOs				
CO 1	Elaborate the Extended and reusable satellite launching vehicles and launching procedures of satellite systems.							1	K4	1,2,3,4,8,9					
CO 2	Describe about the satellite space segment with various satellite subsystems.							2	K2	1,2,8,9					
CO 3	Illustrate the satellite Link design with uplink, downlink, rain effects and Ionospheric characteristics.							3	K2	1,2,8,9					
CO 4	Apply accessing schemes such as TDMA, FDMA and CDMA for satellite communication.							4	K3	1,2,3,8,9					
CO 5	Summarize various satellite applications such as Intelsat series and Mobile satellite services.							5	K2	1,2,8,9					
CO 6	Discuss the LEO, MEO and GEO orbits of satellite and orbital parameters.							5	K2	1,2,8,9					
CO-PO Mapping															
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	3	3	2	1				2	2						
CO 2	2	1						2	2						
CO 3	2	1						2	2						
CO 4	3	2	1					2	2						
CO 5	2	1						2	2						
CO 6	2	1						2	2						

20OE305	FUNDAMENTALS OF IMAGE PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To get exposed to simple image enhancement techniques in Spatial and Frequency domain.
- To learn concepts of degradation function and restoration techniques.
- To study the image segmentation and representation techniques.
- To become familiar with image compression methods.

PRE-REQUISITE: NIL

UNIT - I DIGITAL IMAGE FUNDAMENTALS 9

Steps in Digital Image Processing - Elements of Visual Perception - Image Sensing and Acquisition - Image Sampling and Quantization - Relationships between pixels - Color image fundamentals - RGB, HSI models, Two-dimensional mathematical preliminaries, 2D transforms - DFT, DCT.

UNIT - II IMAGE ENHANCEMENT 9

Spatial Domain: Gray level transformations - Histogram processing - Basics of Spatial Filtering - Smoothing and Sharpening Spatial Filtering, Frequency Domain: Introduction to Fourier Transform - Smoothing and Sharpening frequency domain filters - Ideal, Butterworth and Gaussian filters, Homomorphic filtering.

UNIT - III IMAGE RESTORATION 9

Image Restoration - degradation model, Properties, Noise models - Mean Filters - Order Statistics - Adaptive filters - Band reject Filters - Band pass Filters - Notch Filters - Optimum Notch Filtering - Inverse Filtering - Wiener filtering.

UNIT - IV IMAGE SEGMENTATION 9

Edge detection, Edge linking via Hough transform – Thresholding - Region based segmentation – Region growing – Region splitting and merging – Morphological processing- erosion and dilation, Segmentation by morphological watersheds.

UNIT - V IMAGE COMPRESSION 9

Fundamentals of image compression - Compression methods - Huffman Coding, Arithmetic Coding, LZW Coding, Run-Length coding, Symbol-Based Coding, Bit-Plane Coding, Block Transform Coding, Predictive Coding, Wavelet Coding.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Rafael C. Gonzalez and Richard E. Woods, “Digital Image Processing”, Pearson, Third Edition, 2010.
2. Anil K. Jain, “Fundamentals of Digital Image Processing”, Pearson, 2002.

REFERENCES:

1. Kenneth R. Castleman, “Digital Image Processing”, Pearson, 2006.
2. Rafael C. Gonzalez, Richard E. Woods and Steven Eddins, “Digital Image Processing using MATLAB”, Pearson Education, Inc., 2011.
3. D.E. Dudgeon and R.M. Mersereau, “Multidimensional Digital Signal Processing”, Prentice Hall Professional Technical Reference, 1990.
4. William K. Pratt, “Digital Image Processing”, John Wiley, New York, 2002.
5. Milan Sonka, “Image processing, analysis and machine vision”, Brookes/Cole, Vikas Publishing House, Second Edition, 1999.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Fundamentals of Image Processing		Course Code : 20OE305													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO 1	Explain the fundamentals of digital image processing techniques.	1	K2	1,2,8,10											
CO 2	Apply the various transforms and its properties for 2D signals.	2	K3	1,2,3,8,10											
CO 3	Describe the various image enhancement technique used in digital image processing.	2	K2	1,2,8,9,10											
CO 4	Apply the various filters for image restoration.	3	K3	1,2,3,8,10											
CO 5	Examine feature extraction methods for segmentation.	4	K3	1,2,3,8,10											
CO 6	Apply the different coding methods for image compression.	5	K3	1,2,3,8,10											
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1						2		2					
CO2	3	2	1					2		2					
CO3	2	1						2	2	2					
CO4	3	2	1					2		2					
CO5	3	2	1					2		2					
CO6	3	2	1					2		2					

20OE306

CONSUMER ELECTRONICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To give students an in depth knowledge of various electronic audio and video devices and systems.
- To introduce the consumer electronic gadgets/goods/devices like audio-systems, CD systems.
- To give organization structure and principles of working of various other components like visual display, keyboard drives and printers.
- To find employment in computer industry, repair and maintenance field.

PRE-REQUISITE: NIL

UNIT - I AUDIO SYSTEMS 9

Microphones, their types: Carbon, velocity, crystal, condenser, cordless etc. Loud Speaker: Direct radiating, horn loaded woofer, tweeter, mid-range, multi-speaker system, baffles and enclosures. Sound recording on magnetic tape, its principles, block diagram and tape transport mechanism, Digital sound recording on tape and disc, CD system, Hi- Fi system, pre-amplifier, amplifier and equalizer system, stereo amplifiers, public address systems, Graphics Equalizer, speed Synthesizer, Electronic tuning.

UNIT - II VIDEO SYSTEMS 9

B&W TV, color TV and HD TV systems, LCD, LED, PLASMA Systems, Electronic cameras, VCR, VCP, CD systems, Memory diskettes, Discs and drums. Dolby noise reduction digital and analog recording. Digital projection systems (LCD, DLP, SVGA to UXGA system) Block diagram and principles of working of cable TV and DTH, cable TV using internet.

UNIT - III COMPUTER SYSTEM 9

Different types of mother boards - Single Board Based System - Different types of Buses PCI, ISA, SCSI & Serial and Parallel Ports, USB - Hard Disk Device (HDD) - Computer Monitor - Video Display Adopters - Keyboard - Mouse - Scanner - Printer - digitizer.

UNIT - IV MOBILE PHONE 9

Architecture - Connectivity - RF Transceiver - Antennas - Tx/Rx switch - Baseband part - System-on-chip - ADC/DAC - Memory and storage - Camera - Sensors - Operating system - Microphone and Speaker - Display and Keypad - Battery.

UNIT - V HOUSEHOLD APPLIANCES 9

Microwaves: Microwave Oven Block Diagram, LCD Timer with Alarm, Types of Microwave Ovens Washing Machines: Electronic controller for Washing Machines, Washing Machine Hardware, Air Conditioning: Components of Air Conditioning Systems, Remote Control-buttons, Unitary and Central Air Conditioning Systems, Split Air Conditioners. Refrigeration: Refrigerants, Refrigeration Systems, Dish Washers.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jim Ledin, "Modern Computer Architecture and Organization: Learn x86, ARM, and RISC-V architectures and the design of Smartphones, PCs, and cloud servers", Packt Publishing, Illustrated Edition, 2020.
2. S.P.Bali, "Consumer Electronics", Pearson Education, 2007.

REFERENCES:

1. R.G. Gupta, "Audio and Video Systems: Principles, Maintenance and Troubleshooting", McGraw Hill Education, Second Edition, 2017.
2. Jacob Beckerman, "How to Build a Computer: Learn, Select Parts, Assemble, and Install: A Step by Step Guide to Your First Homebuilt", JIBB Publishing, First Edition, 2014.
3. R.R. Gulati, "Modern Television Practice: Transmission, Reception and Applications", New Age International Private Limited, 2015.
4. Nick Vandome, "Android Phones for Seniors in easy steps: Updated for Android v7 Nougat", In Easy Steps Limited, Second Edition, 2019.
5. Sajid Umair and Muhammad Yousaf Shah, "Mobile Devices and Smart Gadgets in Human Rights", IGI Global, 2018.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Consumer Electronics		Course Code : 20OE306													
CO	Course Outcomes											Unit	K-CO	POs	PSOs
CO 1	Describe the various audio system components and its functionalities.											1	K2	1,2,8,10	
CO 2	Explain the concepts and techniques employed in the construction of televisions.											2	K2	1,2,8,10	
CO 3	Analyse the construction of personal computers.											3	K3	1,2,3,8,10	
CO 4	Illustrate the various blocks and components used in the construction of mobile phones.											4	K2	1,2,8,10	
CO 5	Explain the various systems used in the residence.											5	K2	1,2,8,9,10	
CO 6	Analyse the commonly used consumer electronic gadgets used in our residences.											5	K3	1,2,3,8,10	
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1						2		2					
CO2	2	1						2		2					
CO3	3	2	1					2		2					
CO4	2	1						2		2					
CO5	2	1						2	2	2					
CO6	3	2	1					2		2					

20OE307	FUNDAMENTALS OF DIGITAL SIGNAL PROCESSING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of discrete time systems.
- To learn Discrete Fourier Transform, its properties and its application to linear filtering.
- To understand the characteristics of digital filters, design of FIR and IIR filters and its realization.
- To understand the effects of finite precision representation on digital filters.

PRE-REQUISITE: NIL

UNIT - I DISCRETE TIME SYSTEM ANALYSIS 9

Classification of discrete time systems - linear, causal, stability, time invariance, dynamic, recursive and non-recursive, Sampling, Nyquist rate, Aliasing effect, Quantization and its error - Discrete Time Fourier Transform, magnitude and phase representation.

UNIT - II DISCRETE FOURIER TRANSFORM 9

Frequency - Domain sampling: The Discrete Fourier Transform - Properties of DFT - Linear filtering methods based on the DFT - Efficient computation of the DFT: FFT algorithms: radix 2 FFT algorithms.

UNIT - III FINITE IMPULSE RESPONSE FILTERS 9

Characteristics of practical frequency selective filters - Design of FIR filters: symmetric and Anti-symmetric FIR filters - Design of linear phase FIR filters using windows (Rectangular, Hamming and Hanning window), Frequency sampling method. Structures for FIR systems - linear phase structure, direct form realizations.

UNIT - IV INFINITE IMPULSE RESPONSE FILTERS 9

Characteristics of commonly used analog filters - Butterworth filters, Chebyshev filters. Design of IIR filters from analog filters: Impulse invariance method, Bilinear transformation. Structure of IIR systems - Direct form structures, Cascade and parallel structures.

UNIT - V FINITE WORD LENGTH EFFECTS 9

Representation of Numbers - Quantization of filter coefficients - Round-off effects in Digital filters: Limit cycle oscillations in recursive systems - scaling to prevent overflow.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John G. Proakis and Dimitris G. Manolakis, "Digital Signal Processing – Principles, Algorithms & Applications", Pearson Education / Prentics Hall, Fourth Edition, 2016.
2. Sanjay K. Mitra, "Digital Signal Processing: A Computer based approach", Tata McGraw Hill, Fourth Edition, 2017.

REFERENCES:

1. Emmanuel C. Fleachor and Barrie W. Jervis, "Digital Signal Processing", Fourth Edition, Pearson Education / Prentice Hall, 2007.
2. Vinay K. Ingle and John G. Proakis, "Digital Signal Processing using MATLAB", Cengage Learning Custom Publications, Third Edition, 2011.
3. A.V. Oppenheim, R.W. Schafer and J.R. Buck, "Discrete – Time Signal Processing", Indian Reprint, Pearson, Twenty Eight Edition, 2004.
4. Andreas Antoniou, "Digital Signal Processing", Tata McGraw Hill, 2006.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : Fundamentals of Digital Signal Processing		Course Code : 20OE307													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO 1	Classify the discrete time systems and its frequency response.	1	K3	1,2,3,8,10											
CO 2	Compute DFT and IDFT coefficients of a discrete time sequences using FFT algorithms and output of the discrete time system.	2	K3	1,2,3,8,10											
CO 3	Determine the transfer function of FIR digital filters.	3	K3	1,2,3,8,10											
CO 4	Determine the transfer function of IIR digital filters.	4	K3	1,2,3,8,10											
CO 5	Construct the realization structures for digital filters.	4	K3	1,2,3,8,10											
CO 6	Explain the fundamental concepts of number representation, quantization errors and limit cycle oscillations.	5	K2	1,2,8,9,10											
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1					2		2					
CO2	3	2	1					2		2					
CO3	3	2	1					2		2					
CO4	3	2	1					2		2					
CO5	3	2	1					2		2					
CO6	2	1						2	2	2					

20OE308	INTRODUCTION TO VLSI TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the VLSI era.
- To introduce the fundamental concepts relevant to VLSI fabrication.
- To enable the students to understand the various VLSI fabrication technique.

PRE-REQUISITE: NIL

UNIT - I **9**
LOGIC DESIGN WITH MOSFETS

Ideal Switches and Boolean Operations - MOSFETs as Switches- Basic Logic Gates in CMOS - Complex Logic Gates in CMOS - Transmission Gate Circuits - Clocking and Dataflow Control.

UNIT - II **9**
PHYSICAL STRUCTURE OF CMOS INTEGRATED CIRCUITS

Integrated Circuit Layers - Interconnect Resistance and capacitance – MOSFETs - Electrical Conduction in silicon - nFETs and pFETs - Current flow in a FET - driving the gate capacitance - CMOS Layers - Designing FET Arrays.

UNIT - III **9**
FABRICATION OF CMOS INTEGRATED CIRCUITS

Overview of Silicon Processing - Material Growth and Deposition - Silicon dioxide - Silicon Nitride - polycrystal silicon – metals - doped silicon layers - chemical mechanical polishing – Lithography - The CMOS Process Flow - Design Rules.

UNIT - IV **9**
ELECTRICAL CHARACTERISTICS OF MOSFETS

MOS Physics - derivation of threshold voltage - nFET Current - Voltage Equations - SPICE level 1 equation - body bias effects - derivation of the current flow equation - The FET RC Model - pFET Characteristics - Modeling of Small MOSFET.

UNIT - V **9**
ELECTRONIC ANALYSIS OF CMOS LOGIC GATES

DC Characteristics of the CMOS Inverter - Inverter Switching Characteristics - Power Dissipation - DC Characteristics: NAND and NOR Gates - NAND and NOR Transient Response - Analysis of Complex Logic Gates - Gate Design for Transient Performance - Transmission Gates and Pass Transistors.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John P. Uyemura, "Introduction to VLSI Circuits and Systems", John Wiley & Sons, 2001.
2. S.K. Gandhi, "VLSI Fabrication Principles", John Wiley & Sons, Second Edition, 2008.

REFERENCES:

1. Kamran Eshraghian, Douglas A. Pucknell and Sholeh Eshraghian, "Essentials of VLSI Circuits and Systems", PHI, 2005.
2. Neil H.E. Weste and K. Eshraghian, "Principles of CMOS VLSI Design: A System Perspective", McGraw Hill, 2010.
3. Sung-Mo Kang, Yusuf Lalebici and Chulwookim, "CMOS Digital Integrated Circuits, Analysis and Design", McGraw Hill, Fourth Edition, 2019.
4. Partha Pratim Sahu, "VLSI Design", McGraw Hill, 2013.
5. Neil H.E. Weste, "CMOS VLSI Design: A Circuit and System Perspective", Pearson Education, 2011.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Introduction to VLSI Technology										Course Code : 200E308					
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO 1	Explain the introduction of MOSFET as simple logic controlled switches and then concentrate on the design of CMOS static logic gates at the Boolean level.										1	K2	1,2,8,10		
CO 2	Generalize the views of an integrated circuit as a set of patterned material layers that are used to control the flow of signals.										2	K3	1,2,3,8,10		
CO 3	Discuss the switch level description down to the physical level.										2	K2	1,2,8,10		
CO 4	Discuss the general and specific aspects of the manufacturing process of CMOS.										3	K2	1,2,8,10		
CO 5	Derive the equations for RC switching model based on the square law equation.										4	K3	1,2,3,8,9		
CO 6	Develop the electrical properties of CMOS logic circuits.										5	K3	1,2,3,8,9,10		
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1						2		2					
CO2	3	2	1					2		2					
CO3	2	1						2		2					
CO4	2	1						2		2					
CO5	3	2	1					2		2					
CO6	3	2	1					2	2	2					

20OE401	FUNDAMENTALS OF ARTIFICIAL INTELLIGENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the various characteristics of Intelligent agents
- To learn the different search strategies in AI
- To learn to represent knowledge in solving AI problems
- To understand the different ways of designing software agents
- To know about the various applications of AI

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents– Typical Intelligent Agents – Problem Solving Approach to Typical AI problems.

UNIT-II PROBLEM SOLVING METHODS 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations - Constraint Satisfaction Problems – Constraint Propagation - Backtracking Search - Game Playing – Optimal Decisions in Games – Alpha - Beta Pruning - Stochastic Games.

UNIT - III KNOWLEDGE REPRESENTATION 9

First Order Predicate Logic– Unification – Forward Chaining-Backward Chaining – Resolution – Knowledge Representation - Ontological Engineering-Categories and Objects – Events - Mental Events and Mental Objects - Reasoning Systems for Categories - Reasoning with Default Information.

UNIT - IV SOFTWARE AGENTS 9

Architecture for Intelligent Agents – Agent communication – Negotiation and Bargaining – Argumentation among Agents – Trust and Reputation in Multi-agent systems.

UNIT - V APPLICATIONS 9

AI applications – Language Models – Information Retrieval- Information Extraction – Natural Language Processing - Machine Translation – Speech Recognition

TOTAL: 45 PERIODS

TEXT BOOKS:

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Third Edition, 2009.
2. I. Bratko, 'Prolog: Programming for Artificial Intelligence", Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.

REFERENCES:

1. M. Tim Jones, "Artificial Intelligence: A Systems Approach(Computer Science)", Jones and Bartlett Publishers, Inc., First Edition, 2008
2. Nils J. Nilsson, "The Quest for Artificial Intelligence", Cambridge University Press,2009.
3. William F. Clocksin and Christopher S. Mellish, "Programming in Prolog: Using the ISO Standard", Fifth Edition, Springer, 2003.
4. Gerhard Weiss, "Multi Agent Systems", Second Edition, MIT Press, 2013.
5. David L. Poole and Alan K. Mackworth, "Artificial Intelligence: Foundations of Computational Agents", Cambridge University Press, 2010.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Fundamentals of Artificial Intelligence										Course Code: 20OE401				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO 1	Explain the problem solving approaches to AI problems									1	K2	1,2,8,9,12	1,2	
CO 2	Apply appropriate search algorithms for any AI problems									2	K3	1,2,3,8,9,10	1,2	
CO 3	Solve a problem using first order and predicate logic									3	K3	1,2,3,8,9,10	1,2	
CO 4	Describe the concepts of software agents									4	K2	1,2,8,9	1,2	
CO 5	Discuss the software agents for solving AI problems									4	K2	1,2,8,9	1,2	
CO 6	Describe the applications for Natural Language Processing									5	K2	1,2,1,8,9,10,12	1,2	
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	-	-	-	-	-	1	1	-	-	1	2	2
CO 2	3	2	1	-	-	-	-	1	1	1	-	-	2	2
CO 3	3	2	1	-	-	-	-	1	1	1	-	-	2	2
CO 4	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO 5	2	1	-	-	-	-	-	1	1	-	-	-	2	2
CO 6	3	2	1	-	-	-	-	1	1	1	-	1	2	2

20OE402	INTRODUCTION TO DATABASE MANAGEMENT SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the fundamentals of data models and to depict a database system using ER diagrams
- To study relational database and to write SQL queries to store/retrieve data to/from database
- To understand the fundamental concepts of transaction processing- concurrency control techniques and recovery procedures for real time applications
- To understand working procedures of query processing and query optimization techniques
- To understand the internal storage structures using different file and indexing techniques which will help in physical DB design
- To study concepts of advanced databases

PRE-REQUISITE:NIL

UNIT-I DATABASE FUNDAMENTALS 8

Purpose of Database System – Views of data – Database System Architecture – Introduction to Data Models –Introduction to Relational Model – Constraints – keys – Entity Relationship Model – Entity Sets – Attributes - Extended E-R features – ER reduction to Relational Schemas.

UNIT-II RELATIONAL DATABASE 10

Structure of Relational Database –SQL Fundamentals – Basic Queries – Set Operations – Aggregate Functions – Clauses – Subqueries – Correlated Subqueries – Joins – Views – Authorization – Advanced SQL – Triggers – Cursors – Procedure – Functions – Embedded SQL – Dynamic SQL

UNIT - III 9

Need for Database Design – Functional Dependencies – Closure of Functional Dependencies – Attribute Closure – Dependency Preservation – Decomposition – Canonical Cover – First Normal Form – Second Normal Form – Third Normal Form – Second Normal Form – Third Normal Form – Boyce Codd Normal Form – Multivalued Dependencies - Fourth Normal Form – Join Dependencies – Fifth Normal Form.

UNIT - IV TRANSACTIONS 9

Transaction Concepts – ACID properties – Transaction States – Serializability – Conflict Serializability – View Serializability – Concurrency Control – Lock Based Protocols – Deadlocks – Time Based Protocols – Stamp Based Protocols – Validation Based Protocols – Recovery System,

UNIT - V STORAGE AND QUERY PROCESSING 9

RAID – File Organization – Organization of Records in Files – Indexing and Hashing – Ordered Indices – B+ tree Index Files – B tree Index Files – Static Hashing – Dynamic Hashing – Query Processing Overview – Algorithms for SELECT and JOIN operations.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Abraham Silberschatz, Henry F. Korth, S. Sudharshan, "Database System Concepts", Seventh Edition, Tata McGraw Hill, 2019.
2. Ramez Elmasri, Shamkant B. Navathe, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2016.

REFERENCES:

1. C.J.Date, A.Kannan, S.Swamynathan, "An Introduction to Database Systems", Eighth Edition, Pearson Education, 2006.
2. Raghu Ramakrishnan, "Database Management Systems", Fourth Edition, McGraw-Hill College Publications, 2015.
3. G.K.Gupta,"Database Management Systems", Tata McGraw Hill, 2011

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Introduction To Database Management Systems		Course Code: 20OE402												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO 1	Explain the fundamental elements of relative database management systems.	1	K2	1,2	1,2									
CO 2	Formulate SQL queries for the given relational tables.	2	K2	1,2,8,9,10	1,2									
CO 3	Apply normal forms to identify the redundancy in database tables.	3	K3	1,2,3,8,9,10	1,2									
CO 4	Explain various protocols in transaction processing.	4	K2	1,2,8,9,10,12	1,2									
CO 5	Discuss file organization in database storage system.	5	K2	1,2,8,9,10,12	1,2									
CO 6	Apply algorithms for SELECT and JOIN operations.	5	K3	1,2,3,8,9,10,12	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO 2	2	1	-	-	-	-	-	1	1	1	-	-	2	1
CO 3	3	2	1	-	-	-	-	1	1	1	-	-	2	1
CO 4	2	1	-	-	-	-	-	1	1	1	-	1	2	1
CO 5	2	1	-	-	-	-	-	1	1	1	-	1	2	1
CO 6	3	2	1	-	-	-	-	1	1	1	-	1	2	1

20OE403	COMPUTER COMMUNICATION NETWORKS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the protocol layering and physical level communication.
- To analyze the performance of a network.
- To understand the various components required to build different networks.
- To learn the functions of network layer and the various routing protocols.
- To familiarize the functions and protocols of the Transport layer.

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION AND PHYSICAL LAYER 9

Networks – Network Types – Classification of computer Networks LAN, WAN, MAN, Network Topology: BUS, STAR, RING, MESH- Protocol Layering – TCP/IP Protocol suite – OSI Model – Physical Layer: Performance – Transmission media – Switching – Circuit Switching, Packet Switching.

UNIT-II DATA-LINK & MEDIA ACCESS LAYER 9

Introduction – Link Layer Addressing – Framing, Physical Addressing, Flow control-noisy and noiseless channels, Error Control – Error detection and Error correction codes- Access control ALOHA,CSMA,CSMA/CD,TDMA,FDMA- Ethernet - Wireless LANs -IEEE 802.11, Bluetooth – Connecting Devices.

UNIT - III NETWORK LAYER 9

Network Layer Services – Performance – Logical Addressing- IPV4,IPV6- Network Layer Protocols- IP, ICMP,IGMP – Unicast Routing Algorithms - Distance Vector, Link state algorithms, Multicasting Basics Routing.

UNIT - IV TRANSPORT LAYER 9

Introduction – Transport Layer Protocols-. TCP, UDP – Services – Port Numbers -Flow control-TCP congestion control, Congestion avoidance mechanisms, Quality of service.

UNIT - V APPLICATION LAYER 9

WWW and HTTP– FTP – Email –Telnet –SSH – DNS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Behrouz A. Forouzan, “Data Communications and Networking”, Fifth Edition TMH, 2013.
2. William Stallings, “Data and Computer Communications”, Tenth Edition, Pearson Education, 2013

REFERENCES:

1. Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers Inc., 2012.
2. Nader F. Mir, “Computer and Communication Networks”, Second Edition, Prentice Hall, 2014.
3. Ying-Dar Lin, Ren-Hung Hwang and Fred Baker, “Computer Networks: An Open Source Approach”, McGraw Hill Publisher, 2011.
4. James F. Kurose, Keith W. Ross, “Computer Networking, A Top-Down Approach Featuring the Internet”, Sixth Edition, Pearson Education, 2013.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Computer Communication Networks										Course Code: 20OE403				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain the basic concepts of communication networks									1	K2	1,2	1,2	
CO2	Apply the error detection and error correction methods for bit streams									2	K3	1,2,3,8,9,10	1,2	
CO3	Classify various media access control protocols techniques of communication networks									2	K2	1,2,8,9,10,12	1,2	
CO4	Utilize various types of routing techniques to forward packets									3	K2	1,2,8,9	1,2	
CO5	Illustrate the mechanisms involved in transport layer									4	K2	1,2,8,9,10	1,2	
CO6	Classify different application layer protocols									5	K2	1,2,8,9,10,12	1,2	
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	1
CO2	3	2	1	-	-	-	-	1	1	1	-	-	2	1
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	1
CO4	2	1	-	-	-	-	-	1	1	-	-	-	2	1
CO5	2	1	-	-	-	-	-	1	1	1	-	-	2	1
CO6	2	1	-	-	-	-	-	1	1	1	-	1	2	1

20OE404	CLOUD INFRASTRUCTURE AND TECHNOLOGIES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn about the concept of cloud and utility computing.
- To have knowledge on the various issues in cloud computing.
- To be familiar with the lead players in cloud.
- To appreciate the emergence of cloud as the next generation computing paradigm.

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO CLOUD COMPUTING 9

Introduction to Cloud Computing – Roots of Cloud Computing – Desired Features of Cloud Computing – Challenges and Risks – Benefits and Disadvantages of Cloud Computing.

UNIT-II VIRTUALIZATION 9

Introduction to Virtualization Technology – Load Balancing and Virtualization – Understanding Hypervisor – Seven Layers of Virtualization – Types of Virtualization – Server, Desktop, Application Virtualization.

UNIT - III CLOUD ARCHITECTURE, SERVICES AND STORAGE 9

NIST Cloud Computing Reference Architecture – Public, Private and Hybrid Clouds - IaaS – PaaS – SaaS – Architectural Design Challenges – Cloud Storage.

UNIT - IV RESOURCE MANAGEMENT AND SECURITY IN CLOUD 9

Inter Cloud Resource Management – Resource Provisioning Methods – Security Overview – Cloud Security Challenges – Data Security –Application Security – Virtual Machine Security.

UNIT - V CASE STUDIES 9

Google App Engine(GAE) – GAE Architecture – Functional Modules of GAE – Amazon Web Services(AWS) – GAE Applications – Cloud Software Environments – Eucalyptus – Open Nebula – Open Stack.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Buyya R., Broberg J., Goscinski A., “Cloud Computing: Principles and Paradigm”, First Edition, John Wiley & Sons, 2011.
2. Kai Hwang, Geoffrey C. Fox, Jack G. Dongarra, "Distributed and Cloud Computing, From Parallel Processing to the Internet of Things", Morgan Kaufmann Publishers, 2012.
3. Rittinghouse, John W., and James F. Ransome, “Cloud Computing: Implementation, Management, and Security”, CRC Press, 2017

REFERENCES:

1. Rajkumar Buyya, Christian Vecchiola, S. ThamaraiSelvi, “Mastering Cloud Computing”, Tata Mcgraw Hill, 2013.
2. Toby Velte, Anthony Velte, Robert Eisenpeter, "Cloud Computing - A Practical Approach", Tata Mcgraw Hill, 2009.
3. George Reese, "Cloud Application Architectures: Building Applications and Infrastructure in the Cloud: Transactional Systems for EC2 and Beyond (Theory in Practice)", O'Reilly, 2009.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : Cloud Infrastructure And Technologies		Course Code: 20OE404												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Explain the main concepts, key technologies, strengths and limitations of cloud computing.	1	K2	1,2	1,2									
CO2	Describe the key and enabling technologies that help in the development of cloud.	2	K2	1,2,8,9	1,2									
CO3	Discuss and use the architecture of compute and storage cloud with its service and delivery models.	3	K2	1,2,8,9	1,2									
CO4	Explain the core issues of cloud computing such as resource management and security.	4	K2	1,2,8,9,10,12	1,2									
CO5	Discuss the Cloud Environment using current cloud technologies	4	K2	1,2,8,9,10,12	1,2									
CO6	Illustrate the appropriate technologies, algorithms and approaches for implementation and use of cloud	5	K3	1,2,3,8,9,10,12	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	2
CO2	2	1	-	-	-	-	-	1	1		-	-	1	2
CO3	2	1	-	-	-	-	-	1	1		-	-	1	2
CO4	2	1	-	-	-	-	-	1	1	1	-	1	1	2
CO5	2	1	-	-	-	-	-	1	1	1	-	1	1	2
CO6	3	2	1	-	-	-	-	1	1	1	-	1	1	2

20OE405	MACHINE LEARNING TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide a broad survey of different machine learning approaches and techniques
- To understand the principles and concepts of machine learning
- To understand neural networks concepts
- To learn regression and reinforcement learning
- To develop programming skills that helps to build real world applications based on machine learning

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Introduction: Machine learning: What and why? - Types of Machine Learning - Supervised Learning -Unsupervised Learning - The Curse of dimensionality - Over and under fitting - Model selection - Error analysis and validation - Parametric vs. non-parametric models.

UNIT - II CLASSIFICATION 9

Types of Machine Learning - Supervised Learning - Classification models - Naïve Bayes Classifier – Decision trees - Support Vector Machines - KNN model - Dimensionality reduction - PCA.

UNIT - III CLUSTERING 9

Clustering approaches - Mean Shift clustering - Clustering data points and features - Bi-clustering - Multi-view clustering - K-Means clustering - K-medians clustering - Expectation Maximization (EM).

UNIT - IV REGRESSION 9

Linear models for regression - Ridge Regression - Bayesian linear regression - Logistic models for regression - Bayesian logistic Regression- Reinforcement Learning.

UNIT - V ARTIFICIAL NEURAL NETWORKS 9

Neural networks - Biological motivation for Neural Network - Neural network Representation - Perceptron – Feed forward networks - Multilayer Networks and Back Propagation Algorithms - Hidden layer representation – Application of neural network.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Kevin P. Murphy, “Machine Learning: A Probabilistic Perspective”, MIT Press, 2012.
2. Ethem Alpaydin, “Introduction to Machine Learning”, Second Edition, Prentice Hall of India, 2010.

REFERENCES

1. Laurene Fausett, “Fundamentals of Neural Networks, Architectures, Algorithms and Applications”, Pearson Education, 2008.
2. Tom Mitchell, “Machine Learning”, McGraw-Hill, 1997.
3. C. M. Bishop, “Pattern Recognition and Machine Learning”, Springer, 2007.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : MACHINE LEARNING TECHNIQUES						Course Code : 20OE405								
CO	Course Outcomes					Unit	K-CO	POs		PSOs				
CO1	Discuss the principles and concepts of machine learning and different approaches and techniques					1	K2	1, 2, 8, 9						
CO2	Illustrate different classification techniques for various data sets					2	K3	1,2,3,8,9, 12						
CO3	Utilize clustering approaches for implementing unsupervised learning on data sets					3	K3	1,2,3,8,9, 12						
CO4	Make use of regression models based on supervised learning for data prediction					4	K3	1,2,3,8,9, 12						
CO5	Build an appropriate neural network for learning features in a given data set					5	K3	1,2,3,5,6,8,9, 12						
CO6	Apply neural network for solving real world machine learning problems					5	K3	1,2,3,5,6,8,9, 12						
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-		
CO2	3	2	1	-	-	-	-	1	1	1	-	1		
CO3	3	2	1	-	-	-	-	1	1	1	-	1		
CO4	3	2	1	-	-	-	-	1	1	1	-	1		
CO5	3	2	1	-	1	1	-	1	1	1	-	1		
CO6	3	2	1	-	1	1	-	1	1	1	2	1		

20OE406

JAVA SCRIPT PROGRAMMING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand Definition, Evolution and Nature of JavaScript
- To understand the basics of Script Writing
- To Learn Java Script Names, Objects, and Methods
- To Create Dynamic Web Pages
- To understand the method of Adding Interactivity to a Web Page.

PRE-REQUISITE: NIL

UNIT - I JAVA SCRIPT BASICS 9

JAVA Script Basics: An introduction to JavaScript– Advantages & Limitations of Java Script. Syntax, Variables, Variable Naming Rules and JavaScript Data Types, Expressions and Operators, Flow Control

UNIT - II OBJECTS AND ARRAYS 9

Creating objects, Object Attributes, Serializing Object, Object Methods Represent Multiple values in Java Script, JavaScript DOM, Arrays: Creating Arrays, Array elements, Multi dimensional Arrays, Array Methods , Functions and Methods.

UNIT - III ADDING INTERACTIVITY TO A WEB PAGE 9

Controlling Script Flow, Storing Tasks within Functions, Using Conditional Statements for Decision Making, if Statements, if-else Conditional Statements, Using the Date Object, for Conditional Statements, while Conditional Statements, break and continue Statements, with Statements, Creating Functions in JavaScript, Declaring a Function, Designing a Simple Function.

UNIT - IV CLIENT SIDE JAVASCRIPT 9

Embedding Java Script in HTML, Execution of JS Program, Dialog boxes, Error Handling & Exceptions. Event Handling: Types of Events, Event Handlers, Document load Events, Mouse Events, Keyboard Events, Drag and Drop Events, Text Events.

UNIT - V JAVA SCRIPT VALIDATION 9

Working with Forms: Accessing the form element, The form object, Accessibility, Validation, Using form-based navigation, Form widgets in libraries and HTML5. Errors and Exceptions, Form Validation, Validation-Built-in objects-Event Handling, DHTML with JavaScript

TOTAL: 45 PERIODS

TEXT BOOKS:

1. David Flanagan JavaScript: The Definitive Guide, 6th Edition, O'Reilly, 2011
2. David Sawyer McFarland JavaScript & jQuery: The Missing Manual 3rd Edition, 2014

REFERENCES:

1. Marijn Haverbeke Eloquent JavaScript 3rd Edition, No Starch Press, 2018
2. Michael Moncur Teach yourself Java Script in 24 Hours SAMS Publication 2007

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : JAVA SCRIPTING		Course Code : 20OE406												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Summarize various java script components like data types, expressions, operators etc.	1	K2	1, 2, 8, 9										
CO2	Discuss the various JavaScript elements, methods, properties, functions and objects	2	K2	1, 2, 8, 9										
CO3	Apply appropriate user experience and interactive design concepts to custom websites	3	K3	1, 2, 3,8, 9,12										
CO4	Apply the event handling methods in client side scripting	4	K3	1, 2, 3,8, 9,12										
CO5	Develop interactive web pages using HTML5 and media tags.	5	K3	1, 2, 3, 5,8,9,12										
CO6	Demonstrate HTML5 integration with JavaScript scripting skills in a variety of student designed projects	5	K3	1,2,3,5,8,9, 10,11,12										
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	-		
CO2	2	1	-	-	-	-	-	1	1	1	-	-		
CO3	3	2	1	-	-	-	-	1	1	1	-	1		
CO4	3	2	1	-	-	-	-	1	1	1	-	1		
CO5	3	2	1	-	1	-	-	1	1	1	-	1		
CO6	3	2	1	-	1	-	-	1	1	2	2	1		

20OE407

COMPUTER GRAPHICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To Gain knowledge about graphics hardware devices and software used.
- To Understand the two dimensional graphics and their transformations.
- To Understand the three dimensional graphics and their transformations.
- Appreciate illumination and color models.
- Be familiar with understand animation techniques.

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Survey of computer graphics, Overview of graphics systems – Video display devices, Raster scan systems, Random scan systems, Graphics monitors and Workstations, Input devices, Hard copy Devices, Graphics Software; Output primitives – points and lines, line drawing algorithms, loading the frame buffer, line function; circle and ellipse generating algorithms.

UNIT - II TWO DIMENSIONAL GRAPHICS 9

Two dimensional geometric transformations – Matrix representations and homogeneous coordinates, composite transformations; Two dimensional viewing – viewing pipeline, viewing coordinate reference frame; widow-to-viewport coordinate transformation, Two dimensional viewing functions; clipping operations – point, line, and polygon clipping algorithms.

UNIT - III THREE DIMENSIONAL GRAPHICS 10

Three dimensional concepts; Three dimensional object representations – Polygon surfaces- Polygon tables- Plane equations - Polygon meshes; Curved Lines and surfaces, Quadratic surfaces; Blobby objects; Spline representations – Bezier curves and surfaces - B-Spline curves and surfaces. TRANSFORMATION AND VIEWING: Three dimensional geometric and modeling transformations – Translation, Rotation, Scaling, composite transformations; Three dimensional viewing – viewing pipeline, viewing coordinates, Projections, Clipping.

UNIT - IV ILLUMINATION AND COLOUR MODELS 8

Light sources - basic illumination models – halftone patterns and dithering techniques; Properties of light - Standard primaries and chromaticity diagram; Intuitive colour concepts - RGB colour model - YIQ colour model - CMY colour model - HSV colour model - HLS colour model; Colour selection.

UNIT - V ANIMATIONS & REALISM 9

Animation Graphics: Design of Animation sequences – animation function – raster animation –key frame systems – motion specification –morphing – tweening. Computer Graphics Realism: Tiling the plane – Recursively defined curves – Koch curves – C curves – Dragons – space filling curves – fractals – Grammar based models – fractals – turtle graphics – ray tracing.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John F. Hughes, Andries Van Dam, Morgan Mc Guire ,David F. Sklar , James D. Foley, StevenK. Feiner and Kurt Akeley, "Computer Graphics: Principles and Practice", 3rd Edition, Addison-Wesley Professional, 2013.
2. Donald Hearn and Pauline Baker M, "Computer Graphics", Prentice Hall, New Delhi, 2007

REFERENCES:

1. Donald Hearn and M. Pauline Baker, Warren Carithers,"Computer Graphics With Open GL",4th Edition, Pearson Education, 2010.
2. Jeffrey McConnell, "Computer Graphics: Theory into Practice", Jones and Bartlett Publishers, 2006.
3. Hill F S Jr., "Computer Graphics", Maxwell Macmillan", 1990.
4. Peter Shirley, Michael Ashikhmin, Michael Gleicher, Stephen R Marschner, Erik Reinhard, Kelvin Sung, and AK Peters, Fundamental of Computer Graphics, CRC Press, 2010.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : COMPUTER GRAPHICS							Course Code : 200E407							
CO	Course Outcomes						Unit	K-CO	POs			PSOs		
CO1	Explain the hardware devices and software used in graphics systems.						1	K2	1, 2, 8,9					
CO2	Apply two dimensional graphics and transformation						2	K3	1, 2, 3, 8,9					
CO3	Apply three dimensional graphics and transformation						3	K3	1, 2, 3, 8,9					
CO4	Demonstrate the clipping techniques to graphics.						2,3	K3	1, 2, 3,8,9					
CO5	Discuss about basic illumination and colour models.						4	K2	1, 2, 8,9					
CO6	Explain the animation sequences and various methods in graphics realism						5	K2	1, 2, 8,9					
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						1	1	1				
CO2	3	2	1					1	1	1				
CO3	3	2	1					1	1	1				
CO4	3	2	1					1	1	1				
CO5	2	1						1	1	1				
CO6	2	1						1	1	1				

20OE408

ESSENTIALS OF DATA ANALYTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the basic concepts of Data Analytic.
- To Handle missing data in the real world data sets by choosing appropriate methods
- To Learn data analysis methods
- To learn stream computing
- To Understand and apply Data Analysis Techniques
- To gain knowledge on Hadoop related tools

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION 9

Knowledge domains of Data Analysis, Understanding structured and unstructured data, data analytic tools, applications of data analytics.

UNIT – II DATA PREPROCESSING 9

Data Preprocessing : Data Cleaning –Data Integration - Data Reduction – Data Transformation – Handling Missing Data

UNIT – III CLASSIFICATION AND CLUSTERING 9

Mining Various Kinds of Association Rules – Correlation Analysis, Classification: SVM & Kernel Methods Cluster Analysis, Types of Data in Cluster Analysis, K means, Partitioning Methods, Hierarchical Methods, Density Based Methods, Clustering High Dimensional Data - Predictive Analytics.

UNIT - IV MINING DATA STREAMS 9

Streams: Concepts – Stream Data Model and Architecture - Sampling data in a stream - Mining Data Streams - Real Time Analytics Platform (RTAP) Applications. Case Study: Stock Market Predictions

UNIT - V DATA ANALYTICS USING R

Introduction to R Programming: data types in R - built-in functions - Data Manipulation: Data Cleaning, functions used in Data Inspection - Data Visualization: graphical functions, various graphs like tableplot, histogram, Boxplot

TOTAL: 45 PERIODS

TEXT BOOKS:

1. John Wiley & Sons-Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services (Editor), 2015
2. Craig K. Enders, “Applied Missing Data Analysis”, The Guilford Press, 2010.
3. Kun Ren, Learning R programming, Packt publishing, 2016

REFERENCES:

1. Michael Berthold, David J. Hand, Intelligent Data Analysis, Springer, Second Edition, 2007.
2. Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
3. Richard Cotton, "Learning R – A Step-by-step Function Guide to Data Analysis, ,O'Reilly Media, 2013.
4. Jiawei Han, Micheline Kamber and Jian Pei - Data Mining: Concepts and Techniques", Third Edition, ISBN 0123814790,

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : ESSENTIALS OF DATA ANALYTICS										Course Code : 20OE408				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain the basic concepts of Data Analytic.									1	K2	1, 2,8,9		
CO2	Describe the Data Analysis preprocessing Techniques.									2	K2	1, 2, 8,9		
CO3	Explain about how missing data will be handled during preprocessing.									2	K2	1, 2, 8,9		
CO4	Apply the Classification and Clustering algorithm for a given data set.									3	K3	1, 2,3,8,9		
CO5	Apply the different mining techniques for real time analytics applications.									4	K3	1, 2,3,8,9		
CO6	Explain the Hadoop related tools such as HBase, Cassandra, Pig, and Hive for big data analytics									5	K2	1, 2,5,8,9		
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						1	1					
CO2	2	1						1	1					
CO3	2	1						1	1					
CO4	3	2	1					1	1					
CO5	3	2	1					1	1					
CO6	2	1			2			1	1					

20OE501	PRINCIPLES OF SOFTWARE TESTING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce basic principles and practices of software testing.
- To explore various testing techniques along with concepts of software bugs and its impact.
- To write test plan and validate.
- To be familiar with test management process.
- To understand the need for and challenges in test automation and to develop testing scripts.

PRE-REQUISITE: NIL

UNIT I INTRODUCTION 9

Testing as an Engineering Activity –Software Testing Principles – The Tester’s Role in a Software Development Organization – Origins of Defects – Defect Classes – The Defect Repository and Test Design – Defect Examples – Developer/Tester Support for Developing a Defect Repository.

UNIT II TEST CASE DESIGN 9

Introduction to Testing Design Strategies – The Smarter Tester – Test Case Design Strategies – Using Black Box Approach to Test Case Design Random Testing – Boundary Value Analysis - Equivalence Class Partitioning state-based testing– cause effect graphing – error guessing – compatibility testing – user documentation testing – domain testing– Test Adequacy Criteria –static testing vs. structural testing – code functional testing

UNIT III LEVELS OF TESTING 9

The Need for Levels of Testing – Unit Test – Unit Test Planning –Designing the UnitTests. The Test Harness – Running the Unit tests and Recording results – Integration tests – Designing Integration Tests – Integration Test Planning – scenario testing – defect bash elimination -System Testing – types of system testing - Acceptance testing - performance testing - Regression Testing – internationalization testing – ad-hoc testing - Alpha – Beta Tests

UNIT IV TEST MANAGEMENT 9

People and organizational issues in testing – organization structures for testing teams –testing services - Test Planning – Test Plan Components – Test Plan Attachments – Locating Test Items – test management – test process - Reporting Test Results – The role of three groups in Test Planning and Policy Development – Introducing the test specialist – Skills needed by a test specialist – Building a Testing Group.

UNIT V CONTROLLING AND MONITORING 9

Software test automation – skills needed for automation – scope of automation – requirements for a test tool – challenges in automation - Test metrics and measurements – project, progress and productivity metrics – Status Meetings – Reports and Control Issues – Criteria for Test Completion – SCM – Types of reviews – Developing a review program – Components of Review Plans– Reporting Review Results. – evaluating software quality – defect prevention – testing maturity model

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Paul C. Jorgensen, —Software Testing: A Craftsman’s Approach, Fourth Edition, CRC Press,2013.
2. Srinivasan Desikan and Gopaldaswamy Ramesh, — Software Testing – Principles and Practices,Pearson education, 2006.
3. Aditya P.Mathur, —Foundations of Software Testing, Pearson Education,2008.

REFERENCES:

1. Boris Beizer, —Software Testing Techniques, Second Edition,Dreamtech, 2003
2. .Elfriede Dustin, —Effective Software Testing, First Edition, Pearson Education, 2003.
3. Renu Rajani, Pradeep Oak, —Software Testing – Effective Methods, Tools and Techniques, Tata McGraw Hill, 2004.

OUTCOMES:

On Completion of the course, the students should be able to:

Course Name : Principles of Software Testing											Course Code : 20OE501			
CO	Course Outcomes										Unit	K-CO	POs	PSOs
CO1	Describe the key techniques and processes involved in software testing.										1	K2	1,2,10	
CO2	Construct white-box and black-box test cases using test generation methods like cyclomatic complexity and Finite State Machines.										2	K2	1,2,12	
CO3	Determine adequacy for a given test suite using control flow, data flow, and program mutations										3	K2	1,2,10	
CO4	Describe different levels of testing and their significances										4	K2	1,2,12	2
CO5	Explain the test management activities like test planning, creating teams, generating reports, skills identification for test operations etc.										4	K2	1,2,10	
CO6	Explain the test metrics and need for automated testing										5	K2	1,2,12	2
CO PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	1								1				
CO 2	2	1										1		
CO 3	2	1								1				
CO 4	2	1										1		1
CO 5	2	1								1				
CO 6	2	1										1		1

200E502	FUNDAMENTALS OF WEB TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the technologies used in Web Programming
- To learn more about markup languages like HTML and XHTML
- List various tags in html and use these, apply Cascaded style sheet to create web page.
- To design and implement static and dynamic website
- To understand various web services and how these web services interact

PRE-REQUISITE: NIL

UNIT I WEB ESSENTIALS AND MARK-UP LANGUAGES 9

Web Essentials: Web browser architecture, The Internet, Basic Internet Protocols, The World Wide Web, HTTP request message-response message, Web Clients Web Servers

Mark-up Languages: An Introduction to HTML, History-Versions, Fundamental HTML Elements, Syntax and semantics, Basic Tags, Headers, Linking, List, Tables, Images, Forms, Frames, HTML5.0.

UNIT II CASCADING STYLE SHEETS 9

Introduction, Features-Core Syntax, Style Sheets and HTML, Style Rule- Inline Styles – Embedding Style Sheets - Linking External Style Sheets – Backgrounds – Cascading and Inheritance, Text Properties, Margins and Padding - Positioning using CSS -Box Model Normal Flow Box Layout, Beyond the Normal Flow, CSS3.0.

UNIT III JAVA SCRIPT 9

An introduction to JavaScript–JavaScript DOM Model-Date and Objects,-Regular Expressions-Exception Handling-Validation-Built-in objects-Event Handling- DHTML with JavaScript- JSON introduction – Syntax – Function Files – Http Request – SQL

UNIT IV PHP 9

PHP - Working principle of PHP - PHP Variables - Program control- Built-in functions- Constants - Operators–Flow Control and Looping - Arrays - Strings - Functions - File Handling - PHP and MySQL - PHP and HTML - Cookies - Simple PHP scripts.

UNIT V XML 9

XML-Benefits-Advantages of XML over HTML-XML based Standards-Documents and Vocabularies, Versions and Declaration, Namespaces, XML Schemas-DOM based XML processing, Event-oriented Parsing- SAX- Document using DOM, XML Formatters, CSSXSLT, XPath, XSLT,XQ,Displaying XML, Documents in Browsers, XML5.

TOTAL: 45 PERIODS

TEXT BOOK :

Jeffrey C. Jackson, "Web Technologies--A Computer Science Perspective", Pearson Education, Fourth Edition, 2008.

REFERENCES:

1. Robert. W. Sebesta, "Programming the World Wide Web", Fourth Edition,PearsonEducation, 2007.
2. Deitel, Deitel, Goldberg, "Internet & World Wide Web How To Program", Third Edition, Pearson Education, 2006.
3. Marty Hall and Larry Brown,Core Web Programming, Second Edition, Volume I and II, Pearson Education, 2001.
4. Bates, —Developing Web Applications, Wiley, 2006.

OUTCOMES:

On Completion of the course, the students should be able to:

Course Name : Fundamentals Of Web Technology										Course Code : 20OE502				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO.1	Understand web essential concepts and to design simple web pages using markup language.									1	K2	1,2,10		
CO.2	Ability to use technologies of Web Programming									2	K2	1,2,12		
CO.3	Understand style properties and able to build dynamic web pages using scripting language.									3	K2	1,2,10		
CO.4	Ability to build real world applications using client side and server side scripting languages									4	K4	1,2,3,4,12	1,2	
CO.5	Distinguish PHP as a server side programming language									4	K4	1,2,3,4,10	1,2	
CO.6	Represent web data using XML and develop web pages using JSP.									5	K3	1,2,3,12	1,2	
CO PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2
CO.1	2	1								1				
CO.2	2	1										1		
CO.3	2	1								1				
CO.4	3	3	2	1								1	1	1
CO.5	3	3	2	1						1			1	1
CO.6	3	2	1									1	1	1

20OE503	INTERNET OF THINGS & APPLICATIONS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn Smart Objects and IOT Architectures
- To learn about various IOT-related protocols
- To build simple IOT Systems using Arduino and Raspberry Pi.
- To learn data analytics and cloud in the context of IOT
- To develop IOT infrastructure for popular applications

PRE-REQUISITE: NIL

UNIT I FUNDAMENTALS OF IOT 9

Evolution of Internet of Things – Enabling Technologies – IOT Architectures: oneM2M, Simplified IOT Architecture , Cloud in IOT – Functional blocks of an IOT ecosystem – Sensors, Actuators, Smart Objects and Connecting Smart Objects - Threats of IOT

UNIT II IOT PROTOCOLS 9

IOT Access Technologies: Physical and MAC layers, topology, Network Layer: IP versions, Constrained Nodes and Constrained Networks – Optimizing IP for IOT, Application Transport Methods: Supervisory Control and Data Acquisition – Application Layer Protocols: CoAP and MQTT

UNIT III DEVELOPMENT AND CASE STUDIES 9

IOT system building blocks – Arduino – Board details, Raspberry Pi with Python Programming - Cisco IOT system – IBM Watson IOT platform - Power Utility Industry – GridBlocks Reference Model

UNIT IV RASPBERRY PI/ARDUINO INTERFACING 9

Interface LED with Raspberry Pi/Arduino - Interface motor with Raspberry Pi/Arduino - Interface sensor with Raspberry Pi/Arduino - Interface Bluetooth with Raspberry Pi – Interface WiFi Module Raspberry Pi – Interface camera with Raspberry Pi – Interface IR sensor

UNIT V CASE STUDIES/INDUSTRIAL APPLICATIONS 9

Smart and Connected Cities: Street Layer, City layer, Data Center Layer and Services Layer, Smart Lighting, Smart Parking Architecture and Smart Traffic Control - Smart Transportation – Connected Cars.

TOTAL: 45 PERIODS

TEXT BOOKS :

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, IOT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, Cisco Press, 2017
2. Arshdeep Bahga, Vijay Madiseti, Internet of Things – A hands-on approach, Universities Press, 2015

REFERENCES:

1. Olivier Hersent, David Boswarthick, Omar Elloumi ,The Internet of Things – Key applications and Protocols, Wiley, 2012 (for Unit 2).
2. Jan Holler, Vlasios Tsiatsis , Catherine Mulligan, Stamatis , Karnouskos, Stefan Avesand. David Boyle, —From Machine-to-Machine to the Internet of Things Introduction to a New Age of Intelligence, Elsevier, 2014.
3. Dieter Uckelmann, Mark Harrison, Michahelles, Florian (Eds), Architecting the Internet of Things, Springer, 2011.
4. Michael Margolis, Arduino Cookbook, Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition, O'Reilly Media, 2011.

OUTCOMES:

On Completion of the course, the students should be able to:

Course Name : Internet of Things and Applications									Course Code : 20OE503					
CO	Course Outcomes								Unit	K-CO	POs	PSOs		
CO.1	Explain the concept of IOT.								1	K2	1,2,10			
CO.2	Analyze various protocols for IOT.								2	K2	1,2,12			
CO.3	Explain the development board of Raspberry Pi/Arduino								3	K2	1,2,3,10	1,2		
CO.4	Apply data analytics and use cloud offerings related to IOT.								4	K3	1,2,3,12	1,2		
CO.5	Analyze the different IOT systems								4	K3	1,2,10	1,2		
CO.6	Analyze applications of IOT in real time scenario								5	K4	1,2,3,4,12	1,2		
CO PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PS O2
CO. 1	2	1								1				
CO. 2	2	1										1		
CO. 3	2	1								1			1	1
CO. 4	3	2	1									1	1	1
CO. 5	3	2	1							1			1	1
CO. 6	3	3	2	1								1	1	1

20OE504

CYBER SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To introduce the basic concepts and challenges in Cyber Security.
- To explore the security threats and attacks in Operating System and Networks.
- To analyze the Security Countermeasures to defend and resolve the security issues.
- To acquire the knowledge of Cyberspace Privacy.
- To implement the cyber security principles and methods in organization.

PRE-REQUISITE: NIL

UNIT I INTRODUCTION TO CYBER SECURITY 9

Introduction -Computer Security - Threats -Harm - Vulnerabilities - Controls - Authentication - Access Control and Cryptography - Web—User Side - Browser Attacks - Web Attacks Targeting Users - Obtaining User or Website Data - Email Attacks

UNIT II SECURITY IN OPERATING SYSTEM & NETWORKS 9

Security in Operating Systems - Security in the Design of Operating Systems -Rootkit - Network security attack- Threats to Network Communications - Wireless Network Security - Denial of Service - Distributed Denial-of-Service – SQL Injection.

UNIT III DEFENCES: SECURITY COUNTERMEASURES 9

Cryptography in Network Security - Firewalls – Memory Forensics - Honey Pots -Intrusion Detection and Prevention Systems - Network Management - Databases - Security Requirements of Databases - Reliability and Integrity - Database Disclosure - Data Mining and Big Data.

UNIT IV PRIVACY IN CYBERSPACE 9

Privacy Concepts -Privacy Principles and Policies -Authentication and Privacy - Privacy on the Web - Email Security - Privacy Impacts of Emerging Technologies - Where the Field Is Headed. Case Study : Aadhaar – Banking – Credit Cards.

UNIT V MANAGEMENT AND INCIDENTS 9

Data Theft – Detecting Insider Attacks – The Naïve Bayes Approach - Security Planning - Business Continuity Planning - Handling Incidents - Risk Analysis - Dealing with Disaster - Emerging Technologies - The Internet of Things - Cyber Warfare- Cyberspace and the Law - International Laws - Cyber Crime - Cyber Warfare

TOTAL: 45 PERIODS

TEXT BOOKS :

- 1.Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015
- 2.James Graham, Richard Howard, and Ryan Olson (Eds), “Cyber Security Essentials”, CRC Press, 2011.
- 3.George K.Kostopoulous, Cyber Space and Cyber Security”, CRC Press, 2013.

REFERENCES:

- 1.Salvator J.Stolfo, Steven M.Bellovin, Shlomo Hershkop, Angelos D. Keromytis, Sara Sinclair, and Sean W.Smith (Eds), “Insider Attack and Cyber Security: Beyond the Hacker”, Springer, 2008
- 2.Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics,Technology and Automation” edited, Springer International Publishing Switzerland , 2015.
- 3.Nelson Phillips and Enfinger Stuart, Computer Forensics and Investigations, Cengage Learning, New Delhi, 2009.
- 4.Nilakshi Jain, Ramesh Menon, Cyber Security and Cyber Laws, Willey, 2020.

OUTCOMES:

On Completion of the course, the students should be able to:

Course Name : Cyber Security										Course Code : 20OE504				
Co	Course Outcomes										Unit	K-CO	POs	PSOs
CO.1	Illustrate the Cyber Security challenges.										1	K2	1,2,10	
CO.2	Analyze the security issues in Operating System and Networks										2	K2	1,2,12	
CO.3	Identify the remedial measures taken for preventing security attacks.										3	K2	1,2,3,10	1.2
CO.4	Evaluate threats in order to protect or defend it in Cyberspace from Cyber-attacks.										4	K3	1,2,3,12	1,2
CO.5	Implement the process of cyber security systems in the organizations.										4	K3	1,2,10	1,2
CO.6	Analyze applications of Security in real time scenario										5	K4	1,2,3,4,12	1,2
CO PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1								1				
CO2	2	1										1		
CO3	2	1								1			1	1
CO4	3	2	1									1	1	1
CO5	3	2	1							1			1	1
CO6	3	3	2	1								1	1	1

20OE505	INFORMATION SECURITY ESSENTIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

PRE-REQUISITE: NIL

UNIT - I INTRODUCTION **9**

History, What is Information Security?, Critical Characteristics of Information, NSTISSC. Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT - II SECURITY INVESTIGATION **9**

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues -An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT- III SECURITY ANALYSIS **9**

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNI - IV LOGICAL DESIGN **9**

Blueprint for Security, Information Security Policy, Standards and Practices, ISO 17799/BS 7799, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity.

UNIT - V PHYSICAL DESIGN **9**

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL: 45 PERIODS

TEXT BOOKS

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Securityll, Vikas Publishing House, New Delhi, 2014
2. Micki Krause, Harold F. Tipton, — Handbook of Information Security Managementll, Vol 1-3 CRCPress LLC, 2007

REFERENCES:

1. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposedll, Tata McGraw- Hill, 2003
2. Matt Bishop, — Computer Security Art and Sciencell, Pearson/PHI, 2002.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INFORMATION SECURITY ESSENTIALS										Course Code : 20OE505				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Discuss the basics of information security									1	K2	1,2,8,9,10,12		
CO2	Illustrate the legal, ethical and professional issues in information security									2	K2	2,8,9,10,12		
CO3	Demonstrate the aspects of risk management.									3	K2	2,8,9,10,12		
CO4	Aware of various standards in the Information Security System									4	K2	2,8,9,10,12	1, 2	
CO5	Describe the design and implementation of Security Techniques.									5	K2	2,8,9,10,12	1, 2	
CO6	Identify the technological aspects of Information Security									5	K2	2,8,9,10,12	1, 2	
CO-PO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1						2	2	2		2		
CO2	2	1						2	2	2		2		
CO3	2	1						2	2	2		2		
CO4	2	1						2	2	2		2	1	1
CO5	2	1						2	2	2		2	1	1
CO6	2	1						2	2	2		2	1	1

20OE506

**PRINCIPLES OF CYBER PHYSICAL
SYSTEMS**

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the nature of continuous and discrete systems
- To develop synchronous and asynchronous model of processes
- To specify both safety and liveness requirements in temporal logic
- To debug the correctness of the protocol using model checking
- To develop and analyze model of timed and hybrid systems
- To understand zero behaviors and its hybrid automata

PRE-REQUISITE: NIL

UNIT I INTRODUCTION

9

Introduction-key features of cyber physical systems- Continuous dynamics: actor models-properties of systems-feedback control-Discrete dynamics: Discrete systems- Finite state machines

UNIT II SYNCHRONOUS AND ASYNCHRONOUS MODEL

9

Synchronous model: Reactive components-properties of components-composing components- synchronous design, Asynchronous model- asynchronous processes-asynchronous design primitives- coordination protocols.

UNIT III SAFETY AND LIVENESS REQUIREMENT

9

Safety specifications- verifying invariants- Enumerative search- Temporal logic- Model checking- reachability analysis- proving liveness

UNIT IV TIMED MODEL AND REAL-TIME SCHEDULING

9

Timed processes- Timing based protocols: Timing-Based Distributed Coordination-Audio Control Protocol- Timed automata: Model of Timed Automata-Region Equivalence-Matrix-Based Representation for Symbolic Analysis, Real-time scheduling.

UNIT V HYBRID SYSTEMS

9

Classes of Hybrid systems-Hybrid dynamic models: Hybrid Processes-Process Composition-Zeno Behaviors-Stability- designing hybrid systems- linear hybrid automata

TOTAL: 45 PERIODS

TEXT BOOKS

1. Rajeev Alur, Principles of cyber-physical systems, The MIT press, 2015.
2. E. A. Lee and S. A. Seshia, Introduction to Embedded Systems - A Cyber-Physical Systems Approach, Lulu.com, First Edition, Jan 2013.

REFERENCE:

- 1.Sang C.Suh , U.JohnTanik and John N.Carbone , Applied Cyber-Physical systems, Springer,2014

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : PRINCIPLES OF CYBER PHYSICAL SYSTEMS									Course Code :20OE506					
CO	Course Outcomes								Unit	K-CO	POs		PSOs	
CO1	Ability to understand knowledge, opportunities, challenges and Logical Foundations of Cyber Physical Systems.								1	K2	1, 2, 8, 9		1,2	
CO2	Ability to develop model for synchronous, asynchronous, continuous and discrete systems.								2	K2	1, 2, 8,9,10		1,2	
CO3	Ability to identify safety specifications and critical properties of Cyber Physical Systems.								3	K2	1, 2, 5, 8, 9		1,2	
CO4	Ability to design and analyze the stability of hybrid systems.								4	K2	1, 2, 5, 8, 9,10		1,2	
CO5	Ability to apply automata for timed systems.								5	K2	1, 2, 5, 8, 9		1.2	
CO6	Ability to understand Zeno Behaviors								5	K2	1, 2, 5, 8, 9		1,2	
CO-PO Mapping														
COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1			-	-	-	1	1		-	-	1	1
CO2	2	1			-	-	-	1	1	1	-	-	1	1
CO3	2	1			1	-	-	1	1	-	-	1	1	1
CO4	2	1			1	-	-	1	1	1	-	1	1	1
CO5	2	1			1	-	-	1	1	-	-	1	1	1
CO6	2	1			1			1	1				1	1

200E507

CONCEPTS OF ETHICAL HACKING

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand and analyze security threats & countermeasures related to Ethical Hacking.
- To learn different Scanning and Enumeration methodologies and tools.
- To understand various hacking techniques and attacks at a system level.
- To be exposed to the different hacking methods for web services and session hijacking.
- To understand the hacking mechanisms on how a wireless network is hacked.

PRE-REQUISITE: NIL

UNIT - I ETHICAL HACKING OVERVIEW & VULNERABILITIES 9

Introduction to Hacking – Understanding the Importance of Security – Concept of Ethical Hacking and Essential Terminologies - Phases involved in Hacking – Types of Hacker Attacks – Vulnerability Research - Exploit- Penetration Testing – Penetration Testing Methodologies – Social Engineering

UNIT - II FOOTPRINTING & PORT SCANNING 9

Introduction to Footprinting – Information Gathering Methodology– Footprinting Tools – Introduction to Scanning – Scanning Methodology – Tools – Port Scanning – Introduction to Enumeration – Enumeration Techniques – Enumeration Procedure – Tools - Google Hacking

UNIT- III SYSTEM HACKING 9

Introduction – Various methods of Password cracking – Password Cracking Websites – Password Guessing – Role of Eavesdropping - Password Cracking Tools – Password Cracking Countermeasures – Escalating Privileges – Executing Applications – Keystroke Loggers and Spyware - Understanding Sniffers ,Comprehending Active and Passive Sniffing, ARP Spoofing and Redirection, DNS and IP Sniffing, HTTPS Sniffing.

UNIT-IV HACKING WEB SERVICES & SESSION HIJACKING 9

Web application vulnerabilities - Application coding errors - SQL injection into Back-end Databases - Cross-site scripting - Cross-site request forging - Authentication bypass - Web services and related flaws - Protective http headers - Understanding Session Hijacking - Phases involved in Session Hijacking - Types of Session Hijacking - Session Hijacking Tools

UNIT - V HACKING WIRELESS NETWORKS AND MOBILE SECURITY 9

Wireless Security : Introducing Aircrack - Role of WEP, Cracking WEP Keys, Sniffing Traffic, Wireless DOS attacks, WLAN Scanners, WLAN Sniffers, Hacking Tools, Securing Wireless Network

Mobile Security : Android vs iOS security model, Threat Models, Information Tracking – Rootkits – Threats in Mobile Applications – Analyzer for Mobile Apps to Discover Security Vulnerabilities.

TOTAL: 45 PERIODS

TEXT BOOKS

1. EC-Council, "Ethical Hacking and Countermeasures: Attack Phases", Cengage Learning, 2010.
2. RafayBoloch, "Ethical Hacking and Penetration Testing Guide", CRC Press, 2017.

REFERENCES:

1. Matthew Hickey, Jennifer Arcuri, "Hands on Hacking: Become an Expert at Next Gen Penetration Testing and Purple Teaming", 1st Edition, Wiley, 2020.
2. Kevin Beaver, "Ethical Hacking for Dummies", Sixth Edition, Wiley, 2018.
3. Michael T. Simpson, Kent Backman, James E. Corley, "Hands-On Ethical Hacking and Network Defense", Cengage Learning, 2013.
4. Patrick Engebretson, "The Basics of Hacking and Penetration Testing – Ethical Hacking and Penetration Testing Made Easy", Second Edition, Elsevier, 2013.
5. Jon Erickson, "Hacking, 2nd Edition: The Art of Exploitation", No Starch Press Inc., 2008.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : CONCEPTS OF ETHICAL HACKING										Course Code : 20OE507				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Identify security threats, vulnerabilities, countermeasures related to ethical hacking.									1	K2	1, 2, 8, 9	1,2	
CO2	Protect data assets and exposed to Scanning and Enumeration methodologies and tools.									2	K2	1, 2, 3, 8, 9	1.2	
CO3	Defend a computer against a variety of security attacks using sniffers at different layers.									3	K2	1,2,3,8,9,12	1,2	
CO4	Practice and use safe techniques on the World Wide Web.									4	K2	1,2,3,8,10,9,12	1,2	
CO5	Identify the hacking mechanisms on how a wireless network is hacked.									5	K2	1,2,3,8,9,12	1,2	
CO6	Describe the hacking mechanism to secure the mobile applications									5	K2	1,2,8,9,10	1,2	
CO-PO Mapping														
COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1			-	-	-	1	1		-	-	1	1
CO2	2	1			-	-	-	1	1		-	-	1	1
CO3	2	1			-	-	-	1	1	-	-	1	1	1
CO4	2	1			-	-	-	1	1	1	-	1	1	1
CO5	2	1			-	-	-	1	1	-	-	1	1	1
CO6	2	1						1	1	1			1	1

200E508	INTRODUCTION TO USER INTERFACE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To learn the basics of User interface.
- To learn the foundations of Human Computer Interaction.
- To be familiar with the web design components such as windows.
- To be aware of Multimedia and Windows layout.

PRE-REQUISITE: NIL

UNIT I INTRODUCTION 9

Human-Computer Interface – Characteristics Of Graphics Interface –Direct Manipulation Graphical System – Web User Interface –Popularity –Characteristic & Principles.

UNIT II HUMAN COMPUTER INTERACTION 9

User Interface Design Process – Obstacles –Usability –Human Characteristics In Design – Human Interaction Speed –Business Functions –Requirement Analysis – Direct – Indirect Methods – Basic Business Functions – Design Standards – System Timings – Human Consideration In Screen Design – Structures Of Menu – Functions Of Menu– Contents Of Menu– Formatting – Phrasing The Menu – Selecting Menu Choice– Navigating Menus– Graphical Menus.

UNIT III WINDOWS 9

Characteristics– Components– Presentation Styles– Types– Managements– Organizations– Operations– Web Systems– Device– Based Controls Characteristics– Screen – Based Controls – Operate Control – Text Boxes– Selection Control– Combination Control– Custom Control– Presentation Control.

UNIT IV MULTIMEDIA 9

Text For Web Pages – Effective Feedback– Guidance & Assistance–Internationalization– Accesssibility – Icons– Image– Multimedia – Coloring.

UNIT V WINDOWS LAYOUT- TEST 9

Prototypes – Kinds Of Tests – Retest – Information Search – Visualization – Hypermedia – WWW– Software Tools.

TOTAL: 45 PERIODS

TEXT BOOKS

1. Wilbent. O. Galitz, “The Essential Guide To User Interface Design”, John Wiley&Sons, 2002.
2. Ben Sheiderman, “Design The User Interface”, Pearson Education, 2021.

REFERENCES:

1. Alan Cooper, “The Essential Of User Interface Design”, Wiley – Dream Tech Ltd., 2002.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INTRODUCTION TO USER INTERFACE										Course Code :20OE508				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Design effective dialog using HCI.									1	K2	1, 2, 8, 9	1,2	
CO2	Design effective HCI for individuals.									2	K2	1, 2, 8, 9,10	1,2	
CO3	Explain the structures and functions of Menus.									3	K2	1, 2, 8, 9,12	1,2	
CO4	Explain the various controls in Windows.									4	K2	1, 2, 8, 9,10,12	1,2	
CO5	Assess the importance of user feedback and multimedia applications..									5	K2	1, 2, 8, 9,12	1,2	
CO6	Explain the HCI implications for designing hypermedia, and learn about World Wide Web and software tools.									5	K2	1, 2, 8, 9	1,2	
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1			-	-	-	1	1		-	-	1	2
CO2	2	1			-	-	-	1	1	1	-	-	1	2
CO3	2	1			-	-	-	1	1	-	-	1	1	2
CO4	2	1			-	-	-	1	1	1	-	1	1	2
CO5	2	1			-	-	-	1	1	-	-	1	1	2
CO6	2	1			-			1	1				1	2

20OE601	FUNDAMENTALS OF ELECTRIC VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To know the history of Electric vehicles (EV) and emphasize the need and importance of EV for sustainable future.
- To develop a thorough understanding of the key elements of EV : Electric Machines for Propulsion applications and Energy Storage devices.
- To understand the architecture of hybrid electric vehicles.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Internal Combustion(IC) Engine – Construction- Fuels for IC engine- Emission from IC Engine. Power train: Electric motor — Need- Cost and Emissions- Comparison of Electric (EV) and IC Engine Vehicle. Social and environmental importance of Electric vehicles, Impact of modern drive- Trains on energy supplies.

UNIT-II ELECTRIC VEHICLE 9

Basics of vehicle mechanisms, history of electric vehicles (EV), Electric vehicle Architecture: Major components of electric vehicle .Power/Energy supplies requirements for EV applications, vehicle power source characterization, and transmission characteristics.

UNIT - III HYBRID ELECTRIC VEHICLE 9

Hybrid Electric vehicles – Classification – Micro, Mild, Full, Plug-in - EV Layout and Architecture – Series, Parallel and Series-Parallel Hybrid, Regenerative Braking

UNIT - IV ENERGY STORAGE FOR EV 9

Energy storage- Battery based and Fuel cell based, Battery parameters, Types of Batteries, Modeling of Battery, Fuel Cell basic principle and operation, Types of Fuel Cells, ultra-capacitors as energy sources for EV.

UNIT - V ELECTRIC PROPULSION 9

Electric Propulsion EV consideration, DC motor drives and speed control, Induction motor drives, Permanent Magnet Motor Drives, Switch Reluctance Motor Drive for Electric Vehicles, Configuration and control of Drives.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Mehrdad Ehsani, YiminGao, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles – Fundamentals, Theory and Design, CRC Press, New York, Third Edition,2019.
2. S. S. Thipse, “Alternative Fuels”, Jaico Publications, First Edition 2010
3. Iqbal Hussain, Electric & Hybrid Vehicles – Design Fundamentals, CRC Press, New York,Second Edition,2003.

REFERENCES:

1. James Larminie, John Lowry, Electric Vehicle Technology Explained, John Wiley & Sons Ltd., England, Second Edition, 2012.
2. Sandeep Dhameja, Electric Vehicle Battery Systems, Newness, Massachusetts, 2002.
3. Dr Mike Westbrook, M H Westbrook, The Electric Car: Development & Future of Battery, Hybrid & Fuel-Cell Cars, British library Cataloguing in Publication Data, First Edition, 2001

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : FUNDAMENTALS OF ELECTRIC VEHICLES											Course Code : 20OE601				
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Describe the history and evolution of electric & hybrid electric vehicles										1	K2	1,2,7,8	-	
CO2	Explain the principles of various EV drive train.										2	K2	1,2,7,8	-	
CO3	Select electric propulsion system components for EV drives suitability for the desirable performance and control.										3	K2	1,2,7,8,9	-	
CO4	Compare and evaluate various energy sources and energy storage components for EV and applications										4	K2	1,2,7,8	-	
CO5	Explain the types of electric motor drives for EV.										5	K2	1,2,7,8,9	-	
CO6	Recognize the need to adapt technological changes in the transportation system for sustainable future.										5	K3	1,2,7,8	-	
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-
CO4	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	1	1	1	-	-	-	-	-	-
CO6	2	1	-	-	-	-	1	1	-	-	-	-	-	-	-

200E602

SUPPLY CHAIN MANAGEMENT

L	T	P	C
3	0	0	3

OBJECTIVES:

- To study about the role and drivers of and supply chain management.
- To explain about Supply Chain Network Design.
- To illustrate about the issues related to Logistics in Supply Chain.
- To appraise about Sourcing and Coordination in Supply Chain.
- To study about the application of Information Technology and Emerging Concepts in Supply.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Supply Chain Management concepts and Definitions — Objectives and Components of Supply chain- Scope and Importance- Evolution of Supply Chain - Decision Phases in Supply Chain - Competitive and Supply chain Strategies — Drivers of Supply Chain Performance and Obstacles.

UNIT-II SUPPLY CHAIN NETWORK DESIGN 9

Role of Distribution in Supply Chain — Factors influencing Distribution network design — Design options for Distribution Network Distribution Network in Practice-Role of network Design in Supply Chain — Framework for network Decisions

UNIT - III LOGISTICS IN SUPPLY CHAIN 9

Role of transportation in supply chain – factors affecting transportations decision – Design option for transportation network – Tailored transportation – Routing and scheduling in transportation.

UNIT - IV SOURCING AND COORDINATION IN SUPPLY CHAIN 9

Role of sourcing supply chain supplier selection assessment and contracts- Design collaboration - sourcing planning and analysis - supply chain co-ordination - Bull whip effect— Effect of lack of co-ordination in supply chain and obstacles — Building strategicpartnerships and trust within a supply chain.

UNIT - V SUPPLY CHAIN AND INFORMATION TECHNOLOGY 9

The role of IT in supply chain- The supply chain IT frame work Customer Relationship Management – Internal supply chain management – supplier relationship management – future of IT in supply chain – E-Business in supply chain.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Sunil Chopra, Peter Meindl and Kalra, “Supply Chain Management, Strategy, Planning, and Operation”, Pearson Education, Sixth edition ,2016.
2. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, Firstedition, 2009.
3. James B.Ayers, “Handbook of Supply Chain Management”, St.Lucle press, Secondedition,2006.

REFERENCES:

1. Jeremy F.Shapiro, “Modeling the Supply Chain”, Thomson Duxbury, Second edition,2006
2. Srinivasan G.S, “Quantitative models in Operations and Supply Chain Management, PHI,2010
David J.Bloomberg , Stephen Lemay and Joe B.Hanna, “Logistics”, PHI 2010.

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : SUPPLY CHAIN MANAGEMENT										Course Code : 20OE602					
CO	Course Outcomes										Unit	K-CO	Pos	PSOs	
CO1	Explain the framework and scope of supply chain functions.										1	K2	1,2,8	-	
CO2	Explain the principles of supply chain management										2	K2	1,2,8	-	
CO3	Design, organize and manage a supply network considering various logistics issues										3	K2	1,2,8	-	
CO4	Apply forecasting and purchasing/Inventory concepts to improve supply chain operations										4	K2	1,2,8	-	
CO5	Explain logistics technology tools and resources										5	K2	1,2,8	-	
CO6	Apply internet technology systems to support logistics management decisions.										5	K3	1,2,8	-	
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO2	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO3	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO5	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-
CO6	2	1	-	-	-	-	-	1	-	-	-	-	-	-	-

20OE603

AUTOMOTIVE SAFETY SYSTEM

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand automotive safety in the broader context of transportation safety.
- To impart knowledge on the different types of active and passive safety system used in automobiles.
- To explain the different types of vehicle safety systems used in automobiles.
- To examine the collision warning and avoidance systems in automobiles.
- To provide knowledge on the different comfort and convenience system used in automobiles

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Automotive safety: Introduction, Types. Active safety: driving safety, conditional safety, Perceptibility safety, operating safety. Passive safety: exterior safety, interior safety.

UNIT-II PASSIVE SAFETY CONCEPTS 9

Design of body for safety, deceleration of vehicle, passenger. Concept of crumple zone, Safety Cage. Deceleration on impact with stationary and movable obstacles. Deformation behaviour of vehicle body. Barrier test. Crash tests. Deformation behaviour of Lightweight materials

UNIT - III PASSIVE SAFETY EQUIPMENTS AND CONVENIENCE SYSTEM 9

Seat belt, Seat belt tightener system and importance, collapsible steering column. Air bags and activation. Designing aspects of automotive bumpers and materials for bumpers. Adaptive lighting, central locking system, Tire pressure control system, rain sensor system with auto wiper system.

UNIT - IV ACTIVE SAFETY 9

Antilock braking system, Stability Control. Adaptive cruise control, Lane Keep Assist System, Collision warning, avoidance system, Blind Spot Detection system, Driver alertness detection System.

UNIT - V VEHICLE INTEGRATION AND NAVIGATION SYSTEM 9

Looking out sensors and Looking in sensors, Intelligent vision system, Vehicle Integration system. Global Positioning System. Vehicle Navigation System. Road Network. V2V

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bosch, "Automotive Handbook", 10th Edition, SAE publication, 2018.
2. George. A. Peters, Barbara. J. Peters, Automotive Vehicle Safety, CRC Press, First Edition, 2002.
3. Robert Bosch GmbH - "Safety, Comfort and Convenience Systems"- Wiley; 3rd edition, 2007

REFERENCES:

1. Mark Gonter and Ulrich Seiffert, —Integrated Automotive Safety HandbookII, SAE Publication, 2013.
2. J. Marek, H.-P. Trah, Y. Suzuki, I. Yokomori - “Sensors for Automotive Applications “
WILEYVCH Verlag GmbH & Co. 2003
3. Ronald.K.Jurgen - “Automotive Electronics Handbook” - Second edition- McGraw-Hill Inc., -1999.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : AUTOMOTIVE SAFETY SYSTEM											Course Code : 20OE603				
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Describe the concepts of safety measures in automobiles.										1	K2	1,2,3,9	-	
CO2	Explain the concept of crumble zone										2	K2	1,2,10	-	
CO3	Describe the vehicle structure with respect to crash worthiness										3	K2	1,2,3,9	-	
CO4	Explain the working of passive safety components such as air bags, seatbelts										4	K2	1,2,3,10	-	
CO5	Explain the different types of active safety system used in automobiles.										5	K2	1,2,3,9	-	
CO6	Describe Vehicle integration and navigation system.										5	K3	1,2,3,10	-	
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	2	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	1	-	-	-	-	-

20OE604	BASICS OF AUTOMOBILE ENGINEERING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To familiarize Working of SI & CI engine
- To understand the working of various fuel systems.
- To explain the working of ignition, cooling and lubrication systems
- To explain the suspension and brake system used two and four wheeler

PRE-REQUISITE: NIL

UNIT-I ENGINE CONSTRUCTION AND OPERATION 9

Constructional details of spark ignition (SI) and compression ignition (CI) engines-Working principles. Two stroke SI and CI engines — construction and working. Comparison of SI and CI engines and four stroke and two stroke engines. Engine classification, firing order.

UNIT-II FUEL SYSTEMS 9

Air fuel ratio requirements of SI engines, Air fuel ratio and emissions, Working of a simple fixed venturi carburetor, Constant vacuum carburetor. MPFI. Gasoline direct injection systems. Diesel fuel injection systems- Jerk pumps, distributor pumps, pintle and multi hole nozzles, Unit injector and CRDI systems. Need for a governor for diesel engines. Description of a simple diesel engine governor.

UNIT - III IGNITION SYSTEMS 9

Components and working of battery coil and magneto-ignition system, electronic ignition system, capacitive discharge ignition system, distributor less ignition system, digital ignition system, direct ignition system, ignition triggering devices, centrifugal and vacuum advance mechanisms. Spark plug – Construction, working and types.

UNIT - IV COOLING AND LUBRICATION SYSTEMS 9

Need for cooling, types of cooling systems- air and liquid cooling systems. Thermo siphon and forced circulation and pressurized cooling systems. Properties of coolants. Requirements of lubrication systems. Types- mist, pressure feed, dry and wet sump systems. Properties of lubricants.

UNIT - V TWO AND FOUR WHEELER 9

Two wheeler Suspension Systems- Front and rear suspension systems. Shock absorbers. Four wheeler Suspension Systems -conventional Suspension Systems -independent Suspension Systems –leaf spring – coil spring
Two wheeler Brake system - Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links lay-outs for two wheeler -. Brake actuation mechanism.

Four wheeler Brake System -Pneumatic and Hydraulic Braking Systems, Antilock Braking System (ABS), Construction and Working of Four wheeler Power Steering.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Ganesan V. "Internal Combustion Engines", Fourth Edition, Tata McGraw-Hill, 2017
2. Kirpal Singh, "Automobile Engineering", Vol 1 & 2, 13 Edition, Standard Publishers, New Delhi, 2013.
2. Jain K.K. and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002

REFERENCES:

1. Ramalingam. K. K., "Two Wheelers", Scitech publications, Chennai,2018
2. G.B.S. Narang"Automobile Engineering"5th Edition, Khanna Publishers,Delhi,2010
3. Joseph Heitner, "Automotive Mechanics," Second Edition, East-West Press, 2006.
4. Irving,P.E.," Motor cycle Engineering", Temple Press Book, London, 1992.
5. Bryaut, R.V., Vespa "Maintenance and Repair series".
6. Marshall Cavendish, Encyclopedia of Motor cycling, 20 volumes, New York andLondon

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : BASICS OF AUTOMOBILE ENGINEERING										Course Code : 200E604					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO 1	Recognize the construction and working principle of SI and CI engines.									1	K2	1,2,3,9	-		
CO 2	Describe about the fuel system and fuel pumps used in automotive engines.									2	K2	1,2,3,10	-		
CO 3	Explain basic concepts of ignition systems.									3	K2	1,2,3,9	-		
CO 4	Explain about working of engine cooling and lubrication systems.									4	K2	1,2,3,10	-		
CO 5	Explain the suspension and brake system used in two and four wheeler.									5	K2	1,2,3,9	-		
CO 6	Conversant with basics of automobile systems.									5	K3	1,2,3,10	-		
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	1	-	-	-	-	-	2	-	-	-	-	-	-
CO2	2	1	1	-	-	-	-	-	-	1	-	-	-	-	-
CO3	2	1	1	-	-	-	-	-	2	-	-	-	-	-	-
CO4	2	1	1	-	-	-	-	-	-	1	-	-	-	-	-
CO5	2	1	1	-	-	-	-	-	2	-	-	-	-	-	-
CO6	2	1	1	-	-	-	-	-	-	1	-	-	-	-	-

20OE605	LEAN MANUFACTURING PRACTICES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the various tools for lean manufacturing
- To apply the above tools to implement lean manufacturing system in an organization
- To understand the problem solving methodology in Industries

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION TO LEAN MANUFACTURING 9

TQM – Basic concepts, need - Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT-II TYPES OF LAYOUT, JIT, TPM 9

Layout types – Product, Process, Cellular Manufacturing –, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT - III SMED, 5S, VSM 9

Set up time reduction – Definition, philosophies and reduction approaches. 5S Principles and implementation - Value stream mapping - Procedure and principles, Kaizen.

UNIT - IV SIX SIGMA 9

Six Sigma – Definition, statistical considerations, variability reduction, design of experiments – Six Sigma implementation

UNIT - V CASE STUDIES 9

Problem solving methodology, Case studies of implementation of lean manufacturing at industries.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Design and Analysis of Lean Production Systems, Ronald G. Askin & Jeffrey B. Goldberg, John Wiley & Sons, 2003
2. Automation, Production Systems and CIM. Mikell P. Groover (2002), Prentice hall Publications
3. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda', Lean Enterprise Institute, Brookline, MA.

REFERENCES:

1. Simplified Lean Manufacture , N.Gopalakrishnana, PHI Learning PvtLTd, New Delhi
2. Production planning and control , Dr.V.Jeyakumar, Lakshmi publication
3. Total Quality Management , Dr.V.Jeyakumar , Lakshmi publication

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : LEAN MANUFACTURING PRACTICES											Course Code : 20OE605				
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Understand the principles, elements and various tools of lean manufacturing										1	K2	1,2,3,4,1	-	
CO2	Understand the different types of layout, cellular manufacturing, implementation of JIT, Kanban, TPM										2	K2	1,2,3,4,1	-	
CO3	Apply the concepts of SMED,5S in Industries										3	K3	1,2,3,4,1	-	
CO4	Apply the concepts TQM and VSM.										3	K3	1,2,3,4,1	-	
CO5	Understand the DOE and six sigma implementation										4	K2	1,2,3,4,1	-	
CO6	Solve problems using appropriate lean tools										5	K3	1,2,3,4,1	-	
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-
CO2	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-
CO3	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-
CO4	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-
CO5	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-
CO6	2	1	2	1	-	-	-	-	-	2	-	-	-	-	-

20OE606	MODERN VEHICLE TECHNOLOGY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To impart recent trending knowledge in the Automobile field.
- To develop the skills of the students in recent safety precaution principles
- To improve efficiency, security & performance of automobile using modern electronics and technology.

PRE-REQUISITE: NIL

UNIT-I ELECTRONIC ENGINE MANAGEMENT 9

Single Point and Multipoint Injection System, Working of Electronic Fuel Injector, Different Types of Electronic Fuel Injection Systems Like L, K, KE, LU, LH and Motronic, ME & MH Systems, Cylinder Cut-Off Technology.

UNIT-II DRIVER INFORMATION SYSTEMS 9

Introduction, Driver Support Systems – Driver Information, Driver Perception, Driver Convenience, Driver Monitoring. Vehicle Support Systems – General Vehicle Control, Collision Avoidance, Vehicle Status Monitoring.

UNIT - III DRIVER ASSISTANCE SYSTEMS 9

Global Positioning Systems, Geographical Information Systems, Navigation Systems, Automotive Vision System, Road Recognition, Driver Assistance Systems - Connected Vehicles, Autonomous Vehicles

UNIT - IV SAFETY SYSTEMS 9

Active and Passive Safety Systems, Airbags, Seat Belt Tightening System, Collision Warning Systems, Child Lock, Anti Lock Braking Systems, Traction Control, Electronic Stability Programme, Crash Worthiness of Vehicle, Vehicle Crash Testing, Testing With Dummies. Security Systems - Anti Theft Technologies, Smart Card System, Number Plate Coding.

UNIT - V COMFORT SYSTEMS 9

Active Suspension Systems, Requirement and Characteristics, Different Types, Power Steering, Collapsible and Tiltable Steering Column, Power Windows, Biometric Systems. Adaptive Control Systems: Adaptive Cruise Control, Adaptive Noise Control, Anti Spin Regulation.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. K.K. Ramalingam, "Automobile Engineering", Scitech Publications Pvt. Ltd., 2005
2. Crouse/Anglin "Automotive Mechanics"
3. "Automotive technology " H.Hertz, 2008

REFERENCES:

1. Beranek. L.L. Noise Reduction, McGraw-Hill Book Co., Inc, Newyork, 1993
2. Bosch Hand Book, 3rd Edition, SAE,1993
3. T. Kenneth Garrett, Kenneth Newton and William Steeds, "The Motor Vehicle" 13th Edition, Butterworth-Heinemann Limited, London, 2005.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : MODERN VEHICLE TECHNOLOGY										Course Code : 200E606					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO 1	Explain the recent developments in Alternate power generation for a vehicle.									1	K 2	1,2,3,10	-		
CO 2	List various modern features for better functioning of vehicle.									2	K 2	1,2,3,10	-		
CO 3	Demonstrate the advanced suspension, Braking, and Safety systems in automobile.									3	K 2	1,2,3,10	-		
CO 4	Identify the Various Vehicle operation and control systems.									4	K 2	1,2,3,10	-		
CO 5	Explain the Driver support systems in Vehicle automated tracks.									4	K 2	1,2,3,10	-		
CO 6	Identify and describe various advanced comfort system used in automobile									5	K 2	1,2,3,10	-		
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3
CO1	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-

20OE607	NEW GENERATION AND HYBRID VEHICLES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To illustrate the new generation vehicles and their operation and controls
- To give an exposure regarding types of Power system and new generation vehicles.
- To give an exposure regarding the various types of Vehicle automated tracks.
- To teach the basics of suspension, brakes, aerodynamics and safety.

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Electric and hybrid vehicles, flexible fuel vehicles (FFV), flexible fuel systems, solar powered vehicles, fuel cells and its type, fuel cell vehicles

UNIT-II POWER SYSTEM AND NEW GENERATION VEHICLES 9

Hybrid Vehicle engines, Stratified charge engines, lean burn engines, low heat rejection engines, hydrogen engines, HCCI engine, VCR engine, surface ignition engines, VVTI engines. High energy and power density batteries

UNIT - III VEHICLE OPERATION AND CONTROL 9

Computer Control for pollution and noise control and for fuel economy – Transducers and actuators - Advanced Driver Assistance System Technology- Connected Car Technology.

UNIT - IV VEHICLE AUTOMATED TRACKS 9

Preparation and maintenance of proper road network using Intelligent Transportation System (ITS)–Components of ITS- National highway network with automated roads and vehicles – Satellite control of vehicle operation for safe and fast travel, GPS.

UNIT - V SUSPENSION, BRAKES AND SAFETY 9

Air suspension – Closed loop suspension, compensated suspension, anti skid braking system, retarders, regenerative braking, safety gauge air bags- crash resistance. Safety systems

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Bosch Hand Book, SAE Publication, 2000
2. Heinz, "Modern Vehicle Technology" Second Edition
3. Advance hybrid vehicle power transmission, SAE.

REFERENCES:

1. Advance hybrid vehicle power transmission, SAE.
2. Light weight electric for hybrid vehicle design.
3. Noise reduction, Branek L.L., McGraw Hill Book company, New York, 1999

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name: NEW GENERATION AND HYBRID VEHICLES										Course Code : 20OE607					
CO	Course Outcomes										Unit	K-CO	POs	PSOs	
CO1	Interpret the critical comparisons of HEVs with alternatives such as EVs and fuel cell systems.										1	K2	1,2,3,9	-	
CO2	Define and analyze the fundamental operations of different hybrid engines and the electrochemistry of battery operation.										2	K3	1,2,3,10	-	
CO3	Explain different approaches to control the vehicles with the aid of computer and Information Technology.										3	K3	1,2,3,10	-	
CO4	Identify how to prepare and maintain Road network using satellite and GPS control.										4	K3	1,2,3,9	-	
CO5	Demonstrate the safety features of vehicles										5	K3	1,2,3,9	-	
CO6	Identify and describe materials used for safety precautions in vehicles.										5	K3	1,2,3,9	-	
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO2	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO3	3	3	2	-	-	-	-	-	-	2	-	-	-	-	-
CO4	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO5	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-
CO6	3	3	2	-	-	-	-	-	1	2	-	-	-	-	-

20OE608	AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the need for alternator in the vehicle.
- To understand the need for storage batteries and starter motor
- To explain the different types of electronic ignition systems
- To list common types of sensor and actuators used in vehicles.
- To explain the different safety systems used in vehicles.

PRE-REQUISITE: NIL

UNIT-I CHARGING SYSTEM, LIGHTING SYSTEM AND ACCESSORIES SYSTEM 9

Introduction about electrical and electronics in automobiles. DC Generators and Alternators their characteristics. Voltage and Current Regulation, Cut –out relays and regulators Control unit –electronic regulators. Vehicle interior and exterior lighting systems. Wiring requirements, lighting design. Dashboard instruments - (fog lamps, auxiliary lighting, temperature gauge, oil pressure gauge, fuel gauge, speedometer, odometer, horn, windscreen wiper signaling devices and trafficator)

UNIT-II BATTERIES AND STARTING 9

Types of Batteries – principle, rating, testing and charging, new developments in electrical storage batteries. Starter motors characteristics, principle and construction of starter motor, drive mechanisms, capacity requirements, servicing and trouble shooting, starter switches and solenoids.

UNIT - III ELECTRONIC IGNITION AND INJECTION SYSTEM 9

Conventional ignition system and its components, Electronic, Programmed, Distributor less and direct injection systems, spark advance and retard mechanisms. Types of spark plugs. Types of fuel injection in Petrol and Diesel engines.

UNIT - IV SENSORS, CONTROLLER AND ACTUATORS 9

Types of sensors – Vehicle speed sensor, Oxygen sensor (Lambda sensor), pressure sensor, Hot wire anemometer sensor, Knock sensor, Throttle position sensor, Crank position sensor. Electronic Control Module (ECM).Types of actuators- Exhaust gas recirculation, idle speed, ignition controller, (SI Engines), Injection control and ABS actuator. Applications - Keyless entry system, Electronic suspension system, Electronic steering system.

UNIT - V SAFETY SYSTEMS 9

Antilock braking system, Air bag restraint system, Voice warning system, Seat belt system, Road navigation system, Obstacle avoidance radar system, Alarms and immobilizer system.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. TOM Denton, —Automobile Electrical and Electronic Systems, 3rd Edition, Elsevier Butterworth – Heinemann Publications, 2004.
2. William B. Ribbens, — Understanding Automotive Electronics, 5th Edition, Butterworth –Heinemann Publications, 1998.
3. Kholi .P.L. Automotive Electrical Equipment, Tata McGraw-Hill co ltd, New Delhi, 2004

REFERENCES:

1. Judge A.W., —Modern Electrical Equipment of Automobiles: Motor Manuals Volume Six, 2nd edition, Springer Science & Business Media, 2012.
2. Robert Bosch GmbH, —Automotive Hand Book, 9th Edition, Wiley, 2014. 2004.
3. AdityaP.Mathur, —Introduction to Microprocessors, 3rd Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 1989.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : AUTOMOTIVE ELECTRICAL AND ELECTRONICS SYSTEMS										Course Code : 20OE608					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO 1	Explain the working of charging, lighting and miscellaneous systems involved in automobiles.									1	K2	1,2,3,4,9	-		
CO 2	Explain the battery types and components involved in starting system.									2	K2	1,2,3,4,1	-		
CO 3	Describe the types of ignition and injection systems of IC engine.									3	K2	1,2,3,4,9	-		
CO 4	Determine the function and operation of sensors and actuators and have a good knowledge of how they are used in the management of the vehicle control.									4	K2	1,2,3,4,9	-		
CO 5	Explain the working and applications of Keyless entry system, Electronic suspension system, Electronic steering system.									4	K2	1,2,3,4,1	-		
CO 6	Identify the various safety systems of automobiles and their working.									5	K2	1,2,3,4,9	-		
CO – PO MAPPING															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO2	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO3	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO4	3	2	2	1	-	-	-	-	2	-	-	-	-	-	-
CO5	3	2	2	1	-	-	-	-	-	2	-	-	-	-	-
CO6	3	2	2	1	-	-	-	-	1	-	-	-	-	-	-

20OE701	BIOMEDICAL INSTRUMENTATION AND MEASUREMENTS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study about the different bio potential and its propagation
- To understand the different types of electrodes and its placement for various recording
- To study the design of bio amplifier for various physiological recording
- To learn the different measurement techniques for non-physiological parameters.
- To familiarize the different biochemical measurements.

PRE-REQUISITE: NIL

UNIT-I BIO POTENTIAL GENERATION AND ELECTRODES TYPES 9

Origin of bio potential and its propagation. Types of electrodes - surface, needle and micro electrodes and their equivalent circuits. Recording problems - measurement with two electrodes

UNIT-II BIOSIGNAL CHARACTERISTICS AND ELECTRODE CONFIGURATIONS 9

Biosignals characteristics – frequency and amplitude ranges. ECG – Einthoven’s triangle, standard 12 lead system. EEG – 10-20 electrode system, unipolar, bipolar and average mode. EMG– unipolar and bipolar mode.

UNIT - III SIGNAL CONDITIONING CIRCUITS 9

Need for bio-amplifier - differential bio-amplifier, Impedance matching circuit, isolation amplifiers, Power line interference, Right leg driven ECG amplifier, Band pass filtering

UNIT - IV MEASUREMENT OF NON-ELECTRICALPARAMETERS 9

Temperature, respiration rate and pulse rate measurements. Blood Pressure: indirect methods - Auscultatory method, direct methods: electronic manometer, Systolic, diastolic pressure, Blood flow and cardiac output measurement: Indicator dilution, and dye dilution method, ultrasound blood flow measurement.

UNIT - V BIO-CHEMICAL MEASUREMENTS 9

Blood gas analyzers and Non-Invasive monitoring, colorimeter, Sodium Potassium Analyser, spectrophotometer, blood cell counter, auto analyzer (simplified schematic description).

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Leslie Cromwell, “Biomedical Instrumentation and Measurement”, Prentice Hall of India, reprint 2007.
2. Khandpur R.S, Handbook of Biomedical Instrumentation, Tata McGraw-Hill, 2nd edition, 2014

REFERENCES:

1. John G. Webster, Medical Instrumentation Application and Design, John Wiley and sons, 2015.
2. Khandpur, R.S., “Handbook of Analytical Instruments”, Tata McGraw-Hill publishing Co. Ltd., 3rd edition 2015.
3. Ed. Joseph D. Bronzino, The Biomedical Engineering Hand Book, 4th edition, Boca Raton, CRC Press LLC, 2015.
4. Braun, R.D., “Introduction to Instrumental Analysis”, Pharma Book Syndicate, Singapore, 2012.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : BIOMEDICAL INSTRUMENTATION AND MEASUREMENTS										Course Code : 20OE701				
CO	Course Outcomes										Unit	K-CO	POs	PSOs
CO1	Explain different bio potential and its propagation.										I	K2	1,2,8	1
CO2	Describe electrode placement for various physiological recording										II	K2	1,2,8	1
CO3	Explain design aspects of bio amplifier for various physiological recording										III	K2	1,2,8	1
CO4	Explain various techniques on non electrical physiological measurements										IV	K2	1,2,8	1
CO5	Explain about different biochemical measurements										IV	K2	1,2,8	1
CO6	Explain about various bio gas analyser										V	K2	1,2,8	1
CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO6	2	1	-	-	-	-	-	1	-	-	-	-	1	-

200E702	FUNDAMENTALS OF MEMS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To provide knowledge of semiconductors and solid mechanics to fabricate MEMS devices.
- To educate on the rudiments of Micro fabrication techniques.
- To introduce various sensors and actuators
- To introduce different materials used for MEMS
- To educate on the applications of MEMS

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Intrinsic Characteristics of MEMS – Energy Domains and Transducers- Sensors and Actuators –Introduction to Micro fabrication - Silicon based MEMS processes – New Materials – Review ofElectrical and Mechanical concepts in MEMS – Semiconductor devices – Stress and strain analysis –Flexural beam bending- Torsional deflection.

UNIT-II SENSORS FOR MEMS 9

Electrostatic sensors – Parallel plate capacitors – Applications – Piezoresistive sensors – Piezoresistive sensor materials - Stress analysis of mechanical elements –Applications to Inertia, Pressure, Tactile and Flow– Thermalexpansion – Thermal couples – Thermal resistors – Thermal Bimorph – Applications.

UNIT - III ACTUATORS FOR MEMS 9

Inter digitized Finger capacitor –Comb drive devices – Micro Grippers – Micro Motors - Thermal Sensing and Actuation – Piezoelectric actuators –piezoelectric effects – piezoelectric materials – Applications to Inertia , Acoustic, Tactile and Flow sensors– MagneticActuators – Micro magnetic components.

UNIT - IV MICRO MACHINING 9

Silicon Anisotropic Etching – Anisotropic Wet Etching – Dry Etching of Silicon – Plasma Etching –Deep Reaction Ion Etching (DRIE) – Isotropic Wet Etching – Gas Phase Etchants – Case studies - Basic surface micro machining processes – Structural and Sacrificial Materials – Acceleration of sacrificial Etch – Striction and Antistriction methods .

UNIT - V POLYMER AND OPTICAL MEMS 9

Polymers in MEMS– Polimide - SU-8 - Liquid Crystal Polymer (LCP) – PDMS – PMMA – Parylene – Fluorocarbon - Application to Acceleration, Pressure, Flow and Tactile sensors- Optical MEMS – Lenses and Mirrors – Actuators for Active Optical MEMS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Chang Liu, 'Foundations of MEMS', Pearson Education Inc., 2012.
2. Stephen D Senturia, 'Microsystem Design', Springer Publication, 2006.
3. Tai Ran Hsu, "MEMS & Micro systems Design and Manufacture" Tata McGraw Hill, 2002.

REFERENCES:

1. Nadim Maluf, " An Introduction to Micro Electro Mechanical System Design", Artech House, 2000.
2. Mohamed Gad-el-Hak, editor, " The MEMS Handbook", CRC press Baco Raton, 2001.
3. Julian w. Gardner, Vijay K. Varadan, Osama O.Awadelkarim, Micro Sensors MEMS and Smart Devices, John Wiley & Son LTD, 2002.
4. James J.Allen, Micro Electro Mechanical System Design, CRC Press Publisher, 2005.
5. Thomas M.Adams and Richard A.Layton, "Introduction MEMS, Fabrication and Application,"Springer, 2010.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : FUNDAMENTALS OF MEMS										Course Code : 20OE702				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Explain about use of semiconductors and solid mechanics to fabricate MEMS devices.									I	K2	1,2,8	1	
CO2	Explain about Micro fabrication techniques.									I	K2	1,2,8	1	
CO3	Explain about various electric sensors and actuators									II	K2	1,2,8	1	
CO4	Explain about various magnetic sensors and actuators									III	K2	1,2,8	1	
CO5	Describe about different materials used for MEMS									IV	K2	1,2,8	1	
CO6	Explain about various applications of MEMS									V	K2	1,2,8	1	
CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO6	2	1	-	-	-	-	-	1	-	-	-	-	1	-

200E703	ENERGY CONVERSION TECHNIQUES	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand Conventional energy conversion techniques
- To know about Direct energy conversion systems
- To know about need and necessity of energy storage systems
- To study desirable characteristics of Fuel cells.

PRE-REQUISITE: NIL

UNIT-I	CONVENTIONAL ENERGY CONVERSION CYCLES	9
	Reversible and irreversible cycles – Thermodynamics analysis of Carnot – Stirling – Ericsson – Otto – Diesel – Dual – Lenoir – Atkinson – Brayton - Rankine.	
UNIT-II	DIRECT CONVERSION OF THERMAL TO ELECTRICAL ENERGY	9
	Thermoelectric Converters –Thermionic converters – MHD – Ferro electric converter – Nernst effect generator	
UNIT - III	CHEMICAL & ELECTROMAGNETIC ENERGY TO ELECTRICAL ENERGY	9
	Batteries – types – working – performance governing parameters – hydrogen energy – solar photovoltaic cells	
UNIT - IV	ENERGY STORAGE SYSTEMS	9
	Energy Storage Technologies - Mechanical energy, Electrical energy, Chemical energy, Thermal energy.	
UNIT - V	FUEL CELLS	9
	Basics – types – working - comparative analysis – thermodynamics and kinetics of fuel cell process – performance of fuel cell – applications - advantages and drawbacks	

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Archie.W.Culp, Principles of Energy Conversion, McGraw-Hill Inc., 1991, Singapore
2. Kordesch. K, and Simader.G, Fuel Cell and Their Applications, Wiley-Vch, Germany 1996

REFERENCES:

1. Kettari, M.A.Direct Energy Conversion, Addison-Wesley Pub. Co 1997
2. Hart A.B and Womack, G.J.Fuel Cells: Theory and Application, Prentice Hall Ltd., 1989

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : ENERGY CONVERSION TECHNIQUES										Course Code : 20OE703				
CO	Course Outcomes										Unit	K-CO	POs	PSOs
CO1	Explain about operation of energy conversion cycles										I	K2	1,2,8	1
CO2	Explain Conventional energy conversion techniques										II	K2	1,2,8	1
CO3	Describe about Direct energy conversion systems										II	K2	1,2,8	1
CO4	Describe about chemical to electrical energy conversion systems										III	K2	1,2,8	1
CO5	Explain about need and necessity of energy storage systems										IV	K2	1,2,8	1
CO6	Explain about various types of fuel cells										V	K2	1,2,8	1
CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO6	2	1	-	-	-	-	-	1	-	-	-	-	1	-

20OE704	INSTRUMENTATION IN STEEL INDUSTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To acquire knowledge in steel making process.
- To understand the concepts of steel rolling.
- To know measurement of Process parameters in steel industries.
- To understand the control methods used in steel industries.
- To know about the computer controlled process in steel industries.

PRE-REQUISITE: NIL

UNIT-I	FLOW DIAGARM AND DESCRIPTION OF PROCESS	9
Raw materials preparation – Iron making blast furnaces – Stoves – Raw steel making – Basic Oxygen furnace – Electric furnace.		
UNIT-II	STEEL ROLLING METHODS	9
Casting of steel – Primary rolling – Cold rolling and finishing.		
UNIT - III	MEASUREMENTS AND INSTRUMENTATION IN STEEL PLANTS	9
Measurement of level-pressure – Density – Temperature – Flow weight – Thickness and shape – Graphic displays and alarms.		
UNIT - IV	CONTROL ASPECTS IN STEEL PLANTS	9
Blast furnace stove combustion control system – Gas and water controls in BOF – Stand casting mould level control.		
UNIT - V	COMPUTER APPLICATIONS	9
Model calculating and logging – Computer Control of Rolling mill– Computer Control of Annealing process – Center utilities dispatch computer.		

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Liptak, B.G., "Instrumentation in Processing Industries" Ghilton Book Co., 1973.

REFERENCES:

1. Considine, D.M., "Hand book of Applied Instrumentation", McGraw-Hill, 1984.
2. R.K.Jain, Mechanical and Industrial Measurements, Khanna Publishers, 6th reprint, 2003
3. D. P. Eckman, "Automatic Process control", 7th Edition, John Wiley, 2003.
4. Curtis D. Johnson, "Process Control Instrumentation Technology", 8th Edition, Pearson, 2015.

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : INSTRUMENTATION IN STEEL INDUSTRY										Course Code : 20OE704				
CO	Course Outcomes										Unit	K-CO	POs	PSOs
CO1	draw the PI&D diagram for steel process.										I	K2	1,2,8	1
CO2	describe steel making process.										II	K2	1,2,8	1
CO3	explain the concepts of steel rolling.										II	K2	1,2,8	1
CO4	explain measurement of Process parameters in steel industries.										III	K2	1,2,8	1
CO5	explain the control methods used in steel industries										IV	K2	1,2,8	1
CO6	explain computer controlled Process in steel industries										V	K2	1,2,8	1
CO-PO mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO2	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO3	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO4	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO5	2	1	-	-	-	-	-	1	-	-	-	-	1	-
CO6	2	1	-	-	-	-	-	1	-	-	-	-	1	-

20OE705	LOGIC AND DISTRIBUTED CONTROL SYSTEM	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To give an introductory knowledge on Programmable Logic Controller (PLC) and their programming languages
- To give adequate knowledge about applications of PLC
- To give basic knowledge about Computer Controlled Systems
- To give basic knowledge on the architecture and local control unit of Distributed Control System (DCS)
- To give basic knowledge in Advance Automation topics

PRE-REQUISITE: NIL

UNIT-I PLC & SCADA **9**
 PLC: Evolutions of PLCs – Programmable Controllers – Architecture, I/O modules – Comparative study of Industrial PLCs. SCADA: Remote terminal units- Master station - Communication architectures.

UNIT-II APPLICATIONS OF PLC **9**

Instructions in PLC – Program control instructions, math instructions, data manipulation Instructions, sequencer and shift register instructions .

UNIT - III DISTRIBUTED CONTROL SYSTEM **9**

. DCS – Various Architectures – Comparison – Local control unit – Process interfacing issues – Communication facilities

UNIT - IV INTERFACES IN DCS **9**

Operator interfaces – Low level and high level operator interfaces – Displays – Engineering interfaces – Low level and high level engineering interfaces – Factors to be considered in selecting DCS .

UNIT - V ADVANCED TOPICS IN AUTOMATION **9**

Introduction to Networked Control systems – Plant wide control – Internet of things – Cloud based Automation – OLE for Process Control– Case studies: PLC - SCADA - DCS.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. F.D. Petruzella, Programmable Logic Controllers, Tata Mc-Graw Hill, 5th edition, 2019
2. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co., 2016

REFERENCES:

- 1.T.A. Hughes, Programmable Controllers, 4th edition, ISA press, 2005
2. Krishna Kant, Computer Based Industrial Control, Second revised edition, Prentice Hall of India, New Delhi, 2011.
3. John W. Webb and Ronald A. Reis, 'Programmable Logic Controllers, 1st edition, Pearson Education India, New Delhi, 2015.
4. Clarke, G., Reynders, D. and Wright, E., "Practical Modern SCADA Protocols: DNP3,4. 60870.5 and Related Systems", Newnes, 1st edition, 2004.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : LOGIC AND DISTRIBUTED CONTROL SYSTEM										Course Code : 20OE705					
CO	Course Outcomes									Unit No	K-CO	POs	PSOs		
CO1	Explain architecture & components of PLC									I	K2	1,2	1,2		
CO2	Explain building blocks of computer-controlled systems and SCADA									I	K2	1,2	1,2		
CO3	Explain various instructions used in PLC									II	K2	1,2	1,2		
CO4	Develop ladder programming for industrial sequential applications.									III	K3	1,2	1,2		
CO5	Explain various architectures of DCS									IV	K2	1,2	1,2		
CO6	Discuss the application of automation tools in industries									V	K2	1,2	1,2		
CO-PO mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO4	3	2	-	-	-	-	-	-	-	-	-	-	1	1	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-

20OE706

INDUSTRIAL COMPUTER NETWORKS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To educate on the basic concepts of data networks
- To introduce the basics of internetworking and serial communication ports
- To provide details on HART and Field buses
- To educate on MODBUS, PROFIBUS and other communication protocol
- To introduce industrial Ethernet and wireless communication

PRE-REQUISITE: NIL

UNIT-I DATA NETWORK FUNDAMENTALS 9

Networks hierarchy and switching – Open System Interconnection model of ISO - Data link control protocol - Media access protocol - Command / response - Token passing -CSMA/CD, TCP/IP

UNIT-II INTERNET WORKING and RS 232, RS485 9

Bridges - Routers - Gateways - Standard ETHERNET and ARCNET configuration special requirement for networks used for control - RS 232, RS 485 configuration Actuator Sensor (AS) – interface, Device net

UNIT - III HART AND FIELD BUS 9

Introduction - Evolution of signal standard - HART communication protocol - HART networks - HART commands - HART applications - Fieldbus - Introduction - General Fieldbus architecture - Basic requirements of Fieldbus standard - Fieldbus topology - Interoperability - Interchangeability - Introduction to OLE for process control (OPC).

UNIT - IV MODBUS AND PROFIBUS PA/DP/FMS AND FF 9

MODBUS protocol structure - function codes – troubleshooting Profibus, Introduction, Profibus protocol stack, Profibus communication model - communication objects - system operation -troubleshooting - review of foundation fieldbus - Data Highway

UNIT - V INDUSTRIAL ETHERNET AND WIRELESS COMMUNICATION 9

Industrial communication, Introduction, components of radio link - radio spectrum and frequency allocation - radio MODEMs-Introduction to wireless HART and ISA100.ustrial Ethernet, Introduction, 10 Mbps Ethernet, 100 Mbps Ethernet - Radio and wireless

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Behrouz Forouzan, Data Communications & Networking, 5th edition, TMG, 2017.
2. Steve Mackay, Edwin Wrijut, Deon Reynders, John Park, Practical Industrial Data Networks Design, Installation and Troubleshooting' Newnes Publication, Elsevier 1st edition, 2004

REFERENCES:

1. Andrew S. Tanenbaum, David J. Wetherall, Computer Networks, Pearson Education India 5th Edition. 2013.
2. Theodore S Rappaport, Wireless Communication: Principles and Practice, Pearson Education India, 2nd Edition, 2010.
3. William Stallings, Wireless Communication & Networks, Practice, Pearson Education India, 2nd Edition, 2013.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : INDUSTRIAL COMPUTER NETWORK		Course Code : 20OE706													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO1	Explain the basic concepts of data communication and its	I	K2	1,2	1,2										
CO2	Explain configurations of various internetworking devices	II	K2	1,2	1,2										
CO3	Explain the various communication protocols used in process industries.	III	K2	1,2	1,2										
CO4	Explain the architecture of field bus used in process industries.	III	K2	1,2	1,2										
CO5	Discuss the operation of various protocols & its applications.	IV	K2	1,2	1,2										
CO6	Explain different Ethernet protocol and wireless communication networks used in Industrial process applications.	V	K2	1,2	1,2										
CO-PO mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	2	2	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	2	2	
CO3	2	1	-	-	-	-	-	-	-	-	-	-	2	2	
CO4	2	1	-	-	-	-	-	-	-	-	-	-	2	2	
CO5	2	1	-	-	-	-	-	-	-	-	-	-	2	2	
CO6	2	1	-	-	-	-	-	-	-	-	-	-	2	2	

200E707

MODERN ELECTRONIC INSTRUMENTATION

L	T	P	C
3	0	0	3

OBJECTIVES:

- To impart knowledge on Electronic Instruments used in real life applications.
- To familiarize various types of oscilloscopes and analysers
- To understand the concepts and syntax for VI and to develop simple VI programs.
- To know about various telemetry systems

PRE-REQUISITE: NIL

UNIT-I ELECTRONIC INSTRUMENTS 9

Introduction to measurement system - Electronic Voltmeter and their advantages – Types, Differential amplifier, source follower, rectifier – True rms reading voltmeter – Electronic multimeter and ohmmeter – Current measurement – Power measurement - Q meter

UNIT-II CRO OSCILLOSCOPE & SIGNAL ANALYZERS 9

General purpose cathode ray oscilloscope – Dual trace, dual beam and sampling oscilloscopes– Analog and digital storage oscilloscope - frequency selective and heterodyne wave analyzer – Harmonic distortion analyzer – Spectrum analyzer.

UNIT - III VIRTUAL INSTRUMENTATION 9

Virtual instrumentation (VI) – Definition, flexibility – Block diagram and architecture of virtual instruments – Virtual instruments versus traditional instruments – Software in virtual Instrumentation - DAQ cards for VI applications –DAQ modules with serial communication

UNIT - IV VI PROGRAMMING 9

Concept of VIs and sub VI – Data types – Display types – Digital – Analog – Chart – Graphs- Oscilloscopic types – Loops – Case and sequence structures – Arrays and Cluster- Array function – Formulae nodes – Local and global variables.

UNIT - V TELEMETRY 9

General telemetry system – voltage, current and position telemetry systems – Radio frequency telemetry – Frequency modulation, pulse-amplitude modulation and pulse-code modulation telemetry – Frequency and time multiplexing

TOTAL: 45 PERIODS

TEXT BOOKS:

1. A.K. Sawhney, "A Course in Electrical and Electronic Measurements and Instrumentation", Dhanpat Rai & Co. (P) Limited, 2015.
2. Jovitha Jerome, "Virtual Instrumentation Using Labview", PHI learning Pvt.Ltd,2010.

REFERENCES:

1. David A. Bell, "Electronic Instrumentation and measurements", 2nd Edition, 2003
2. A.D.Helfrick, W.D.Cooper, "Modern Electronic Instrumentation & Measurement Techniques", Prentice Hall of India, 2010.
- 3.Kalsi H.S, Electronic Instrumentation, 2nd Edition, Tata Mc Graw Hill Company, 2004
4. Sanjay Gupta, "Virtual Instrumentation using Lab view", Tata McGraw-Hill Education,2010

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : MODERN ELECTRONIC INSTRUMENTATION										Course Code : 20OE707					
CO	Course Outcomes									Unit	K-CO	POs	PSOs		
CO1	Explain construction and working of Electronic Instruments									I	K2	1,2	1,2		
CO2	Discuss the working of various types of oscilloscopes and analysers									II	K2	1,2	1,2		
CO3	Explain the concepts of Virtual instrumentation									III	K2	1,2	1,2		
CO4	Explain DAQ system in VI									IV	K2	1,2	1,2		
CO5	Develop simple VI programs in LabVIEW environment									IV	K3	2,3,5,12	1,2		
CO6	Explain working principles of various telemetry systems									V	K2	1,2,10	1,2		
CO-PO mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	1	-	-	-	-	-	-	--	-	-	-	1	1	-
CO2	2	1	-	-	-	-	-	-	--	-	-	-	1	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	--	1	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO5	3	2	1	-	1	-	-	-	-	-	-	1	1	1	-
CO6	2	1	-	-	-	-	-	-	--	1	-	-	1	1	-

200E708	INSTRUMENTATION FOR AGRO FOOD INDUSTRY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore scope of Instrumentation in agriculture field
- To know difference between continuous and batch process
- To Know greenhouse automation schemes
- To Understand sensors used in agriculture field.
- To Understand Instrumentation at weather monitoring stations

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION 9

Necessity of instrumentation & control for agriculture, engineering properties of soil: fundamental definitions & relationships, index properties of soil, permeability & seepage analysis, shear strength - Sensors: introduction to sonic anemometers, hygrometers, fine wire thermocouple

UNIT-II INSTRUMENTATION IN PROCESS INDUSTRY 9

Flow diagram of sugar plant & instrumentation set up for it, flow diagram of fermenter & control (batch process), flow diagram of dairy industry & instrumentation set up for it, juice extraction control process & instrumentation set up for it.

UNIT - III FOOD PROCESSING 9

Definition-Properties of foods and processing theory-Ambient Temperature Processing- Processing using electric fields, high hydrostatic pressure, light or ultra sound-Blanching – Heat sterilization- Dehydration- Baking and roasting – Chilling- Freezing – Post Processing operations- Coating- packing – filling and sealing of containers – Material handling.

UNIT - IV INSTRUMENTATION IN IRRIGATION AND GREEN HOUSE SYSTEM 9

Irrigation systems: necessity, irrigation methods: overhead, centre pivot, lateral move, micro irrigation systems, soil moisture measurement methods: resistance based method, voltage based method, thermal based method, Application of SCADA for DAM parameters & control. Green houses & instrumentation: ventilation, cooling & heating, wind speed, temperature & humidity, rain gauge carbon dioxide enrichment measurement & control.

UNIT - V INSTRUMENTS IN AGRICULTURE 9

Automation in earth moving equipments & farm equipments, implementation of hydraulic, pneumatic & electronics control circuits in harvesters cotton pickers, tractor etc. classification of pumps: pump characteristics, pump selection & installation. Agro metrological instrumentation weather stations, surface flux measurement, soil water content measurement.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. B.C. Nakra and K.K. Chaudhary, "Instrumentation Measurement and Analysis", Tata Mc Graw Hill, 2016.
2. P. Fellows, "Food Processing Technology Principles and Practice," 2nd edition, CRC press 2000

REFERENCES:

1. Bela G. Liptak, "Instrument Engineers' Handbook, Process Control and Optimization", CRC Press; 4th edition, 2012.
2. Robert H. Brown, "CRC Handbook of Engineering in Agriculture, Volume II: CRC Press; 1st edition, 1988.
3. D. Patranabis, "Principles of Industrial instrumentation" TMH, 2010.
4. Michael. A.M, "Irrigation : Theory and Practice", Vikas Publishing House Pvt Ltd, 2nd edition 2008.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : INSTRUMENTATION FOR AGRO FOOD INDUSTRY		Course Code : 200E708													
CO	Course Outcomes	Unit	K-CO	POs	PSOs										
CO1	Explain soil properties and sensors used for	I	K2	1,2	1,2										
CO2	Explain continuous and batch process.	II	K2	1,2	1,2										
CO3	Discuss various food Processing methods	III	K2	1,2	1,2										
CO4	Explain design aspects an automation scheme	IV	K2	1,2	1,2										
CO5	Explain various irrigation methods.	IV	K2	1,2	1,2										
CO6	Discuss the role of instrumentation in Agriculture	V	K2	1,2	1,2										
CO-PO mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO2	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO3	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO4	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-
CO6	2	1	-	-	-	-	-	-	-	-	-	-	1	1	-

20OE801	LINEAR ALGEBRA AND NUMBER THEORY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the basic concepts of vector space, linear transformations and diagonalization.
- To apply the concept of inner product spaces in orthogonalization.
- To Understand the basic concept of Number Theory.

PRE-REQUISITE: NIL

UNIT - I VECTOR SPACES 9

Vector spaces – Subspaces – Linear combinations and linear system of equations – Linear independence and linear dependence – Bases and dimensions.

UNIT - II LINEAR TRANSFORMATION AND DIAGONALIZATION 9

Linear transformation - Null spaces and ranges - Dimension theorem - Matrix representation of a linear transformations – Eigen values and eigenvectors – Diagonalizability.

UNIT - III INNER PRODUCT SPACES 9

Inner product, norms - Gram Schmidt orthogonalization process - Adjoint of linear operations - Least square approximation.

UNIT - IV DIVISIBILITY THEORY AND CONGRUENCES 9

Division algorithm –Prime and composite numbers – GCD – Euclidean algorithm – Fundamental Theorem of arithmetic– LCM- Linear Diophantine equations -Congruences – Linear Congruence’s- Modular exponentiation-Chinese remainder theorem.

UNIT - V THREE CLASSICAL THEOREMS 9

Wilson’s theorem – Fermat’s little theorem – Euler’s theorem – Euler’s Phi functions – Tau and Sigma functions.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Friedberg, A.H., Insel, A.J. and Spence, L., “Linear Algebra”, Prentice Hall of India, New Delhi,2004.
2. Koshy, T., Elementary Number Theory with Applications, Elsevier Publications, New Delhi, 2002

REFERENCES:

1. James. G. , "Advanced Modern Engineering Mathematics", Pearson Education, 4th Edition, 2016.
2. Lay.D.C., "Linear Algebra and it's a Applications", Pearson Education, 5th Edition, 2018.
3. Niven, I., Zuckerman.H.S., and Montgomery, H.L., An Introduction to Theory of Numbers, 5th Edition, John Wiley and Sons , Singapore, 2004.

OUTCOMES:

AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:

Course Name : ADVANCED CALCULUS										Course Code : 24BS201				
CO	Course Outcomes									Unit	K –CO	POs	PSOs	
CO1	Apply the concepts of Vector space to determine bases and dimensions									I	K3	1,2,3		
CO2	Determine Eigen values and Eigen vectors using Linear transformations									II	K3	1,2,3		
CO3	Construct the least square fit and orthonormal basis for an inner product space by using Gram-Schmidt process									III	K3	1,2,3.		
CO4	Apply Euclidean algorithm to find GCD of two integers.									IV	K3	1,2,3		
CO5	Solve Linear Diophantine equations and Congruence's of various types and its applications									IV	K3	1,2,3		
CO6	Apply Wilson's , Fermat's little and Euler's theorem to establish congruences with a prime modulus and establishing properties									V	K3	1,2,3		
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO5	3	2	1	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	-	-	-	-	-	-	-

20OE802	COMMUNICATION AND EMPLOYABILITY SKILLS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To outline the importance of Employability Skills for the current job market and future of work.
- To list different learning and employability related portals and their usage, trends, required skills and the available opportunities.
- To highlight the importance of practicing 21st century skills like Self-Awareness, Behavior Skills, time management, critical and adaptive thinking, problem-solving, creative thinking, social and cultural awareness, emotional awareness, learning to learn etc. in personal or professional life
- To demonstrate how to communicate effectively using digital devices, verbal and nonverbal communication etiquette and draft professional CV and prepare for an interview.
- To describe the types of entrepreneurship and apprenticeship opportunities, identify potential business and relevant regulatory customers.

PRE-REQUISITE: NIL

UNIT-I Introduction to Employability Skills 9
 Employability Skills - Significance - Competent Skills - Professional Approaches –Acquiring Job Requirements.

UNIT-II Career Development & Goal Setting for 21st Century Professional 9
 Self-Awareness - Behavior Skills - Positive Attitude - Self-Motivation - Problem-Solving - Creative Thinking - Time Management - Social and Cultural Awareness - Emotional Awareness - Continuous Learning Mindset etc.

UNIT-III Essential Digital Skills /Communication Skills 9
 Operation of Digital Devices – Utility of Digital Applications – Secure and Safe Use of Internet and Social Media Platforms - Basic English Phrases or Sentences - Corporate Manners while Communicating – Team Etiquettes.

UNIT- IV Entrepreneurship &Customer Service 9
 Identify and Assess Opportunities for Potential Business - Identify Monetary Sources – Meeting and Overcoming Financial Challenges - Identify Different Types of Customers and Needs - Addressing the Customers Appropriately - Follow Appropriate Grooming Standards.

UNIT-V Getting Ready for Apprenticeship & Jobs 9
 Create a Basic Resume / CV - Search for Suitable Jobs and Apply - Identify and Register Apprenticeship Opportunities.

TOTAL: 45 PERIODS

Text Books:

1. Professional Skills for 21st Century : A Key to Success, Vitthal Gore, Blue rose Publishers Pvt. Ltd. ISBN: 9789358192049, Edition: First, 2023
2. The Ultimate Guide to 21st Century Careers, Richa Dwivedi, 2017, ISBN 9789351951469

Digital References

1. <https://www.rasmussen.edu/student-experience/college-life/21st-century-skills/>
2. <https://www.magnifylearningin.org/employability-21st-century-skills-in-a-pbl>
3. <https://www.edalex.com/guides/21st-century-skills-what-they-are-why-important/>

OUTCOMES:**AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name : COMMUNICATION AND EMPLOYABILITY SKILLS							Course Code : 20OE802								
CO	Course Outcomes						Unit	K –CO	POs	PSOs					
CO1	Learn the importance of Employability Skills in meeting the job requirements						I	K3	9,10,12						
CO2	Identify well-defined short- and long-term goals relevant for 21 st century employment.						II	K3	9,10,12						
CO3	Demonstrate how to operate and use the associated applications and features, safely and securely						III	K3	9,10,12						
CO4	Enhance the importance of communication etiquette and use various sources to search and apply for jobs.						IV	K5	9,10,12						
CO5	Identify different types of customers, and respond to them in a professional manner.						V	K3	9,10,12						
CO6	Communicate properly, manage customers and time, and prove to be a successful Entrepreneur.						I-V	K3	9,10,12						
CO-PO Mapping															
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	
CO1	-	-	-	-	-	-	-	-	2	3	-	2	-	-	
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	-	
CO3	-	-	-	-	-	-	-	-	2	3	-	2	-	-	
CO4	-	-	-	-	-	-	-	-	2	3	-	2	-	-	
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	-	
CO6	-	-	-	-	-	-	-	-	2	3	-	2	-	-	

200E803	ENGLISH FOR RESEARCH PAPER WRITING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand that how to improve your writing skills and level of readability.
- To learn about what to write in each section.
- To understand the skills needed when writing a Title
- To ensure the good quality of paper at very first time submission
- To make them Ready for effective research presentations

PRE-REQUISITE: NIL

UNIT-I Building Sentences	9
Planning and Preparation, Word Order & Breaking up Long Sentences, Structuring Sentences and Paragraphs.	
UNIT-II The Essentials of Scholarly Communication	9
Being Concise, Avoiding Redundancy, Ambiguity and Vagueness, Literature Survey - Highlighting your Findings, Hedging, Paraphrasing and Plagiarism.	
UNIT-III Anatomy of a Research Paper	9
Sections of a Paper – Abstract, Introduction, etc. Review of the Literature, Writing - Methods, Results, Discussion, Conclusions and Final Check.	
UNIT- IV The Foundation of a Research Paper	9
Writing – Title, Abstract and Introduction, Review of Literature and Methods.	
UNIT-V Citation Styles	9
Useful Phrases and Punctuation, In-Text Citation and Bibliography – MLA/APA Styles.	

TOTAL: 45 PERIODS

Text Books:

3. Adrian Wallwork, English for Writing Research Papers, Springer New York Dordrecht Heidelberg, London, 2011.
4. Day R. How to Write and Publish a Scientific Paper, Cambridge University Press, 2006.
5. Goldbort R. Writing for Science, Yale University Press, 2006.
6. Highman N. Handbook of Writing for the Mathematical Sciences, SIAM.Highman's book, 1998.

Digital References

4. <https://www.enago.com/academy/how-to-write-research-paper/>
5. <https://www.grammarly.com/blog/how-to-write-a-research-paper/>
6. <https://www.youtube.com/watch?v=AfcVdLqvIM0>
7. <https://www.youtube.com/watch?v=-kguil17880>
8. <https://pitt.libguides.com/citationhelp/ieee>

**OUTCOMES:
AT THE END OF THE COURSE, LEARNERS WILL BE ABLE TO:**

Course Name :English for Research Paper Writing										Course Code : 20OE803				
CO	Course Outcomes									Unit	K –CO	POs	PSO	
CO1	Demonstrate writing meaningful sentences and coherent paragraphs.									I	K3	9,10,12	-	
CO2	Show conciseness, clarity and avoid redundancy in writing.									II	K3	9,10,12	-	
CO3	Summarize, evaluate literature, and write methodology, results and conclusion.									III	K3	9,10,12	-	
CO4	Describe how to develop title, write abstract and introduction									IV	K3	9,10,12	-	
CO5	Apply correct style of referencing and use punctuation appropriately.									V	K3	9,10,12	-	
CO6	Analyze and evaluate the concepts and represent concepts in scholarly language									I-V	K3	9,10,12	-	
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	-	-	-	-	-	-	-	-	2	3	-	2	-	-
CO2	-	-	-	-	-	-	-	-	2	3	-	2	-	-
CO3	-	-	-	-	-	-	-	-	2	3	-	2	-	-
CO4	-	-	-	-	-	-	-	-	2	3	-	2	-	-
CO5	-	-	-	-	-	-	-	-	2	3	-	2	-	-
CO6	-	-	-	-	-	-	-	-	2	3	-	2	-	-

200E901	DATA SCIENCE USING PYTHON	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basic concepts of python programming.
- To Handle the file and exception
- To Learn Numpy
- To learn data manipulation with pandas
- To Understand Data cleaning Techniques
- To gain knowledge on data preparation

PRE-REQUISITE: NIL

UNIT I	INTRODUCTION TO DATA SCIENCE AND PYTHON PROGRAMMING	9
	Introduction to Data Science - Why Python? - Essential Python libraries - Python Introduction- Features, Identifiers, Reserved words, Indentation, Comments, Built-in Data types and their Methods: Strings, List, Tuples, Dictionary, Set - Type Conversion- Operators. Decision Making- Looping- Loop Control statement- Math and Random number functions. User defined functions - function arguments & its types	
UNIT II	FILE, EXCEPTION HANDLING AND OOP	9
	User defined Modules and Packages in Python- Files: File manipulations, File and Directory related methods - Python Exception Handling.OOPs Concepts -Class and Objects, Constructors – Data hiding- Data Abstraction- Inheritance.	
UNIT III	INTRODUCTION TO NUMPY	9
	NumPy Basics: Arrays and Vectorized Computation- The NumPyndarray- Creating ndarrays- Data Types for ndarrays- Arithmetic with NumPy Arrays- Basic Indexing and Slicing - Boolean Indexing-Transposing Arrays and Swapping Axes.Universal Functions: Fast Element-Wise Array Functions- Mathematical and Statistical Methods-Sorting Unique and Other Set Logic.	
UNIT IV	DATA MANIPULATION WITH PANDAS	9
	Introduction to pandas Data Structures: Series, Data Frame, Essential Functionality: Dropping Entries Indexing, Selection, and Filtering- Function Application and Mapping- Sorting and Ranking. Summarizing and Computing Descriptive Statistics- Unique Values, Value Counts, and Membership. Reading and Writing Data in Text Format.	
UNIT V	DATA CLEANING, PREPARATION AND VISUALIZATION	9
	Data Cleaning and Preparation: Handling Missing Data - Data Transformation: Removing Duplicates, Transforming Data Using a Function or Mapping, Replacing Values, Detecting and Filtering Outliers- String Manipulation: Vectorized String Functions in pandas. Plotting with pandas: Line Plots, Bar Plots, Histograms and Density Plots, Scatter or Point Plots.	

TOTAL: 45 PERIODS

TEXT BOOKS

1. Y. Daniel Liang, "Introduction to Programming using Python", Pearson,2012.
2. Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython", O'Reilly, 2nd Edition,2018.
3. Jake VanderPlas, "Python Data Science Handbook: Essential Tools for Working with Data", O'Reilly, 2017

REFERENCES:

1. Wesley J. Chun, "Core Python Programming", Prentice Hall,2006.
2. Mark Lutz, "Learning Python", O'Reilly, 4th Edition, 2009.

Course Name: DATA SCIENCE USING PYTHON		CourseCode:20OE901												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Explain the basic problems using Python built-in data types and their methods	I	K2	1,2,8,12	1									
CO2	Describe the user-defined modules and packages using OOP concept	II	K2	1,2,8,12	1									
CO3	Explain about data operations using NumPy arrays	III	K2	1,2,5,12	1									
CO4	Apply the concepts of Pandas data Series and Data Frame to display datas	IV	K3	1,2,3,5,12	1									
CO5	Explain the data preprocessing modules using Pandas	V	K2	1,2,5,12	1									
CO6	Describe the data visualization methods using Pandas	V	K2	1,2,5,8,12	1									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	-	-	-	1	2	-
CO2	2	1	-	-	-	-	-	1	-	-	-	1	2	-
CO3	2	1	-	-	1	-	-	-	-	-	-	1	2	-
CO4	3	2	1	-	1	-	-	-	-	-	-	1	2	-
CO5	2	1	-	-	1	-	-	-	-	-	-	1	2	-
CO6	2	1	-	-	1	-	-	1	-	-	-	1	2	-

200E902	INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To explore the need of Artificial Intelligence.
- To provide knowledge of AI systems and its variants.
- To Investigate the role of data science.
- To Work with data pre-processing methods
- To Work with data analytics methods

PRE-REQUISITE: NIL

UNIT I INTRODUCTION TO AI 9

Introduction–Definition - Future of Artificial Intelligence – Characteristics of Intelligent Agents–Typical Intelligent Agents – Problem Solving Approach to Typical AI problems

UNIT II KNOWLEDGE REPRESENTATION 9

Problem solving Methods - Search Strategies- Uninformed - Informed - Heuristics - Local Search Algorithms and Optimization Problems - Searching with Partial Observations – Constraint Satisfaction Problems

UNIT III INTRODUCTION TO DATA SCIENCE 9

Introduction– Evolution of Data Science – Data Science Roles – Stages in a Data Science Project – Applications of Data Science in various fields – Data Security Issues

UNIT IV DATA COLLECTION AND DATA PRE-PROCESSING 9

Data Collection Strategies – Data Pre-Processing Overview – Data Cleaning – Data Integration and Transformation – Data Reduction – Data Discretization.

UNIT V EXPLORATORY DATA ANALYTICS 9

Descriptive Statistics – Mean, Standard Deviation, Skewness and Kurtosis – Box Plots – Pivot Table – Heat Map – Correlation Statistics – ANOVA

TOTAL: 45 PERIODS

TEXT BOOKS

1. S. Russell and P. Norvig, "Artificial Intelligence: A Modern Approach", Prentice Hall, Fourth Edition, 2021.
2. Bratko, —Prolog: Programming for Artificial Intelligence, Fourth edition, Addison-Wesley Educational Publishers Inc., 2011.
3. JojoMoolayil, "Smarter Decisions : The Intersection of IoT and Data Science", PACKT, 2016
4. Cathy O’Neil and Rachel Schutt , "Doing Data Science", O’Reilly, 2015

REFERENCES:

1. Husain, Amir. The sentient machine: The coming age of artificial intelligence. Simon and Schuster, 2017
2. Kaplan, Jerry. Artificial intelligence: What everyone needs to know. Oxford University Press, 2016
3. David Dietrich, Barry Heller, Beibei Yang, "Data Science and Big data Analytics", EMC 2013
4. Raj, Pethuru, "Handbook of Research on Cloud Infrastructures for Big Data Analytics", IGI Global

Course Name: INTRODUCTION TO ARTIFICIAL INTELLIGENCE AND DATA SCIENCE										Course Code:20OE902				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Understand the characteristics of intelligent agents									I	K2	1,2,9,10,12	1	
CO2	Classify searching algorithm in AI									II	K3	1,2,3,9,10,12	1	
CO3	Describe various knowledge representation methods									II	K2	1,2,4,9,10,12	1	
CO4	Examine the basics of data science									III	K3	1,2,3,9,10,12	2	
CO5	Apply the concepts of Data Collection and Data Pre-Processing									IV	K3	1,2,3,9,10,12	2	
CO6	Demonstrate exploratory data analytics									V	K3	1,2,3,9,10,12	2	
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	3	2	-	2	3	-
CO2	3	2	1	-	-	-	-	-	3	2	-	2	3	-
CO3	2	1	-	-	-	-	-	-	3	2	-	2	3	-
CO4	3	2	1	-	-	-	-	-	3	2	-	2	-	3
CO5	3	2	1	-	-	-	-	-	3	2	-	2	-	3
CO6	3	2	1	-	-	-	-	-	3	2	-	2	-	3

200E903	MOBILE APP DEVELOPMENT AND ITS APPLICATION	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand system requirements for mobile applications
- Generate suitable design using specific mobile development frameworks
- Generate mobile application design
- Implement the design using specific mobile development frameworks
- Deploy the mobile applications in market place for distribution

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO MOBILE APPLICATIONS 9

WebVsmobileApp–CostofDevelopment–Myths-MobileApplications–Marketing-MobileUserInterfaceDesign-EffectiveUseofScreen–MobileUsers-MobileInformationDesign-MobilePlatforms -Tools of Mobile Interface Design

UNIT- II ANDROID USER INTERFACE DESIGN 9

Android Architecture–Android SDK Tools – Application Components-Intents –Content providers-Broadcast receivers–Services- User Interface Design -Views –View Groups–Layouts-Event Handling–Listeners–Adapters–Menus- Action Bars–Notifications-Android Localization

UNIT- III ANDROID DATA STORAGE 9

Content Providers–Uri –CRUD access–Browser–Call Log–Contacts–Media Store-Data Access and

Storage-SharedPreferences–StorageExternal-NetworkConnection-SQLiteDatabases

UNIT-IV ANDROID NATIVE CAPABILITIES 9

Camera–Audio-SensorsandBluetooth-Playingaudio/video-Mediarecording-Sensors-Listeningto

sensor readings – Bluetooth - Android Communications – GPS - Working with Location Manager, Working with Google Maps extensions - Maps via intent - Map Activity - Location based Services –LocationUpdates-LocationProviders-SelectingaLocationProvider-Finding Location

UNIT-V IOS DESIGN 9

iPhoneCraze–iOSFeatures–iOSTools-iOSProject–ObjectiveCBasics–BuildingiOSApp–ActionsandOutlets–Delegates-UserInterfaceElements–Accelerometer–LocationHandling-SQLiteDatabase

TOTAL:45PERIODS

TEXTBOOK

1.JeffMcWherterandScottGowell,"ProfessionalMobileApplicationDevelopment",Wrox,2012.

REFERENCES

1. RetoMeier,“Professional Android for Development”,JohnWileyandSons,2012.
2. DavidMark,JackNutting,JeffLaMarcheandFredericOlsson,“BeginningiOS6Development:ExploringtheiOSDK”,Apress,2013.

Course Name: MOBILE APP DEVELOPMENT AND ITS APPLICATION										Course Code:20OE903				
CO	Course Outcomes									Unit	K-CO	POs	PSOs	
CO1	Understand the requirements for mobile applications									I	K2	1,2,9,10,12	-	
CO2	Describe user interface for mobile applications									II	K3	1,2,3,9,10,12	-	
CO3	Store mobile data of android applications									III	K2	1,2,9,10,12	-	
CO4	Native capabilities of android applications									IV	K2	1,2,9,10,12	-	
CO5	Describe iOS applications with tools									V	K3	1,2,3,9,10,12	-	
CO6	Classify Mobile App using android and ios platforms									V	K3	1,2,3,9,10,12	-	
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO3	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO4	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO5	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	-	-

200E904	FOUNDATION OF ROBOTICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To study the kinematics, drive systems and programming of robots.
- To study the basics of robot laws and transmission systems.
- To familiarize students with the concepts and techniques of robot manipulator, its kinematics.
- To familiarize students with the various Programming and Machine Vision application in robots.
- To build confidence among students to evaluate, choose and incorporate robots in engineering systems

PRE-REQUISITE: NIL

UNIT - I	FUNDAMENTALS OF ROBOT	9
Robot – Definition – Robot Anatomy – Co-ordinate systems, Work Envelope, types and classification – specifications – Pitch, yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and their functions – Need for Robots – Different Applications		
UNIT - II	ROBOT KINEMATICS	9
Forward kinematics, inverse kinematics and the difference: forward kinematics and inverse Kinematics of Manipulators with two, three degrees of freedom (in 2 dimensional), four degrees of freedom (in 3 dimensional) – derivations and problems.		
UNIT- III	ROBOT DRIVE SYSTEMS AND END EFFECTORS	9
Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of All These Drives. End Effectors – Grippers		
UNI - IV	SENSORS IN ROBOTICS	9
Force sensors, touch and tactile sensors, proximity sensors, non-contact sensors, safety considerations in robotic cell, proximity sensors, fail safe hazard sensor systems, and compliance mechanism. Machine vision system - camera, frame grabber, sensing and digitizing image data – signal conversion, image storage, lighting techniques, image processing and analysis		
UNIT - V	PROGRAMMING AND APPLICATIONS OF ROBOT	9
Teach pendant programming, lead through programming, robot programming languages – VAL programming – Motion Commands, Sensors commands, End-Effector Commands, and simple programs - Role of robots in inspection, assembly, material handling, underwater, space and medical fields.		

TOTAL: 45 PERIODS

TEXT BOOKS

1. Ganesh.S.Hedge, "A textbook of Industrial Robotics", Lakshmi Publications, 2006.
2. Mikell.P.Groover , "Industrial Robotics – Technology, Programming and applications" McGraw Hill 2ND edition 2012.

REFERENCES:

1. Fu K.S. Gonalz R.C. and ice C.S.G."Robotics Control, Sensing, Vision and Intelligence", McGraw Hill book co. 2007.
2. YoramKoren, "Robotics for Engineers", McGraw Hill Book, Co., 2002.
3. Janakiraman P.A., "Robotics and Image Processing", Tata McGraw Hill 2005.
4. John. J.Craig, "Introduction to Robotics: Mechanics and Control" 2nd Edition, 2002.
5. Jazar, "Theory of Applied Robotics: Kinematics, Dynamics and Control", Springer India reprint, 2010.

Course Name: FOUNDATION OF ROBOTICS									Course Code:20OE904						
CO	Course Outcomes								Unit	K-CO	POs			PSOs	
CO1	Understand the features of robots and technology involved in the control.								I	K2	1,2,9,10,12			1	
CO2	Describe the basic engineering knowledge for Robot Kinematics								II	K3	1,2,3,9,10,12			1	
CO3	Apply various concepts like configurations, End effectors and grippers								III	K3	1,2,3,9,10,12			1	
CO4	Classify different sensors in robots.								IV	K3	1,2,3,9,10,12			1	
CO5	Demonstrate the image processing and image analysis techniques								IV	K3	1,2,3,9,10,12			1	
CO6	Acquire knowledge of programming languages and applications of Robot								V	K3	1,2,3,9,10,12			1	
CO-PO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	1	-	-	-	-	-	-	2	2	-	2	3	-	
CO2	3	2	1	-	-	-	-	-	2	2	-	2	3	-	
CO3	3	2	1	-	-	-	-	-	2	2	-	2	3	-	
CO4	3	2	1	-	-	-	-	-	2	2	-	2	3	-	
CO5	3	2	1	-	-	-	-	-	2	2	-	2	3	-	
CO6	3	2	1	-	-	-	-	-	2	2	-	2	3	-	

200E905

**ARTIFICIAL NEURAL NETWORK AND
APPLICATIONS**

L	T	P	C
3	0	0	3

OBJECTIVES:

1. Study the concepts of Artificial Intelligence.
2. Learn the methods of solving problems using Artificial Intelligence.
3. Introduce the concepts of ANN.

PRE-REQUISITE:NIL

UNIT-I INTRODUCTION TO ANN

9

Features , structure and working of Biological Neural Network , Trends in Computing Comparison of BNN and ANN

UNIT- II BASICS OF ARTIFICIAL NEURAL NETWORKS

9

History of neural network research, characteristics of neural networks terminology, models of neuron McCulloch – Pitts model, Perceptron, Adaline model, Basic learning laws, Topology of neural network architecture

UNIT- III BACK PROPAGATION NETWORKS : (BPN)

9

Architecture of feed forward network, single layer ANN, multilayer perceptron, back propagation learning, input - hidden and output layer computation, back propagation algorithm, applications, selection of tuning parameters in BPN, Numbers of hidden nodes, learning.

**UNIT-IV BASIC FUNCTIONAL UNITS OF ANN FOR PATTERN
RECOGNITION TASKS**

9

Basic feedforward, Basic feedback and basic competitive learning neural network. Pattern association, pattern classification and pattern mapping tasks

UNIT-V APPLICATIONS OF ANN

9

Pattern classification – Recognition of Olympic games symbols, Recognition of printed Characters. Neocognitron – Recognition of handwritten characters.NET Talk: to convert English text to speech. Recognition of consonant vowel(CV) segments, texture classification and segmentation

TOTAL:45PERIODS

TEXTBOOK

1. B. Yegnanarayana - Artificial neural network PHI Publication.
2. S. Raj sekaran, VijayalakshmiPari - Neural networks, Fuzzy logic and Genetic Algorithms
3. Kevin L. Priddy, Paul E. Keller – Artificial neural networks: An Introduction - SPIE Press, 2005

REFERENCES

1. Mohammad H. Hassoun – Fundamentals of artificial neural networks - MIT Press ,1995
2. Nelson Morgan – Artificial neural network: Electronic Implementations – IEEE Press, 1990
3. Journal of Artificial neural networks, Volume 1 – Ablex Publishing corporation , 1994

Course Name: ARTIFICIAL NEURAL NETWORK AND APPLICATIONS								Course Code:20OE905						
CO	Course Outcomes							Unit	K-CO	POs			PSOs	
CO1	Organize synaptic connectivity as the basis of neural computation and learning							I	K3	1,2,3,9,10,12			1	
CO2	Understand the ideological basics of artificial neural networks							II	K2	1,2,9,10,12			1	
CO3	Apply the back propagation algorithm in ANN							III	K3	1,2,3,9,10,12			1	
CO4	Identify the different structures of artificial neural networks.							IV	K3	1,2,3,9,10,12			1	
CO5	Explain functional units of ANN for pattern recognition							IV	K3	1,2,3,9,10,12			1	
CO6	Describe various application of artificial neural networks							V	K3	1,2,3,9,10,12			1	
CO-PO Mapping														
CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	3	2	1	-	-	-	-	-	2	2	-	2	2	-
CO2	2	1	-	-	-	-	-	-	2	2	-	2	3	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO5	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	3	-

200E906

AI and ROBOTICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To present a problem oriented in depth knowledge of Artificial Intelligence and Robotics.
- To address the underlying concepts, methods and application of different Artificial Intelligence and Robotics

PRE-REQUISITE:NIL

UNIT-I Scope of AI

9

Games theorem, natural language processing, vision and speech processing, robotics, expert systems, AI techniques- search knowledge, abstraction.

UNIT- II Problem solving

9

State space search; Production systems, search space control: depth first, breadth-first search, heuristic search - hill climbing, best-first search, branch and bound. Problem Reduction, Constraint Satisfaction End, Means-End Analysis

UNIT- III Knowledge Representation

9

Predicate Logic: unification, modus ponens, resolution, dependency directed backtracking. Rule based Systems: forward reasoning, conflict resolution, backward reasoning, use of no backtracks. Structured Knowledge Representation: semantic net slots, exceptions and default frames, conceptual dependency, scripts.

UNIT-IV Handling uncertainty and learning

9

Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions, neural network.

UNIT-V Robotics

9

Robot Classification, Robot Specification, notation Direct and Inverse Kinematics: Co-ordinates Frames, Rotations, Homogeneous Coordinates

TOTAL:45PERIODS

TEXTBOOK

1. E. Rich and K. Knight, "Artificial intelligence", MH, 2nd ed., 1992.
2. N.J. Nilsson, "Principles of AI", Narosa Publ. House, 2000.
3. Robin R Murphy, Introduction to AI Robotics PHI Publication, 2000

REFERENCES

1. D. W. Patterson, "Introduction to AI and Expert Systems", PHI, 1992.
2. R. J. Schalkoff, "Artificial Intelligence - an Engineering Approach", McGraw Hill Int. Ed., Singapore, 1992.
3. George Lugar, .AI-Structures and Strategies for and Strategies for Complex Problem solving, 4/e, 2002, Pearson Educations.

Course Name: AI and ROBOTICS		Course Code:20OE906												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand natural language processing, AI techniques	I	K2	1,2,9,10,12	1									
CO2	Apply the problem solving techniques	II	K3	1,2,3,9,10,12	1									
CO3	Classify the Predicate Logic and Rule based Systems	III	K3	1,2,3,9,10,12	1									
CO4	understand the Concept of learning	IV	K2	1,2,9,10,12	1									
CO5	Explain Structured Knowledge Representation in AI	IV	K3	1,2,3,9,10,12	1									
CO6	Classify Robots and discover its specification	V	K3	1,2,3,9,10,12	1									
CO-PO Mapping														
C O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	2	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO4	2	1	-	-	-	-	-	-	2	2	-	2	2	-
CO5	3	2	1	-	-	-	-	-	2	2	-	2	3	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	2	-

200E907

**FUNDAMENTALS OF BLOCKCHAIN
TECHNOLOGY**

L	T	P	C
3	0	0	3

OBJECTIVES:

1. To understand the history, types and applications of Blockchain
2. To acquire knowledge about cryptography and consensus algorithms.
3. Deploy projects using Web3j and design blockchain based applications

PRE-REQUISITE: NIL

UNIT-I INTRODUCTION TO BLOCKCHAIN 9

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain

UNIT- II BLOCKCHAIN ARCHITECTURE 9

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance(BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET)

UNIT- III BLOCKCHAIN-BASED FUTURES SYSTEM 9

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract

UNIT-IV BLOCKCHAINS IN BUSINESS AND CREATING ICO 9

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchain as a Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Tokensale contracts- Contract security and testing the code.

UNIT-V DISTRIBUTED STORAGE IPFS AND SWARM 9

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, Hosting our frontend: Serving your front end using IPFS, Serving your frontend using Swarm, IPFS file uploader project: Project setup the web page

TOTAL: 45 PERIODS

TEXTBOOK

1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packt Publishing Ltd, March 2018.
2. Bellaj Badr, Richard Horrocks, Xun (Brian) Wu, "Blockchain By Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packt Publishing Limited, 2018.

REFERENCES

1. Andreas M. Antonopoulos , “Mastering Bitcoin: Unlocking Digital Cryptocurrencies”, O’Reilly Media Inc, 2015
2. Arvind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, “Bitcoin and CryptocurrencyTechnologies: A Comprehensive Introduction”, Princeton University Press, 2016

Course Name: FUNDAMENTALS OF BLOCKCHAIN TECHNOLOGY		Course Code:200E907												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand the Mining Mechanism and Blockchain Network.	I	K2	1,2,9,10,12	-									
CO2	Understand the cryptography and Consensus mechanism	II	K2	1,2,9,10,12	-									
CO3	Classify Project presentation using Web3j.	III	K3	1,2,3,9,10,12	-									
CO4	Implement an ICO on Ethereum	IV	K3	1,2,3,9,10,12	-									
CO5	Explain blockchain based application with Swarm and IPFS	V	K3	1,2,3,9,10,12	-									
CO6	Demonstrate Initial Coin Offering and Contract security	V	K3	1,2,3,9,10,12	-									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO2	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO3	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO5	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	-	-

200E908	INTRODUCTION TO WEB APPLICATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

1. To reveal the underlying in web application.
2. To identify and aid in fixing any security vulnerabilities during the web development process.
3. To understand the security principles in developing a reliable web application

PRE-REQUISITE:NIL

UNIT-I Overview of Web Applications 9

Introduction history of web applications interfaces ad structure benefits and drawbacks of web applications Web application Vs Cloud application.

UNIT- II Web Application Security Fundamentals 9

Security Fundamentals: Input Validation - Attack Surface Reduction Rules of Thumb- Classi- fying and Prioritizing Threads

UNIT- III Browser Security Principles 9

Origin Policy - Exceptions to the Same-Origin Policy - Cross-Site Scripting and Cross-Site Request Forgery - Reflected XSS - HTML Injection

UNIT-IV Web Application Vulnerabilities 9

Understanding vulnerabilities in traditional client server application and web applications, client state manipulation, cookie based attacks, SQL injection, cross domain attack (XSS/XSRF/XSSI) http header injection. SSL vulnerabilities and testing - Proper encryption use in web application- Session vulnerabilities and testing - Cross-site request forgery

UNIT-V Web Application Security 9

Http request , http response, rendering and events , html image tags, image tag security, issue, java script onerror , Javascript timing , port scanning , remote scripting , running remotecode, frame and iframe , browsersandbox, policy goals, same origin policy, library import, domain relaxationClickjacking - DNS rebinding - Flash security - Java applet security - Single-sign-on solution and security -IPv6 impact on web security

TOTAL:45PERIODS

TEXTBOOK

1. Sullivan, Bryan, and Vincent Liu. Web Application Security, A Beginner’s Guide. McGraw HillProfessional, 2011.
2. Stuttard, Dafydd, and Marcus Pinto. The Web Application Hacker’s Handbook: Finding andExploiting Security Flaws. John Wiley Sons, 2011

REFERENCES

1. Hacking Exposed Web Applications, 3rd edition, JOEL SCAMBRAY, VINCENT LIU,CALEB SIMA
2. The Web Application Hacker's Handbook Discovering and Exploiting Security Flaws ByDafyddStuttard, Marcus Pinto
3. Rich Bowen, Ken Coar, “Apache Cookbook”, O’Reilly
4. Open Web Application Security Project. A Guide to Building Secure Web Applications andWeb Services. http://www.owasp.org/index.php/Category:OWASP_Guide_Project

Course Name: INTRODUCTION TO WEB APPLICATION SECURITY									Course Code:20OE908					
CO	Course Outcomes								Unit	K-CO	POs		PSOs	
CO1	Identify the vulnerabilities in the web applications.								I	K2	1,2,9,10,12		-	
CO2	Explain various types of threats and mitigation measures of web applications								II	K3	1,2,3,9,10,12		-	
CO3	Understand the Browser Security Principles								III	K2	1,2,9,10,12		-	
CO4	Apply the security principles in developing a reliable web application								IV	K3	1,2,3,9,10,12		-	
CO5	Use industry standard tools for web application security								V	K2	1,2,9,10,12		-	
CO6	Describe penetration testing to improve the security of web applications								V	K3	1,2,3,9,10,12		-	
CO-PO Mapping														
C O	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO1	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO2	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO3	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO4	3	2	1	-	-	-	-	-	2	2	-	2	-	-
CO5	2	1	-	-	-	-	-	-	2	2	-	2	-	-
CO6	3	2	1	-	-	-	-	-	2	2	-	2	-	-

200EA01	FUNDAMENTALS OF COMPUTER NETWORKING	L	T	P	C
		3	0	0	3

OBJECTIVES:

- Understand the division of network functionalities into layers.
- Be familiar with the components required to build different types of networks.
- Be exposed to the required functionality at each layer.
- Learn the flow control and congestion control algorithms.

UNIT I FUNDAMENTALS & LINK LAYER

Building a network – Requirements – Layering and protocols – Internet Architecture – Network software – Performance; Link layer Services – Framing – Error Detection – Flow control.

UNIT II MEDIA ACCESS & INTERNETWORKING 9

Media access control – Ethernet (802.3) – Wireless LANs – 802.11 – Bluetooth – Switching and bridging – Basic Internetworking (IP, CIDR, ARP, DHCP, ICMP).

UNIT III ROUTING 9

Routing (RIP, OSPF, metrics) – Switch basics – Global Internet (Areas, BGP, IPv6), Multicast – addresses – multicast routing (DVMRP, PIM).

UNIT IV TRANSPORT LAYER 9

Overview of Transport layer – UDP – Reliable byte stream (TCP) – Connection management – Flow control – Retransmission – TCP Congestion control – Congestion avoidance (DECbit, RED) – QoS – Application requirements.

UNIT V APPLICATION LAYER 9

Traditional applications -Electronic Mail (SMTP, POP3, IMAP, MIME) – HTTP – Web Services – DNS – SNMP

TOTAL:45 PERIODS

TEXT BOOK

1.Larry L. Peterson, Bruce S. Davie, “Computer Networks: A Systems Approach”, Fifth Edition, Morgan Kaufmann Publishers, 2011.

REFERENCES

1. James F. Kurose, Keith W. Ross, “Computer Networking – A Top-Down Approach Featuring the Internet”, Fifth Edition, Pearson Education, 2009.
2. Nader. F. Mir, “Computer and Communication Networks”, Pearson Prentice Hall Publishers, 2010.
3. Ying-Dar Lin, Ren-Hung Hwang, Fred Baker, “Computer Networks: An Open Source Approach”, Mc Graw Hill Publisher, 2011.
4. Behrouz A. Forouzan, “Data communication and Networking”, Fourth Edition, Tata McGraw – Hill, 2011.

OUTCOMES:

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

Course Name: FUNDAMENTALS OF COMPUTER NETWORKING		Course Code: 200EA01												
CO	Course Outcomes	Unit	K-CO	POs			PSOs							
CO1	Explain the organization of computer networks with layered approach	1	K2	1,2,8,9,10,12			2							
CO2	Identify the components required to build different types of networks.	2	K2	1,2,8,9,10,12			2							
CO3	Understand the routing concepts and multicast addressing	3	K2	1,2,3,8,9,10,12			2							
CO4	Learn the TCP, connection management and flow control	4	K2	1,2,3,8,9,10,12			2							
CO5	Discuss the concepts of UDP and QoS - Application requirements	4	K2	1,2,8,9,10,12			2							
CO6	Classify different application layer protocols	5	K2	1,2,8,9,10,12			2							
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1		-	-	-	-	1	1	1	-	1	2	-
CO2	2	1		-	-	-	-	1	1	1	-	1	2	-
CO3	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO4	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1		-	-	-	-	1	1	1	-	1	2	-
CO6	2	1		-	-	-	-	1	1	1	-	1	2	-

200EA02	CYBER SECURITY BASICS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand various types of cyber-attacks and cyber-crimes
- To learn threats and risks within context of the cyber security
- To have an overview of the cyber laws & concepts of cyber forensics
- To study the defensive techniques against these attacks

UNIT I INTRODUCTION

Basic Cyber Security Concepts, layers of security, Vulnerability, threat, Harmful acts, Internet Governance – Challenges and Constraints, Computer Criminals, CIA Triad, Motive of attackers, active attacks, passive attacks, Software attacks, hardware attacks, Cyber Warfare, Cyber Crime, Cyber terrorism, Cyber Espionage

UNIT II CYBERSPACE & CYBER FORENSICS 9

Introduction, Cyber Security Regulations, The INDIAN Cyberspace, National Cyber Security Policy. Introduction, Historical background of Cyber forensics, Digital Forensics Science, The Need for Computer Forensics, Cyber Forensics and Digital evidence, Forensics Analysis of Email, Digital Forensics Lifecycle, Forensics Investigation, Challenges in Computer Forensics

UNIT III CYBER CRIME: MOBILE AND WIRELESS DEVICES 9

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Laptops.

UNIT IV CYBER SECURITY: ORGANIZATIONAL IMPLICATIONS 9

Introduction: cost of cybercrimes and IPR issues, web threats for organizations, security and privacy implications, social media marketing: security risks and perils for organizations, social computing and the associated challenges for organizations

UNIT V PRIVACY ISSUES AND CYBERCRIME 9

Privacy Issues: Basic Data Privacy Concepts: Fundamental Concepts, Data Privacy Attacks, Data linking and profiling, privacy policies and their specifications, privacy policy languages, privacy in different domains - medical, financial, etc
 Cybercrime: Examples and Mini-Cases Examples: Official Website of Maharashtra Government Hacked, Indian Banks Lose Millions of Rupees, Parliament Attack, Pune City Police Bust Nigerian Racket, e-mail spoofing instances. Mini-Cases: The Indian Case of online Gambling, An Indian Case of Intellectual Property Crime, Financial Frauds in Cyber Domain.

TOTAL:45 PERIODS

TEXT BOOKS:

1. Nina Godbole and SunitBelpure, Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Wiley, 2013
2. B.B.Gupta, D.P.Agrawal, Haoxiang Wang, Computer and Cyber Security: Principles, Algorithm, Applications, and Perspectives, CRC Press, 2018.

REFERENCES:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press, 2016
2. Chwan-Hwa (John) Wu, J. David Irwin, Introduction to Computer Networks and Cyber security, CRC Press T&F Group, 2013

OUTCOMES:

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

Course Name: CYBER SECURITY BASICS		Course Code: 20OEA02												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand the various types of cyber-attacks, crimes and cyber policies	1	K2	1,2,8,9,10,12	2									
CO2	Learn the concepts of cyber laws & cyber forensics	2	K2	1,2,8,9,10,12	2									
CO3	Understand the Security Challenges and attacks on Wireless devices	3	K2	1,2,8,9,10,12	2									
CO4	Understand IPR issues, privacy implications & challenges for Organization	4	K2	1,2,8,9,10,12	2									
CO5	Apply policies and procedures to manage privacy issues	5	K2	1,2,8,9,10,12	2									
CO6	Describe the cyber-crimes cases	5	K2	1,2,8,9,10,12	2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	2	1	-	-	-	-	-	1	1	1	-	1	2	-

200EA03	INTRODUCTION TO INFORMATION SECURITY	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To understand the basics of Information Security
- To know the legal, ethical and professional issues in Information Security
- To know the aspects of risk management
- To become aware of various standards in this area
- To know the technological aspects of Information Security

UNIT I INTRODUCTION

History, What is Information Security?, Critical Characteristics of Information, NSTISSC Security Model, Components of an Information System, Securing the Components, Balancing Security and Access, The SDLC, The Security SDLC

UNIT II SECURITY INVESTIGATION 9

Need for Security, Business Needs, Threats, Attacks, Legal, Ethical and Professional Issues - An Overview of Computer Security - Access Control Matrix, Policy-Security policies, Confidentiality policies, Integrity policies and Hybrid policies

UNIT III SECURITY ANALYSIS 9

Risk Management: Identifying and Assessing Risk, Assessing and Controlling Risk - Systems: Access Control Mechanisms, Information Flow and Confinement Problem

UNIT IV LOGICAL DESIGN 9

Blueprint for Security, Information Security Policy, Standards and Practices, NIST Models, VISA International Security Model, Design of Security Architecture, Planning for Continuity

UNIT V PHYSICAL DESIGN 9

Security Technology, IDS, Scanning and Analysis Tools, Cryptography, Access Control Devices, Physical Security, Security and Personnel

TOTAL:45 PERIODS

TEXT BOOKS:

1. Michael E Whitman and Herbert J Mattord, —Principles of Information Securityll, Vikas Publishing House, New Delhi, 2003

REFERENCES

1. Micki Krause, Harold F. Tipton, — Handbook of Information Security Managementll, Vol 1-3 CRCPress LLC, 2004.
2. Stuart McClure, Joel Scrambray, George Kurtz, —Hacking Exposedll, Tata McGraw-Hill, 2003
3. Matt Bishop, — Computer Security Art and Science, Pearson/PHI, 2002.

OUTCOMES:

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

Course Name: INTRODUCTION TO INFORMATION SECURITY		Course Code: 20OEA03												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Discuss the basics of information security	1	K2	1,2,8,9,10,12	1									
CO2	Illustrate the legal, ethical and professional issues in information security	2	K2	1,2,8,9,10,12	1									
CO3	Demonstrate the aspects of risk management	3	K2	1,2,8,9,10,12	1									
CO4	Discuss the various standards in the Information Security System	4	K2	1,2,8,9,10,12	1									
CO5	Design and analyze the of Security Techniques.	5	K2	1,2,3,8,9,10,12	1									
CO6	Use security tools to implement security techniques	5	K3	1,2,3,8,9,10,12	1									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	3	2	1	-	-	-	-	1	1	1	-	1	2	-

200EA04	WEB ESSENTIALS	L	T	P	C
		3	0	0	3

OBJECTIVES:

- To introduce the fundamentals of Internet and the principles of web design
- To construct basic websites using HTML and Cascading Style Sheets
- To build dynamic webpages with validation using JavaScript objects and by applying different event handling mechanisms
- To develop modern interactive web applications using PHP, XML and MySQL

UNIT I INTRODUCTION 9

Concept of WWW, Internet and WWW, HTTP Protocol Request and Response Web browser and Web servers, Features of latest version of Web, Concepts of effective web design, Look and Feel of the Website, Page Layout and linking, User centric design, Sitemap, Planning and publishing website, Designing effective navigation

UNIT II HTML 9

Basics of HTML, formatting and fonts, commenting code, color, hyperlink, lists, tables, images, forms, XHTML, Meta tags, Character entities, frames and frame sets, Browser architecture and Website structure. Need for CSS, introduction to CSS, basic syntax and structure, using CSS, background images, colors and properties, manipulating texts, using fonts, borders and boxes, margins, padding lists, positioning using CSS, CSS2

UNIT III JAVASCRIPT 9

Client side scripting with JavaScript, variables, functions, conditions, loops and repetition, Pop up boxes, JavaScript and objects, JavaScript own objects, the DOM and web browser environments, Manipulation using DOM, forms and validations

UNIT IV XML 9

Introduction to XML, uses of XML, simple XML, XML key components, DTD and Schemas, Using XML with application. Transforming XML using XSL and XSLT.

UNIT V PHP and MySQL 9

Basic commands with PHP examples, Connection to server, creating database, selecting a database, listing database, listing table names, creating a table, inserting data, altering tables, queries, deleting database, deleting data and tables, PHP my admin and database buas

TOTAL:45 PERIODS

TEXTBOOKS

1. Ralph Moseley and M.T.Savaliya,Developing Web Applications,Wiley-India Private Limited,2011.
2. Robert W.Sebesta,Programming the World Wide Web,7th edition, Pearson Education,2013.

REFERENCES

1. Kogent Learning Solutions Inc., Web Technologies Black Book,Dream tech Press, 2009.
2. Joel Sklar,Principles of Web Design,Cengage Learning,6th Edition,2015.
3. B.M.Harwani,Developing Web Applications in PHP and AJAX,Tata McGraw-Hill,2010.
4. Internet and World Wide Web How to program, Paul J.Deitel,Harvey M.Deitel,and Abbey Deitel,5th Edition,Pearson Education,2011.

OUTCOMES:

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

Course Name: WEB ESSENTIALS					Course Code: 200EA04									
CO	Course Outcomes				Unit	K-CO	POs		PSOs					
CO1	Describe the concepts of World Wide Web and the requirements of effective web design.				1	K2	1,2,8,9,10,12		1					
CO2	Develop web pages using the HTML and CSS features with different layouts as per need of applications.				2	K2	1,2,3,8,9,10,12		1					
CO3	Use the JavaScript to develop the dynamic web pages.				3	K2	1,2,3,8,9,10,12		1					
CO4	Construct simple web pages in PHP and to represent data in XML format.				4	K2	1,2,3,8,9,10,12		1					
CO5	Understand the concepts of server side scripting with PHP				5	K2	1,2							
CO6	Use server side scripting with PHP to generate the web pages dynamically using the database connectivity.				5	K2	1,2,3,8,9,10,12		1					
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO3	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO4	3	2	1	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	-	-	-	-	-	-	-
CO6	3	2	1	-	-	-	-	1	1	1	-	1	2	-

200EA05

ESSENTIALS OF NETWORK SECURITY

L	T	P	C
3	0	0	3

OBJECTIVES:

- To understand the fundamentals of network security
- To acquire knowledge on standard algorithms used to provide confidentiality, integrity and authenticity.
- To understand the various key distribution and management schemes.
- To understand how to deploy encryption techniques to secure data in transit across datanetworks.
- To design security applications in the field of Information technology

UNIT I INTRODUCTION

10

Services, Mechanisms and attacks-Classical Encryption techniques (Symmetric cipher model, substitution techniques, transposition techniques). Finite fields and number theory: Groups, Rings, Euclid's Algorithm-Finite fields- Polynomial Arithmetic –Prime numbers-Fermat's and Euler's Theorem-Testing for primality -The Chinese remainder theorem

UNIT II BLOCK CIPHERS & PUBLIC KEY ENCRYPTION

10

Data Encryption Standard-Block cipher design principles-block cipher modes of operation-Advanced Encryption Standard (AES)-Triple DES-Blowfish-RC5 algorithm. Public key encryption: Principles of public key cryptosystems-The RSA algorithm – Key Management - Diffie Hellman Key exchange.

UNIT III HASH FUNCTIONS AND DIGITAL SIGNATURES

9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – Digital signature and authentication protocols – DSS

UNIT IV E-MAIL, IP & WEB SECURITY

8

E-mail Security: Pretty Good Privacy-S/MIME. IP Security: Overview of IPsec - IP security policy-Encapsulation Security Payload (ESP)- Web Security: Web Security Considerations-Secure Socket Layer (SSL)-Transport Layer Security (TLS)- -Secure Electronic Transaction (SET).

UNIT V SYSTEM SECURITY

8

Authentication applications – Kerberos – X.509 Authentication services - Firewalls – Types of Firewalls- Firewall design principles- Trusted System. Intruders – Intrusion detection – Viruses and related threats – Virus Countermeasures

TOTAL: 45 PERIODS

REFERENCES:

1. Behrouz A. Ferouzan, "Cryptography & Network Security", Tata McGraw Hill, 2007.
2. Bruce Schneier and Neils Ferguson, "Practical Cryptography", First Edition, Wiley Dream techIndia Pvt Ltd, 2003.
3. Charles Pfleeger, "Security in Computing", 4th Edition, Prentice Hall of India, 2006.
4. Charlie Kaufman and Radia Perlman, Mike Speciner, "Network Security", Second Edition, Private Communication in Public World, PHI 2002.
5. Douglas R Simson, "Cryptography – Theory and practice", First Edition, CRC Press, 1995.
6. Ulysess Black, "Internet Security Protocols", Pearson Education Asia, 2000.
7. William Stallings, "Cryptography and Network Security", 6th Edition, Pearson Education, March 2013.
8. Man Young Rhee, "Internet Security: Cryptographic Principles-Algorithms and Protocols", Wiley Publications, 2003.

OUTCOMES:

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

Course Name: ESSENTIALS OF NETWORK SECURITY		Course Code: 20OEA05												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Compare various Security Techniques Design Secure Applications Inject secure coding in the developed applications	1	K2	1,2,8,9,10,12	1									
CO2	Analyze the vulnerabilities in any computing system and hence be able to design a security solution.	2	K2	1,2,8,9,10,12	1									
CO3	Analyze the possible security attacks in complex real time systems and their effective countermeasures	3	K2	1,2,8,9,10,12	1									
CO4	Identify the security issues in the network and resolve it.	4	K2	1,2,8,9,10,12	1									
CO5	Understand the various security mechanisms using rigorous approaches,	5	K2	1,2,8,9,10,12	1									
CO6	Evaluate the security mechanisms such as theoretical derivation, modeling, and simulations	5	K3	1,2,3,8,9,10,12	1									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	3	2	1	-	-	-	-	1	1	1	-	1	2	-

200EA06

ETHICAL HACKING BASICS

L	T	P	C
3	0	0	3

OBJECTIVES:

- To learn about the importance of information security
- To learn different scanning and enumeration methodologies and tools
- To understand various hacking techniques and attacks
- To be exposed to programming languages for security professionals
- To get familiarized with the different phases in penetration testing

UNIT I INTRODUCTION TO HACKING

9

Introduction to Hacking – Importance of Security – Elements of Security – Phases of an Attack – Types of Hacker Attacks – Hacktivism – Vulnerability Research – Introduction to Footprinting – Information Gathering Methodology – Footprinting Tools – WHOIS Tools – DNS Information Tools – Locating the Network Range –Meta Search Engines.

UNIT II SCANNING AND ENUMERATION

9

Introduction to Scanning – Objectives – Scanning Methodology – Tools – Introduction to Enumeration– Enumeration Techniques – Enumeration Procedure – Tools.

UNIT III SYSTEM HACKING

9

Authentication requirement – Authentication function – MAC – Hash function – Security of hash function and MAC –MD5 - SHA - HMAC – Digital signature and authentication protocols – DSS

UNIT IV PROGRAMMING FOR SECURITY PROFESSIONALS

9

Programming Fundamentals – C language – HTML – Perl – Windows OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures – Linux OS Vulnerabilities – Tools for Identifying Vulnerabilities – Countermeasures.

UNIT V PENETRATION TESTING

9

Introduction – Security Assessments – Types of Penetration Testing- Phases of Penetration Testing –Tools – Choosing Different Types of Pen-Test Tools – Penetration Testing Tools

TOTAL: 45 PERIODS

TEXT BOOKS

1. Michael T. Simpson, Kent Backman, and James E. Corley, Hands-On Ethical Hacking and Network Defense, Course Technology, Delmar Cengage Learning, 2010.
2. The Basics of Hacking and Penetration Testing - Patrick Engebretson, SYNGRESS, Elsevier, 2013.
3. The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Dafydd Stuttard and Marcus Pinto, 2011.

REFERENCES

1. Black Hat Python: Python Programming for Hackers and Pentesters, Justin Seitz , 2014.

OUTCOMES:

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

Course Name: ETHICAL HACKING BASICS									Course Code: 20OEA06						
CO	Course Outcomes								Unit	K-CO	POs			PSOs	
CO1	Express knowledge on basics of computer based vulnerabilities								1	K2	1,2,8,9,10,12			1	
CO2	Understand the different foot printing, reconnaissance and scanning methods.								2	K2	1,2,8,9,10,12			1	
CO3	Demonstrate the enumeration and vulnerability analysis methods								3	K2	1,2,8,9,10,12			1	
CO4	Gain knowledge on hacking options available in Web and wireless applications.								4	K2	1,2,8,9,10,12			1	
CO5	Acquire knowledge on the options for network protection.								5	K2	1,2,8,9,10,12			1	
CO6	Use Penetration test tools for security assessment								5	K3	1,2,3			1	
CO-PO Mapping															
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-	
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-	
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-	
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-	
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-	
CO6	3	2	1												

OBJECTIVES:

- To learn cyber crime and forensics
- To become familiar with forensics tools
- To learn to analyze and validate forensics data
- To understand cyber laws and the admissibility of evidence with case studies
- To learn the vulnerabilities in network infrastructure with ethical hacking

UNIT I INTRODUCTION TO CYBER CRIME AND FORENSICS 9

Introduction to Traditional Computer Crime, Traditional problems associated with Computer Crime. Role of ECD and ICT in Cybercrime - Classification of Cyber Crime. The Present and future of Cybercrime - Cyber Forensics -Steps in Forensic Investigation - Forensic Examination Process - Types of CF techniques - Forensic duplication and investigation - Forensics Technology and Systems - Understanding Computer Investigation – Data Acquisition.

UNIT II EVIDENCE COLLECTION AND FORENSICS TOOLS 9

Processing Crime and Incident Scenes – Digital Evidence - Sources of Evidence -Working with File Systems. - Registry - Artifacts - Current Computer Forensics Tools: Software/ Hardware Tools - Forensic Suite - Acquisition and Seizure of Evidence from Computers and Mobile Devices - Chain of Custody

UNIT III ANALYSIS AND VALIDATION 9

Validating Forensics Data – Data Hiding Techniques – Performing Remote Acquisition – Network Forensics – Email Investigations – Cell Phone and Mobile Devices Forensics - Analysis of Digital Evidence - Admissibility of Evidence - Cyber Laws in India - Case Studies

UNIT IV ETHICAL HACKING 9

Introduction to Ethical Hacking - Footprinting and Reconnaissance - Scanning Networks - Enumeration - System Hacking - Malware Threats – Sniffing – Email Tracking

UNIT V ETHICAL HACKING IN WEB 9

Social Engineering - Denial of Service - Session Hijacking - Hacking Web servers - Hacking Web Applications – SQL Injection - Hacking Wireless Networks - Hacking Mobile Platforms.

TOTAL: 45 PERIODS**TEXT BOOKS**

1. Bill Nelson, Amelia Phillips, Christopher Steuart, — Guide to Computer Forensics and InvestigationsII, Cengage Learning, India Sixth Edition, 2019.
2. CEH official Certified Ethical Hacking Review Guide, Wiley India Edition, Version 11, 2021.
3. Dejey, S. Murugan - Cyber Forensics, Oxford University Press, India, 2018

REFERENCES

1. John R.Vacca, "Computer Forensics ", Cengage Learning, 2005
2. MarjieT.Britz, "Computer Forensics and Cyber Crime: An Introduction 3rd Edition, Prentice Hall, 2013.
3. AnkitFadia " Ethical Hacking, Second Edition, Macmillan India Ltd, 2006
4. Kenneth C.Brancik "Insider Computer FraudII Auerbach Publications Taylor &Francis Group– 2008.

OUTCOMES:

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

Course Name: FUNDAMENTAL OF CYBER FORENSICS		Course Code: 20OEA07												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Understand Cyber Crime and Forensics	1	K2	1,2,8,9,10,12	1									
CO2	Utilize Forensic Tools for Evidence Collection	2	K2	1,2,8,9,10,12	1									
CO3	Analyze and Validate Digital Evidence	3	K2	1,2,8,9,10,12	1									
CO4	Demonstrate Ethical Hacking Techniques	4	K2	1,2,8,9,10,12	1									
CO5	Assess Security Threats in Web	5	K2	1,2,8,9,10,12	1									
CO6	the Security Threats in Mobile Environments	5	K3	1,2,8,9,10,12	1									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO2	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO3	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO4	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO5	2	1	-	-	-	-	-	1	1	1	-	1	2	-
CO6	2	1	-	-	-	-	-	1	1	1	-	1	2	-

OBJECTIVES

- To understand, explore, and acquire a critical understanding cyber law.
- To develop competencies for dealing with frauds and deceptions (confidence tricks, scams) and other cyber-crimes for example, child pornography etc. that are taking place via the internet.

UNIT I INTRODUCTION TO CYBER LAW EVOLUTION OF COMPUTER TECHNOLOGY 9

Emergence of Cyber space. Cyber Jurisprudence, Jurisprudence and law, Doctrinal approach, Consensual approach, Real Approach, Cyber Ethics, Cyber Jurisdiction, Hierarchy of courts, Civil and criminal jurisdictions, Cyberspace-Web space, Web hosting and web Development agreement, Legal and Technological Significance of domain Names, Internet as a tool for global access.

UNIT II INFORMATION TECHNOLOGY ACT 9

Overview of IT Act, 2000, Amendments and Limitations of IT Act, Digital Signatures, Cryptographic Algorithm, Public Cryptography, Private Cryptography, Electronic Governance, Legal Recognition of Electronic Records, Legal Recognition of Digital Signature Certifying Authorities, Cyber Crime and Offences, Network Service Providers Liability, Cyber Regulations Appellate Tribunal, Penalties and Adjudication.

UNIT III CYBER LAW AND RELATED LEGISLATION 9

Patent Law, Trademark Law, Copyright, Software – Copyright or Patented, Domain Names and Copyright disputes, Electronic Data Base and its Protection, IT Act and Civil Procedure Code, IT Act and Criminal Procedural Code, Relevant Sections of Indian Evidence Act, Relevant Sections of Bankers Book Evidence Act, Relevant Sections of Indian Penal Code, Relevant Sections of Reserve Bank of India Act, Law Relating To Employees And Internet, Alternative Dispute Resolution , Online Dispute Resolution (ODR).

UNIT IV ELECTRONIC BUSINESS AND LEGAL ISSUES 9

Evolution and development in E- commerce, paper vs paper less contracts E-Commerce models- B2B, B2C, E security. Business, taxation, electronic payments, supply chain, EDI, E-markets, Emerging Trends.

UNIT V CASE STUDY ON CYBER CRIMES 9

Harassment Via E-Mails, Email Spoofing (Online A Method Of Sending E-Mail Using A False Name Or E-Mail Address To Make It Appear That The E-Mail Comes From Somebody Other Than The True Sender, Cyber Pornography (Exm.MMS),Cyber-Stalking.

TOTAL: 45 PERIODS**TEXT BOOKS :**

1. K.Kumar, "Cyber Laws: Intellectual property & E Commerce, Security", 1st Edition, Dominant Publisher, 2011.
2. Rodney D. Ryder, "Guide To Cyber Laws", Second Edition, Wadhwa And Company, New Delhi, 2007.
3. Information Security policy & implementation Issues, NIIT, PHI.

REFERENCES :

1. Vakul Sharma, "Handbook Of Cyber Laws" Macmillan India Ltd, 2nd Edition, PHI, 2003.
2. Justice Yatindra Singh, " Cyber Laws", Universal Law Publishing, 1st Edition, New Delhi, 2003.
3. Sharma, S.R., "Dimensions Of Cyber Crime", Annual Publications Pvt. Ltd., 1st Edition, 2004.
4. Augastine, Paul T., " Cyber Crimes And Legal Issues", Crecent Publishing Corporation, 2007.

OUTCOMES:

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

Course Name: CYBER LAW AND POLICIES		Course Code: 200EA08												
CO	Course Outcomes	Unit	K-CO	POs	PSOs									
CO1	Describe the concepts of cyber Space and Cyber Laws	1	K2	1,2,8,9	-									
CO2	Understand the Information Technology ACT	2	K2	1,2,10	-									
CO3	Describe the cyber laws and various relevant sections	3	K2	1,2,8,9	-									
CO4	Discuss the Electronic commerce and E Security	4	K2	1,2,10	1,2									
CO5	Describe the emerging trends and security	5	K2	1,2,8,9	1,2									
CO6	Discuss the various Case Studies on Real Time Crimes	5	K3	1,2,10,12	1,2									
CO-PO Mapping														
CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	-	-	-	-	1	1	-	-	-	-	-
CO2	2	1	-	-	-	-	-	-	-	1	-	-	-	-
CO3	2	1	-	-	-	-	-	1	1	-	-	-	-	-
CO4	2	1	-	-	-	-	-	-	-	1	-	-	1	1
CO5	2	1	-	-	-	-	-	1	1	-	-	-	1	1
CO6	2	1	-	-	-	-	-	-	-	1	-	1	1	1