ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY
Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.TECH
INSTRUMENTATION ENGINEERING

7th SEMESTER

ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Course Structure
(From Academic Session 2018-19 onwards)

B.Tech 7th Semester: Instrumentation Engineering
Semester VII/ B.TECH/IE

Sl. No.	Sub-Code	Subject	Hours per Week			Credit	Marks	
			L	T	P	C	CE	ESE
Theory								
1	IE181701	Telemetry and Tele Control	3	1	0	4	30	70
2	IE1817PE3*	Program Elective-3	3	0	0	3	30	70
3	IE1817PE4*	Program Elective-4	3	0	0	3	30	70
4	IE1817OE3*	Open Elective-3	3	0	0	3	30	70
5	HS181704	Principles of Management	3	0	0	3	30	70
Practical								
1	IE181722	Project-1	0	0	6	3	50	50
2	SI181721	Internship-III (SAI - Industry)	0	0	0	2	-	200
TOTAL			15	1	6	**21**	**200**	**600**
Total Contact Hours per week: 22								
Total Credit: 21								

Program Elective-3

Sl. No.	Sub-Code	Subject
1	IE1817PE31	Advanced Process Control
2	EE1817PE32	Computer Networks
3	EE1817PE33	Pattern Recognition and Machine Learning
4	IE1817PE3*	Any other subject offered from time to time with the approval of the University

Program Elective-4

Sl. No.	Sub-Code	Subject
1	IE1817PE41	Biomedical Signal Processing
2	IE1817PE42	Advanced Sensors and Instrumentation
3	EE1817PE42	Renewable Energy Sources
4	IE1817PE4*	Any other subject offered from time to time with the approval of the University

Open Elective- 3

Sl. No.	Sub-Code	Subject
1	IE1817OE31	Fundamental of Power Electronics
2	IE1817OE32	Principles of Safety and Fire
3	IE1817OE3*	Any other subject offered from time to time with the approval of the University

Detail Syllabus:

Course Code	Course Title	Hours per week L-T-P	Credit C
IE181701	**Telemetry and Tele Control**	**3-1-0**	**4**

Course Outcomes (CO):

CO1: Students will be able to define the term telemetry and explain different types of telemetry systems with the main emphasis on the applications of telemetry and tele control like PLCC.
CO2: Students will be able to present the operational techniques of computer networks and concept of satellite telemetry system.
CO3: Students will be able to articulate the concept of amplitude and frequency modulation techniques and its applications.
CO4: Students will be able to distinguish between various digital data communication techniques like multiplexing, pulse and digital modulations.
CO5: Students will be able to express the concept of different demodulation techniques and various signaling formats.

MODULE 1: Telemetry
Introduction, definition, classifications of telemetering systems, Purpose of telemetry, Telemetry links, Telemetry errors caused by noise, interference and distortion, signal characterization in time and frequency domain, analog and digital signals, landline telemetry, mechanical , pneumatic and electrical systems, basic schemes, voltage, current and frequency telemetry, line length limitations, Industrial telemetry and carrier communication systems, PLCC, synchro transmitter-receiver, V/f converter, comparator.

MODULE 2: Modulation Techniques
Continuous wave (CW) modulation - AM, DSB/SC, SSB/SC, methods of generation, square law and switching modulators, Nonlinear modulation techniques - FM and PM, narrowband FM, wideband FM, methods of generation- direct and indirect method, varactor diode, FM spectrum.

MODULE 3: Multiplexing
FDM & TDM systems, their relative merits.

MODULE 4: Sampling and Pulse Modulation
Sampling theorem, Nyquist frequency sampling techniques and signal reconstruction, pulse modulation- PAM, PWM, PPM signals, Quantization of signals, pulse code modulation- generation and demodulation schemes, coding formats.

MODULE 5: Digital Communication
ASK, FSK, PSK and higher order modulation

MODULE 6: Demodulation Techniques
Demodulation of AM and FM waves- envelope detector and synchronous detector.

MODULE 7: Local Area Network

Local and public data networks, modems and coders, Fiber and satellite communication, remote control, LED and ILD in Telecommunication applications, transmitter and receiver circuits.

Text/Reference Books:

1. Communication System Engineering John G. Proakis, M. Salehi, PHI
2. Principles of Communication System, Taub and Schilling, McGraw Hill I.E.
3. Communication Systems, Simon Hykin, M. Moher Wiley
4. Telemetry principles, D. Patranabis TMH
5. Handbook of Telemetry and Remote control E. L. Gruenberg Mc Graw Hill

Course Code	Course Title	Hours per week L-T-P	Credit C
IE1817PE31	Advanced Process Control	3-0-0	3

Objectives:

- To make the students understand the basic concepts of advanced process control schemes.
- Students will be able to design, tune, and analyze the advanced controllers used for solving the critical problems in the process industries.
- To introduce soft-computing techniques used in process control and provide fundamental knowledge about the digital controllers.

Course Outcomes (COs):

CO1 : Develop the concept of advanced control techniques that can be used in process industries.

CO2 : Design of various model-based controllers for specific problems in chemical industry.

CO3 : Make use of soft-computing techniques in process control.

CO4 : Identify the control techniques of multivariable processes.

CO5 : Develop the fundamental concepts of PLC, DCS, and SCADA.

MODULE 1: Introduction to Advanced Process Control

Basic concepts of higher order and multivariable processes; Process identifications and approximations; Various modes of controller; Fractional-order controllers; Concepts of controller tuning

MODULE 2: Advanced Control Strategies

Feed-forward control; Ratio control; Cascade control; Split range, selective and override control; Dead time compensation technique; Adaptive control techniques; Model reference adaptive control

MODULE 3: Model-Based Control

Design of model-based controller; Direct synthesis; Internal model control; Development of controller structure; Controller tuning for stable, integrating and unstable processes

MODULE 4: Soft-Computing Techniques in Process Control

Fuzzy logic control; Mamdani and Sugeno methods; Artificial neural network; Optimization techniques; Genetic algorithm

MODULE 5: Control of Multivariable Processes

Centralized control and decentralized control; Decoupling techniques; Degree of freedom; Pairing of controlled and manipulated variables; Relative gain array; Relative gain matrix; Equal interaction flow process; Blending process

MODULE 6: Digital Controllers

Programmable logic controllers; Ladder diagram; Human machine interface; Distributed control system; SCADA

Text/Reference Books:

1. G. Stephanopoulos, 'Chemical Process Control: An Introduction to Theory and Practice', Prentice Hall Inc, 1984.
2. B. W. Bequette, 'Process Control Modeling, Design, and Simulation', Prentice-Hall, 2003.
3. D. E. Seborg, T. F. Edgar, and D. A. Melichamp, 'Process Dynamic and Control', New York: Wiley, 2004.
4. K. J. Astrom and B. Wittenmark, 'Adaptive Control', Pearson, 1994.
5. D. Driankov, H. Hellendron, and M. Reinfrank, 'An introduction to fuzzy control', New York: Springer-Verlag, 1993.
6. S. Haykin, 'Neural networks and learning machines', Pearson, 2009.
7. B. G. Liptak, 'Instrument Engineers Handbook', CRC press, 2003.

Course Code	Course Title	Hours per week L-T-P	Credit C
EE1817PE32	Computer Networks	3-0-0	3

COURSE OBJECTIVES:

- To teach the basics of the working of the Internet.
- To teach fundamentals of the protocols involved in the working of various layers of the Internet.

COURSE OUTCOMES:

At the end of this course, the students will be able:

CO1: To Understand the Basics of the Working of the Internet.

CO2: To Study Various Internet Protocols.

CO3: To Understand Various Security Measures in Internetworking.

CO4: To Understand Various Uses of Computer Networking.

MODULE 1: Introduction to Internet

a) To study Topology of Internet.
b) To study structure of Internet, Internet standards and Internet administration.
c) To study protocol layering.

MODULE 2: The Physical Layer

a) To learn Information Theory.
b) To learn coding of data, conversion methods between various types of data and multiplexing techniques.
c) To learn about various transmission media.
d) To learn about Circuit Switching, Packet Switching and various switches.

MODULE 3: The Data Link Layer

a) To learn error detection and correction techniques.
b) To learn DLC protocols.
c) To learn MAC protocols.
d) To learn various wired and wireless LAN protocols.
e) To learn mobile telephone protocols.
f) To learn satellite systems.

MODULE 4: **The Network Layer**

a) To learn packet switching methods.
b) To learn congestion control techniques.
c) To learn IP, IPv4, ICMPv4,
d) To learn Unicast Routing and Multicast Routing
e) To learn about IPv6 and ICMPv6,

MODULE 5: The Transport Layer

a) To learn about transmission layer issues protocols.
b) To learn about UDP, TCP-IP, SCTP

MODULE 6: The Application Layer

a) To learn basics of WWW, HTTP, FTP, E-Mail and DNS
b) To learn issues concerning multimedia in Internet.
c) To learn basics of Internet Security.

Textbooks/ Reference Books:

1. Computer Networking:: Stallings :: TMH
2. Computer Networks:: Tannenbaum :: PHI
3. Data Communication and Networking :: Forouzan :: McGraw Hill India

Course Code	Course Title	Hours per week L-T-P	Credit C
EE1817PE33	**Pattern Recognition and Machine Learning**	**3-0-0**	**3**

COURSE OBJECTIVES:
To teach concepts of inculcating artificial intelligence in machines by different computational methods

COURSE OUTCOMES: At the end of this course, the students will be able to
CO1: describe structure, components and mathematical formulation of learning by machines
CO2: develop algorithms for learning and pattern recognition by machines
CO3: analyze performances and characteristics of machine learning and pattern recognition algorithms for utilization in societal, academic and industrial purposes

MODULE 1: Introduction to Machine Learning
Intelligent Machines, Data Representation, Diversity of Data, Forms of learning, Machine learning and data mining, Linear Algebra and Machine Learning Techniques

MODULE 2: Supervised Learning
Learning from observation, Bias and Variance, Computational Learning Theory, Estimating Generalization errors, Metrics for assessing regression, Metrics for assessing classification

MODULE 3: Statistical Learning
Descriptive Statistics in learning Techniques, Bayesian Reasoning, k-Nearest Neighbour (kNN) Classifier, Discriminant functions and Regression functions, Linear Regression with Least Square Error criterion, Logistic Regression for Classification Tasks

MODULE 4: Learning with Support Vector Machine (SVM)
Linear Discriminant Function for binary classification, Linear Maximal Margin classifier for overlapping classes, Non Linear classifier, Regression by SVM, Variants of basic SVM Techniques

MODULE 5: Learning with Neural Networks
Cognitive Machines, Neuron Models, Network Architectures, Perceptrons, Linear Neurons, Error correction delta Rule, Multilayer perceptron (MLP) networks, Radial Basis Function (RBF) networks, Genetic Neural Systems

MODULE 6: Fuzzy Inference System
Cognitive Uncertainty and Fuzzy Rule Base, Fuzzy Quantification of Knowledge, Fuzzy Rule Base and Approximate Reasoning, Mamdani Model, Neuro Fuzzy Inference model, Genetic Fuzzy Systems

MODULE 7: Data Clustering and Data Transformation
Unsupervised Learning, Engineering Data, Overview of basic clustering models, K-Means Clustering, Fuzzy k-means clustering, some useful data transformation, Introduction to PCA, Decision Tree Learning, Measuring of Impurity for evaluating Splits in Decision Trees, Pruning Decision Trees, Strengths and weaknesses of Decision Tree Approach

MODULE 8: Application of Machine Learning
Some Practical Application Implementation

Textbooks/ Reference Books:

1. M Gopal: Applied Machine Learning, McGraw Hill Education
2. Geoffry J. McLachlan: Discriminant Analysis and Statistical Pattern Recognition, John Wiley & Sons
3. Richard O. Duda, Peter E. Hart, David G. Stork: Pattern Classification, John Wiley & Sons
4. S. Theodoridis, K. Koutroumbas: Pattern Recognition, Elsevier
5. Keinosuke Fukunaga: Introduction to statistical pattern recognition, Morgan Kaufmann, Academic Press
6. Shai Shalev-Shwartz, Shai Ben-David: Understanding Machine Learning: From Theory to Algorithms Cambridge University Press, 2015
7. S. Rajasekaran, G. A. Vijayalakshmi Pai: Neural Networks, Fuzzy Systems and Evolutionary Algorithms: Synthesis and Applications, PHI 2017.
8. B. Yegnanarayana: Artificial Neural Networks, PHI 2015
9. Simon Haykin: Neural Networks, Pearson Education, 2003.
10. Laurance Fausett: Fundamentals of Neural Networks, Englewood cliffs, N.J., Pearson Education, 1992.
11. Jacek M. Zurada: Introduction to Artificial Neural Systems, Jaico Publishing Home, 2002.
12. U Dinesh Kumar Manaranjan Pradhan: Machine Learning using Python, John Wiley & Sons 2019
13. B. Kosko: Neural Networks and Fuzzy Systems, Prentice-Hall of India Pvt. Ltd., 1994.
14. G. J. Klir and T. A. Folger: Fuzzy Sets, Uncertainty and Information, Prentice-Hall of India Pvt. Ltd., 1993.
15. H.J. Zimmermann: Fuzzy Set Theory and Applications, Allied Publication Ltd., 1996.
16. Timothy J. Ross: Fuzzy Logic with Engineering Applications, Tata McGraw Hill, 1997
17. John Yen & Reza Langari: Fuzzy Logic – Intelligence Control & Information, Pearson Education, New Delhi, 2003.
18. Driankov, Hellendroon: Introduction to Fuzzy Control, Narosa Publishers.
19. David Goldberg: Genetic Algorithms and Machine learning, PHI
20. Z Michalewicz: Genetic Algorithms + Data Structures = Evolution Programs, 3rdEd, Springer, 1996.
21. T Baeck, D B Fogel, Z Michalewicz: Evolutionary Computation Vol 2 Advanced Algorithms and Operators, Institute of Physics Publishing, Bristol, UK, 2000
22. Y. Gong, W. Xu: Machine Learning for Multimedia Content Analysis, Springer
23. Mehryar Mohri, Afshin Rostamizadeh, and Ameet Talwalkar: Foundations of Machine Learning, MIT Press.
24. Simon Haykin: Neural Networks & Learning Machines, Pearson 2016

Course Code	Course Title	Hours per week L-T-P	Credit C
IE1817PE41	Biomedical Signal Processing	3-0-0	3

Course Outcomes (CO):

CO1: Students will be able to develop a thorough understanding on basics of random variables and random processes.
CO2: Students will be able to apply different mathematical techniques for ECG data compression.
CO3: The students will be able to analyze ECG with characteristic feature points and understand how to apply specific mathematical techniques to solve problems in the areas of ECG signal processing like QRS Detection, Arrhythmia detection and Heart rate variability analysis.
CO4: Students will be able to develop a thorough understanding on basics of adaptive noise canceling and signal averaging to solve the different problems of cardio logical signals.
CO5: Students will be able to analyze neurological signal and can apply specific mathematical techniques to solve problems in the area of EEG signal processing.

MODULE 1: Statistical Estimates of Signal
Discrete and continuous Random variables, Probability distribution and density functions. Gaussian and Rayleigh density functions, Correlation between random variables.

MODULE 2: Stationary Random Process
Ergodicity, Power spectral density and autocorrelation function of random processes. Noise power spectral density analysis, Noise bandwidth, noise figure of systems.

MODULE 3: Data Compression Techniques
Lossy and Lossless data reduction Algorithms. ECG data compression using Turning point, AZTEC, CORTES, Hoffman coding, vector quantization, DCT and the K L transform.

MODULE 4: Cardio Logical Signal Processing
Pre-processing. QRS Detection Methods. Rhythm analysis. Arrhythmia detection Algorithms. Automated ECG Analysis. ECG Pattern Recognition. Heart rate variability analysis.

MODULE 5: Adaptive Noise Canceling
Principles of Adaptive Noise Canceling. Adaptive Noise Canceling with the LMS adaptation Algorithm. Noise Canceling Method to Enhance ECG Monitoring. Fetal ECG Monitoring.

MODULE 6: Signal Processing
Signal Averaging, polishing mean and trend removal, Prony's method. Linear prediction. Yule walker equations.

MODULE 7: Neurological Signal Processing
Modeling of EEG Signals. Detection of spikes and spindles Detection of Alpha, Beta and Gamma Waves. Auto Regressive (A.R.) modeling of seizure EEG. Sleep Stage analysis. Inverse Filtering. Least squares and polynomial modeling. Original Prony's Method, Prony's Method based on the Least Squares Estimate, Analysis of Evoked Potentials and PCG Case study: Brain computer interfacing, data acquisition, preprocessing, feature extraction, Application of BCI.

Textbooks/ Reference Books:

1. Rangaraj M. Rangayyan "Biomedical Signal Analysis". IEEE Press, 2001.
2. D.C.Reddy, Biomedical Signal Processing- principles and techniques, Tata McGraw-Hill.
3. Biomedical Digital Signal Processing, Willis J.Tompkins, PHI,
4. Weitkunat R, Digital Bio Signal Processing, Elsevier.
5. Akay M, Biomedical Signal Processing, Academic: Press.
6. Cohen.A, Biomedical Signal Processing -Vol. I Time & Frequency Analysis, CRC Press.

Course Code	Course Title	Hours per week L-T-P	Credit C
IE1817PE42	**Advanced Sensors and Instrumentation**	**3-0-0**	**3**

Pre-requisites of course: Basic Transducers and Industrial Instruments

Course Outcomes (COs):

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

MODULE 1: Quick revision of: Working n applications of Sensors & Transducer- Resistive, Inductive & Capacitive; Measurement of temperature & position, Use of proximity sensor, vibration sensor, Flow Sensors-- Ultrasonic & Laser, Level Sensors: Ultrasonic. **(5 lectures)**

MODULE 2: Virtual Instrumentation: Graphical programming techniques, Data types, Advantage of Virtual Instrumentation techniques, Concept of WHILE & FOR loops, Arrays, Clusters & graphs, Structures: Case, Sequence & Formula nodes, need of software based instruments for industrial automation. **(8 lectures)**

MODULE 3: Data Acquisition Methods: Basic block diagram, Analog and Digital IO, application of Counters, Timers, Types of ADC and DAC: Weighted Resistor and R-2R Ladder type, Use of Data Sockets for Networked Communication. **(8 lectures)**

MODULE 4: Intelligent Sensors: General Structure of smart sensors & its components, Characteristic of smart sensors: Self calibration, Self-testing & self-communicating, Application of smart sensors: Automatic robot control & automobile engine control. **(8 lectures)**

MODULE 5: Introduction to Communication protocols for example Modbus, Profibus, Foundation Fieldbus etc. Introduction to Programmable Automation Controller. **(8 lectures)**

Text Books:

1. DVS Murthy, Transducers and Instrumentation, PHI 2nd Edition 2013
2. D Patranabis, Sensors and Transducers, PHI 2nd Edition 2013.
3. S. Gupta, J.P. Gupta / PC interfacing for Data Acquisition & Process Control, 2nd ED / Instrument Society of America, 1994. 4. Gary Johnson / Lab VIEW Graphical Programing II Edition / McGraw Hill 1997.

Reference Books:

1. Arun K. Ghosh, Introduction to measurements and Instrumentation, PHI, 4th Edition 2012.
2. A.D. Helfrick and W.D. cooper,Modern Electronic Instrumentation & Measurement Techniques, PHI – 2001
3. Hermann K.P. Neubert, "Instrument Transducers" 2nd Edition 2012, Oxford University Press.

Course Code	Course Title	Hours per week L-T-P	Credit C
EE1817PE42	Renewable Energy Sources	3-0-0	3

Objectives

Introduce fundamental concepts in Renewable Energy Sources, advantages and disadvantages, design, simulation and their applications.

Course Outcomes

CO1: To comprehend the world energy situation and the notion of distributed end use energy and to understand the bad effects of the present concentration use of energy.

CO2: To understand the different types of renewable energy sources, their advantages/disadvantages and applications

CO3: To able to know the basics of solar energy and to be able to design and development of solar photovoltaic/thermal systems.

CO4: To be able to model, analyze and design wind energy systems along with biomass based systems.

CO5: To be able to understand and analyze the energy from the ocean wave, Magneto-Hydro-Dynamic Generation and fuel cell.

MODULE 1: Introduction

Fossil fuel based systems, impact of fossil fuel based systems, renewable energy – sources and features, seasonal variations and availability, importance, primary & secondary energy sources, limitations to primary sources, various sources of renewable energy, applications

MODULE 2: Solar Energy Solar Geometry

Solar radiation, solar radiation angles, local solar time, solar radiation spectrum, radiation measurement, solar collector-flat plate collector & solar concentrator, solar heater-water heater & air heater, solar cooker, solar distillation, solar energy storage- sensible heat storage & latent heat storage.

MODULE 3: Solar Photovoltaic Systems

Operating principle, photovoltaic cell concepts, cell, module, array, series and parallel connections, Maximum power point tracking (MPPT)

MODULE 4: Wind Energy

Wind turbine rotor -classification, characteristics, Analysis of ideal wind turbine rotor, Power co-efficient, Types of wind mills, Site selection Characteristics of wind generators

MODULE 5: Biomass

Operating principle, classification, design and applications

MODULE 6: Energy from the Ocean

Tidal energy, wave energy, ocean thermal energy conversion (OTEC) introduction, types, plants & their specifications

MODULE 7: Geo-Thermal Energy

Sources and use of geo-thermal energy, classification of geo-thermal power plants

MODULE 8: Magneto Hydro Dynamic
Generation Principles of MHD generation, MHD generator, equivalent circuits, MHD system

MODULE 9: Fuel Cell
Introduction, energy conversion principles, types of fuel cell, components of a fuel cell, polarization

Textbooks/ Reference Books:

1. Swami Saran, "Soil Dynamics and Machine Foundations", Galgotia Publications Pvt. Ltd., New Delhi.
2. Shamsher Prakesh and Vijay Kumar Puri, "Foundations for Machines: Analysis and Design", A Wiley-Interscience Publication, John Wiley and Sons.
3. P. Srinivasulu and C. V. Vaidyanathan, "Hand Book of Machine Foundations", McGraw-Hill Education.
4. Steven L. Kramer, "Geotechnical Earthquake Engineering", Prentice Hall International Series, Pearson Education India
5. F. E. Richart, Jr., J. R. Hall, Jr. and R. D. Woods, "Vibrations of Soils and Foundations", Prentice-Hall International Series
6. IS 2974-1: "Code of Practice for Design and Construction of Machine Foundations", Part 1: Foundation for Reciprocating Type Machines, Bureau of Indian Standards

Course Code	Course Title	Hours per week L-T-P	Credit C
IE1817OE31	Fundamental of Power Electronics	3-0-0	3

Course Objectives:

- To understand the principle of operation of SCR, GTO devices etc.
- To know about triggering, commutation of SCR, firing circuits, commutation circuits etc.
- To understand various connections of thyristors, protection etc.
- To understand operation of various converters. UPS etc
- To know principle of operation of chopper, inverter, their voltage control etc.

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

CO1: Use switching characteristics of various power semiconductor devices and understand their principal of operations.

CO2: Develop in-depth knowledge of the single-phase and three-phase uncontrolled and controlledrectifiers with various loads.

CO3: Examine the working of various choppers and build knowledge of commutation circuits.

CO4: Analyze and evaluate the operation of inverters, cycloconverters and AC controllers.

CO5: Demonstrate the application of various power electronics converters like SMPS, UPS etc.

MODULE 1: Semiconductor Power Devices

Introduction, operation and characteristics of power diode, power transistors (BJT, MOSFET, IGBT etc.),DIAC, TRIAC, GTO, SCR; Rating, mounting, cooling, protection, triggering and control of SCRs; Natural and forced commutation of SCRs.

MODULE 2: Uncontrolled and Controlled Rectifiers

Single phase half-wave, full-wave and bridge uncontrolled rectifiers with various loads, three-phase uncontrolled rectifier circuits, operation of freewheeling diode, half-controlled and full-controlled circuits, single-phase and three-phase controlled rectifiers, effect of load and source inductance.

MODULE 3: Choppers

Principle of operation of chopper, PWM switching, step-up and set-down choppers, class A, B, C, D andE operations, commutation circuits: Morgan chopper, Jones chopper; Buck, Boost and Cuk regulators.

MODULE 4: Inverters

Principle of operation of inverter, dual converter, single-phase and three-phase inverters, voltage control inverter: PWM modulation, voltage source and current source inverters.

MODULE 5: AC Controllers and Cycloconverters

Principle of operation of A C controller,Single phase and three phase, half control and full control, applications of AC controller.

Principle of operation of cycloconverter, step-up and step-down cycloconverters, blocked group operation, circulating current mode.

MODULE 6: Application of Power Electronic Converters

Switched mode power supply, uninterrupted power supply, DC and AC motor control etc.

Textbooks/Reference Books:

1. M.H. Rashid, 'Power Electronics - Circuits, Devices and Applications,' Pearson Education India.
2. P.S. Bimbhra, 'Power Electronics,' Khanna Publishers.
3. Cyril W. Lander, 'Power Electronics,' McGraw-Hill Inc.
4. Mohan, Undeland, and Robbin, 'Power Electronics - Converters, Applications and Design,' JohnWiley and Sons.

Course Code	Course Title	Hours per week L-T-P	Credit C
IE1817OE32	Principles of Safety and Fire	3-0-0	3

Course Objective:
The course will introduce the principles of safety and fire, discuss their applications in various domains and build a supporting knowledge against engineering disasters.

Course Outcome:

1. Develop functional knowledge of various accident prevention methods and work permit.
2. Analyze the safety requirements in material handling and equipment.
3. Select different structural elements and their dimensions for a particular fire resistance rating of a building.
4. Develop guidelines to ensure safety at construction site and plants.

Pedagogy:

- Class lectures and discussion on the fundamental principles of safety.
- Case study presentations.
- Individual and group assignments.

MODULE 1: Introduction
Socio-Legal Awareness: Right to Information (RTI), Intellectual Property Rights (IPR) and Patents, Factories Act, 1948.
Meaning and Scope of Industrial Psychology and Industrial Sociology, Fatigue, Selection and Training of Workers, Motives for Work in Industry, Sustainable Development, Professional Ethics.

MODULE 2: Principles of Safety Management
Accident prevention Methods- Engineering, Education and Enforcement. Safety Education a Training- Importance, Various training methods, Effectiveness of training, Behaviour oriented training. Communication-purpose, barrier to communication. Housekeeping: Responsibility of management and employees. 5 s of housekeeping.
Work permit system- objectives, hot work and cold work permits. Typical industrial models and methodology. Entry into confined spaces.
Definitions: Accident, Injury, Unsafe act, Unsafe Condition, Dangerous Occurrence, Reportable accidents. History of safety movement. Theories of accident causation.

MODULE 3: Safety in Construction Site
Safety in material handling and equipment - Safety in storage a stacking of construction materials. Safety in the use of construction equipment/vehicles- excavators, graders and dozers - cranes - hoists a lifts - other lifting gears˜ wire ropes - chain-pulley blocks - mixers - conveyors - pneumatic and hydraulic tools in construction, Case Studies (at-least one).
Safety in temporary power supply, HV line and fire safety at construction site and Safety gears, Case studies (at-least one).

MODULE 4: Safety in Refinery and Chemical Plant
Safety during startup and shutdown - safety checks in the design of the equipment - reactor safety - safety in erection and commissioning of chemical plants - non -destructive testing methods - pressure and leak testing - emergency safety devices, Hazardous inorganic and organic reactions and processes, Reactivity as a process hazard, Detonations, Deuagrations, and Runaways, Assessment and Testing strategies, Self

- heating hazards of solids, Explosive potential of chemicals, Structural groups and instability of chemicals, Thermochemical screening, Case studies (at-least one).
Personal protection in the work environment, Types of PPEs, Personal protective equipment- respiratory and non-respiratory equipment. Standards related to PPEs.
Monitoring Safety Performance: Frequency rate, severity rate, incidence rate, activity rate.

MODULE 5: Structural Fire Safety

Compartment fire-factors controlling fire severity, ventilation controlled and fuel controlled fires; Spread of fire in rooms, within building and between buildings.
Effect of temperature on the properties of structural materials- concrete, steel, masonry and wood; Behaviour of non-structural materials on fire- plastics, glass, textile fibres and other household materials. Determination of combustibility by fire tube method; Brief description on non-combustibility test and classification of UAME spread rate of materials as per relevant standards (BIS).
Fire area- calculation of building fire area, subdivision of fire areas in Industrial, Residential and Public buildings; Fire separation between building- principles of calculation of safe distance.

MODULE 6: Accident Investigation with Case Study

Accident investigation -Why? When? Where? Who? How? Basics- Man- Environment a System. Process of Investigation -Tools-Data Collection- Handling witnesses- Case study.
Accident analysis -Analytical Techniques-System Safety-Change Analysis- MORT-Multi Events Sequencing-TOR.
Cost of Accidents-Computation of Costs- Utility of Cost data. Plant safety inspection, types, inspection procedure. Safety sampling techniques. Job safety analysis (JSA), Safety surveys, and Safety audits. Safety Inventory Technique

Text Books:

1. John V. Grimaldi and Rollin H. Simonds. Safety Management. All India Traveller Book Seller, Delhi, 1989.
2. L M Deshmukh. Industrial Safety Management, Mc Graw Hill, 2005.

Reference:

1. V. J. Davies and K. Tomasin. Construction Safety Handbook. Thomas Telford Publishing, London, 1996.
2. Ted S. Ferry. Modern Accident Investigation and Analysis, John Wiley a Sons, Hoboken, N. J., 1988.

Course Code	Course Title	Hours per week L-T-P	Credit C
HS181704	Principles of Management	3-0-0	3

MODULE1: Introduction
Definition and meaning of management, Characteristics of management, importance of management, functions of management-planning, organising, directing, staffing, coordination and controlling etc., principles of management, Difference between administration and management

MODULE2: Financial Management
Definition and management of financial planning, importance and characteristics of sound financial plan, concepts of capital- fixed capital and working capital, source of finance, fund flow statement.

MODULE3: Marginal Costing
Definition and meaning of marginal costing, advantages, marginal cost equation, contribution, profit-volume ratio, break even analysis, margin of safety.

MODULE4: Cost Accounting
Cost Accounting- Concept and benefit, elements of cost, preparation of cost sheet with adjustment of raw materials, work-in-progress and finished goods.

MODULE5: Capitalisation
Definition and meaning of capitalisation, over and under capitalisation.

MODULE6: Motivation
Introductory observation, definition of motivation, motivational technique, features of sound motivational system.

MODULE7: Leadership
Concept of leadership, principles of leadership, functions of leadership, qualities of leadership, different styles of leadership**.**

Textbooks/Reference Books:

1. Principle of Business Management: RK Sharma, Shashi K.Gupta
2. Business Organisation and Management: SS Sarkar, RK Sharma, Shashi K.Gupta
3. Industrial Organisation and Management: SK Basu, KC Sahu, B Rajviv
4. Principles of Management by Dr. A. K. Bora: Chandra Prakash, Guwahati.
5. Management Accounting: RK Sharma, Shashi K Gupta
6. Cost Accounting: SP Jain, K I Narang
7. Cost Accounting, RSN Pillai, V Bhagawati
8. Principles of Management: RN Gupta
9. Principles of Management: RSN Pillai, S. Kala
10. Principles of Management: Dipak Kumar Bhattacharj

Course Code	Course Title	Hours per week L-T-P	Credit C
IE181722	**Project-1**	**0-0-6**	**3**
GUIDELINES WILL BE ISSUED BY THE UNIVERSITY FROM TIME TO TIME			

Course Code	Course Title	Hours per week L-T-P	Credit C
SI181721	**Internship-III (SAI - Industry)**	**0-0-0**	**2**
GUIDELINES WILL BE ISSUED BY THE UNIVERSITY FROM TIME TO TIME			

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