



IPS ACADEMY- INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(A UGC Autonomous Institute, affiliated to RGPV, Bhopal)

Rajiv Gandhi Pradyogiki Vishwavidyalaya, Bhopal

Scheme of Examination as per AICTE Flexible Curricula

IV Semester Bachelor of Technology (B.Tech.)

[Fire Technology & Safety Engineering]

| S. No | Course Type | Course Code | Subject Name | Maximum Marks Allotted | | | | | Total Marks | Contact Hours per week | | | Total Credits |
|---------------------------------------|-------------|-------------|---|------------------------|----------------|------------------|-----------|--------------------------------|-------------|------------------------|----|----|---------------|
| | | | | Theory | | | Practical | | | L | T | P | |
| | | | | End Sem | Mid Sem. Exam. | Quiz/ Assignment | End Sem | Term work Lab Work & Sessional | | | | | |
| 1 | BSC | MA03 | Probability and Statistics | 60 | 25 | 15 | - | - | 100 | 2 | 1 | - | 3 |
| 2 | PCC | FT05 | Fire Prevention and Protection Measures | 60 | 25 | 15 | - | - | 100 | 2 | 1 | - | 3 |
| 3 | PCC | FT06 | Heavy Vehicle Automobile Engineering and Safety | 60 | 25 | 15 | - | - | 100 | 3 | - | - | 3 |
| 4 | PCC | FT07 | Strength of Materials | 60 | 25 | 15 | - | - | 100 | 2 | 1 | - | 3 |
| 5 | PCC | FT08 | Salvage Evaluation of Fire Situation | 60 | 25 | 15 | - | - | 100 | 2 | - | - | 2 |
| 6 | HSMC | HS04 | Entrepreneurship Principles and Process | 60 | 25 | 15 | - | - | 100 | 1 | - | - | 1 |
| 7 | IFC | EC01 | Interdisciplinary Foundation Course-I | 60 | 25 | 15 | - | - | 100 | 2 | - | 0 | 2 |
| 8 | LC | FT05(P) | Fire Prevention and Protection Measures Lab | - | - | - | 60 | 40 | 100 | - | - | 2 | 1 |
| 9 | LC | FT06(P) | Heavy Vehicle Automobile Engineering and Safety | - | - | - | 60 | 40 | 100 | - | - | 2 | 1 |
| 10 | LC | FT07(P) | Strength of Materials | - | - | - | 60 | 40 | 100 | - | - | 2 | 1 |
| 11 | SBC | FT02(P) | Fire Fighting & Field Training | - | - | - | 60 | 40 | 100 | - | - | 4 | 2 |
| 12 | MLC | MLC02 | Constitution of India | - | - | - | - | - | - | 1 | - | - | Audit |
| 13 | LLC | LLC02 | Liberal Learning Course II | - | - | - | - | 100 | 100 | - | - | 2 | 1 |
| Total | | | | 420 | 175 | 105 | 240 | 260 | 1200 | 15 | 03 | 12 | 23 |
| Total Academic Engagement and Credits | | | | | | | | | | 30 | | | 23 |

Interdisciplinary Foundation Course (IFC)-I, EC01 (Offered by Electronics and Communication Department.)

➤ Sensors and Automation

Liberal Learning Course-II, LLC02 (Any One Course from NSO/NCA)

A. NSO Any one Sports at State Level

B. NCA

Music/Dance/Photography /Cinematography /Podcasting /Theatre/Painting

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|------------------|-----------------------------------|--------------------------|-------------------|
| BSC-MA 03 | Probability and Statistics | 3L:0T:0P (04 hrs) | 03 Credits |
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Course Objective: The objective of this course is to familiarize the students with statistical techniques, develop statistical skills and increase students' thinking power. It aims to equip the students with standard concepts and tools at an intermediate to advance level that will serve them well towards tackling various problems in the discipline.

Module 1 (10 Hrs)

DATA COLLECTION & ANALYSIS : Introduction and importance of statistics, Types of data, Methods of collecting primary data, Methods of sampling, Merits and limitations of sampling, Types of classification, Formation of frequency distribution, Tabulation of data, Frequency distribution, Types of graphs and diagrams, Histogram, Bar diagram, Frequency polygon, Frequency curve, Ogive, Pie diagram, Pictogram.

Module 2 (10 Hrs)

STATISTICAL MEASURES: Measures of central tendency, Arithmetic mean, Median, Mode, Geometric mean, Harmonic mean, Measures of absolute dispersion, Range, Quartile deviation, Average deviation, Standard deviation, Skewness and Kurtosis.

Module-3 (8 Hrs)

CORRELATION & REGRESSION ANALYSIS : Introduction, Significance, Types, Scatter diagram, Karl Pearson's correlation coefficient, Coefficient of correlation, Rank correlation coefficient, Regression lines, Regression equations, Standard error of estimate.

Module 4 (10 Hrs)

PROBABILITY THEORY : Definition of probability, Mutually exclusive events, Additive law of probability, Compound events, Dependent and independent events, Multiplicative law of probability, Conditional probability, Total probability, Bayes' theorem, Random variables and their properties, Probability mass function, Probability density function.

Module-5 (10 Hrs)

DISCRETE AND CONTINUOUS PROBABILITY DISTRIBUTIONS: Introduction, Discrete distribution: Binomial and Poisson's distribution, Continuous distribution: Normal distribution, Exponential distribution, Gamma & Beta distribution.

Course Outcome:

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

1. Explain concept of statistical analysis and find the distribution behind data.
2. Explain and apply the basic ideas of statistics including measures of Central tendency.
3. Explain and apply the concepts of correlation and regression.
4. Define the principal concepts about probability and apply to engineering problems.
5. Explain and apply the concepts of probability distribution in evaluation of engineering problems.

List of Text/Reference Books:

1. J. Susan Milton and Jesse Arnold, Introduction to Probability and Statistics, McGraw Hills 2017
2. B.V. Ramanna, Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 2017.
3. C. Douglas Montgomery and G. C. Runger, Applied Statistic and Probability for Engineers,
4. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, Probability and Statistics for engineering and Scientist, Pearson Education, 9th Edition, 2011.
5. Dr. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 44th Edition, 2020.
6. Dr. T.K.V. Iyengar, B.Krishna Gandhi, S.Ranganatham, Dr. M.V.S.S.N. Prasad, Probability and Statics S. Chand Publication,
7. A Text Book for Probability and Statistics, Morris H. Degroot, 4th Edition 2012.

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|-----------------|--|--------------------------|-------------------|
| PCC-FT05 | Fire Prevention & Protection Measures | 2L:1T:0P (03 hrs) | 03 Credits |
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Course Objectives:

- To learn about the fundamentals of buildings and their classifications.
- To teach about the evacuation procedure and means of escape during emergency in tall structures.
- To learn about automatic fire and gas detection in different types of occupancy.
- To teach about first aid fire fighting equipments, their working principles and periodic maintenance.
- To learn about ideal fire and life safety requirement based on different types of buildings.

Course Content:

Module 1 (08 Hrs)

BUILDING STUDIES Basic Terminology, Elements of Structure, Fire Test, Standard time, Temperature relationship, Non combustibility test, Ignitibility test, Fire Propagation test, Performance criteria for fire resistance, Fire resistance rating of structural elements, Type of Building construction, Classification of building based on occupancy, Fire zones..

Module 2 (09 Hrs)

MEANS OF ESCAPE General requirements for evaluation facilities, Principle factors for design consideration, evacuation time, Occupancy load, Occupancy, Travel distance, Design for evacuation routes, evacuation route quantification, requirement of stairs ways, phased evacuation in tall buildings, Life Safety Consideration refuse area, Exit Route, Assibilate of fire fighting approach evacuation facility or disable people, use of lifts & air lifting, safe evacuation time.

Module 3 (08 Hrs)

FIRE AND GAS DETECTION Fire Alarm system basic, classification of fire alarm system, Basic consideration for installation, Automatic fire detectors, heat detector, Smoke detector, Gas sensing fire detector, Radiant energy sensing fire, detectors, detector installation, maintenance & testing, Inspection, Testing & maintenance shutting for Fire alarm system & its component gas & vapor fixed detection system, Sensors portable gas maintaining instrument.

Module 4 (10 Hrs)

FIRE EXTINGUISHMENT Basic concept of fire fighting with water, carbon dioxide, dry chemical powder, foam and inert gases, Extinguishing Properties of Water, Droplet size, Smoothing, Heat absorbing capacity, Surface tension and waiting agent additives and its limitations, Properties of inert gases as extinguishing agent, properties of foam, Expansion, Concentration, bubbles size, Extinguishing properties of Dry chemical powder, Composition, Particle size, Radiation shielding, Chain breaking mechanism, Description, working principle and Operation methods of portable Fire Extinguishers, Care inspection and maintenance of portable Fire Extinguisher, Performance criteria of different types of Fire Extinguisher as per relevant Indian Standard.

Module 5 (06 Hrs)

MODEL FIRE AND LIFE SAFETY REQUIREMENT: Residential buildings, Educational buildings, Institutional buildings, Assembly buildings, Business buildings, Industrial buildings, Storage buildings and Hazardous buildings, Life Safety requirement in Underground structure, Basement protection, Fire Protection is Building under construction, Fire Control Room.

Course Outcome:

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

1. Explain fire resistance rating of different structural elements and fire resistance test on building material.
2. Design evacuation routes and performed evacuation in tall buildings.
3. Design fire alarm system with fire and gas detection apparatus in different types of occupancy.
4. Demonstrate first aid fire fighting appliances and performed periodic care and maintenance for the same.
5. Present model fire and life safety requirement in different type of buildings. .

List of Text/Reference Books:

1. Barendra Mohan Sen, Fire Protection And Prevention The Essential Handbook, Ubs Publishers.
2. Dr. Than Singh Sharma, Fundamentals In Building Design.
3. Lon H. Ferguson, Fundamentals Of Fire Protection For The Safety Professional, The Scarecrow Press, Inc.
4. National Building Code Of India Part-Iv.
5. Fire Protection Hand Book Volume-Ii Section-Ix.

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|-----------------|--|--------------------------|-------------------|
| PCC-FT06 | Heavy Vehicle Automobile Engg. & Safety | 3L:0T:0P (03 hrs) | 03 Credits |
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Course Objectives:

- To understand the basic concept of Engine classification and types gear box
- To understand the basic concept of differential systems
- To understand the basic concept of Electrical system of Heavy vehicle.
- To understand the Lubrication system of heavy vehicle and safety arrangements in automobiles.
- To study the Indian Motor Vehicle Act and Safety Systems in Automobiles..

Course Content:

Module 1

(08 Hrs)

ENGINES : Engine Classification, construction, details of Engine Components. Combustion in S.I. Engines, Combustion in C.I. Engines, Study of fuel system components. Function of carburettors, construction details, Type of Study of diesel fuel feed systems. Carburation and mass distribution of mixture, supercharging, fuel injection and injection sections. Clutch, Types, Construction, Operation and Fault finding of clutches. Transmission assembly, Types of Gear box, Transfer of gear box, operation and maintenance of gear box.

Module 2

(08 Hrs)

DIFFERENTIAL: Necessity, Construction of differential systems. Axles, Types and Application. Brakes, Types, Construction and Operation of Hydraulic, Pneumatic Brake Systems, Maintenance of Brakes. Suspension, Necessity, Types, Construction and operation, Shock absorber, Coil springs, Independent suspension, Hotchkiss drive, Torque tube drive. Steering, Systems, Constructional details, types of steering gear box, steering geometry, caster, camber, king pin inclination, Effect of steering geometry on directional stability, Power steering

Module 3

(06 Hrs)

ELECTRICAL SYSTEM. Ignition Systems, Magnet ignition, Battery Ignition, Electronic Ignition, Merits and Demerits, Working, Self Starter, Dynamo voltage regulator, Battery construction, operation and maintenance. Pollution. Air-Pollution, Euro norms, Pollution Control techniques.

Module 4

(08 Hrs)

LUBRICATING SYSTEM: Types, Components, Lubricating oil, Cooling System, Detail of Components, Study of Systems, Types, Miscellaneous, Spacial Gadgets and accessories for Fire Fighting vehicles, Automobile Accidents, CMV Rules regarding safety devices for Drivers, Passengers, Fire fighting vehicles & Appliances. Construction & operation of fire fighting vehicles & appliances Construction & Operation of Fire boats & other Water borne applications Rules & regulations of RTO. Laboratory testing of vehicles. Road testing of vehicles.

Module 5

(08 Hrs)

MOTOR VEHICLES ACT AND SAFETY SYSTEMS

Motor Vehicle Act, Driving License, Traffic signs & Light Signals, Driving techniques for Special Situations, Driving in emergency situations, Safety provisions, Active and Passive Safety Measures, Features for minimum injury during clash, State of the art Safety systems,

Course Outcome:

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

1. Explain engines, their classifications and construction details.
2. Find the basic Faults in the different types of Engines and their operations with Construction of differential system, axles, brakes, gear box, steering system and lubrication system.
3. Identify the electrical faults in vehicle and also will understand the operation and construction of the electrical systems in fire fighting vehicles with applying its pollution control techniques.
4. Apply CMV rules regarding safety devices for drivers, passenger fire fighting vehicles and special type of appliances.
5. Have basic knowledge of operation of fire boats and rules and regulation of RTO with its testing.

List of Text/Reference Books:

1. Wills H. Crouse, Automobile Chassis And Body Construction, Operation And Maintenance, Tata Mcgraw Hill 1976
2. Dr. D.S. Kumar, Automobile Engineering, S.K. Kataria & Sons 2015
3. Arther V. Judge, Modern Petrol Engine 1975
4. A.T. Walford, Ergonomies Of Automation 1989
5. S.Adhey, Bormh Practical Automobile Engineering Illustrated, Asia Publishing House, 1983
6. G.B.S. Narrang, Automobile Engineering, Khanna Publisher
7. R.B. Gupta, Automobile Engineering, Satya Prakashan 2015
8. R.P. Sharma, A Course In Automobile”Engineering, Dhanpat Rai & Sons

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|-----------------|------------------------------|--------------------------|-------------------|
| PCC-FT07 | Strength of Materials | 2L:1T:0P (04 hrs) | 03 Credits |
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Course Objective :

To familiarize the students with the fundamentals of deformation, stresses, strains in structural elements.

Course Content:

Module 1 (10 Hrs)

STRESS AND STRAIN: stresses in members of a structure, axial loading, normal stress, shear stress, analysis of simple structures, stepped rods, members in series and parallel: stress strain diagram, Hooke's law, stress due to temperature, Poisson's ratio, Bulk modulus, shear strain, relation among elastic constants, residual stress, fiber reinforced composite materials, strain energy under axial loads and stresses due to impact of falling weights. Transformation of stress and strain, principal stresses, normal and shear stress, Mohr's circle and its application to two and three dimensional analysis.

Module 2 (08 Hrs)

BENDING: Pure bending, symmetric member, deformation and stress, bending of composite sections, eccentric axial loading, shear force and BM diagram, relationship among load, shear and BM, shear stresses in beams, strain energy in bending, deflection of beams, equation of elastic curve, Macaulay's method and Area moment method for deflection of beams.

Module 3 (07 Hrs)

TORSION IN SHAFTS: Tensional stresses in a shafts, deformation in circular shaft, angle of twist, stepped and hollow transmission shafts.

Module 4 (08 Hrs)

THEORIES OF FAILURES: Maximum normal stress & shear stress theory; maximum normal and shear strain energy theory; maximum distortion energy theory; application of theories to different materials and loading conditions.

Module 5 (07 Hrs)

COLUMNS AND STRUTS: Stability of structures, Euler's formula for columns with different end conditions, Rankine's formula.

Course Outcomes:

At the completion of this course, students will be able to:

1. Know the concepts of stress and strain.
2. Analyze the beam of different cross sections for shear force, bending moment, slope and deflection.
3. Understand the concepts of Torsion in Shafts through deformation, angle of twist and hollow transmission necessary
4. Understand the theory of failures in different material and loading condition.
5. Understand the concepts of stability of structures.

List of Text/Reference Books:

1. Beer Fp, Johnson Mechanics Of Materials ,Sixth Edition ;Mc Graw Hills
2. Debabrata Nag & Abhijet Chanda :Strength Of Materials : Wiley
3. Rattan; Strength Of Materials;Second Edition , Mc Graw Hills
4. Nash William; Schaum's Outline Series; Forth Edition Strength Of Materials;Mc Graw Hills
5. Singh Arbind K; Mechanics Of Solids; Phi
6. Sadhu Singh; Strength Of Materials; Khanna Pub.
7. R Subramannian , Strength Of Materials Oxford University Press ,Third Edition .
8. S Ramamurthum , Strength Of Materials , Dhanpat Rai

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|-----------------|---|--------------------------|-------------------|
| PCC-FT08 | Salvage Evaluation of Fire Situation | 2L:0T:0P (02 hrs) | 02 Credits |
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Course Objectives:

1. To teach the significance of salvage and smoke movement in fire investigation process.
2. To learn the fundamental of compartment fire and its application in fire investigation process.
3. To calculate the fire loss by different methodology and application of data in identification of fire trends.
4. To understand the evacuation process with different models of evacuation.
5. To learn the role of insurance agency in legal and claim aspect

Course Content:

Module 1 (08 Hrs)

SALVAGE AND SMOKE CONTROL: Concept of salvage, salvage operation, equipments, apparatus and methodology used in salvage operations, case studies in different types of occupancies. Mass flow rate, temperature, soot protection. Smoke generation, smoke flow & dispersion, prediction of smoke flow patterns, scaling of smoke proportion, smoke impact in visibility, smoke control system, pressure differences in ventilation system, calculation of discharge rate of air blowers, smoke extraction.

Module 2 (08 Hrs)

COMPARTMENT FIRE: Stage of fire development, fire induced flows, compartment flow dynamics, single room fire analysis, Model of enclosure fires, theory & concepts of zone models, Dynamics of enclosure fire: Heat release, fire generated flows, heat transfer & flow through openings. Zone modeling of pre flashover enclosure fire: Flame & burning object, source terms, fire plume source terms. Hot layer source terms, product of combustion source terms one zone modeling of pool flash fire.

Module 3 (06 Hrs)

FIRE LOSS INVESTIGATION: Fire Risk analysis methods, Quantitative Deterministic methods, Quantitative probabilistic methods, Monte Carlo Technique, Safety Index Method, Ranking method, Fire Risk Index Method, Initial observation and Examination of the Scene, Use of Fire Incident data, Approaches to fire data analysis, top down & topic driven analysis, analysis by fire causes and property type, Analysis of small data sets, application of data trends identification.

Module 4 (08 Hrs)

PYROLYSIS: Importance of Pyrolysis in Fires, Pyrolysis process, Physico Chemical Description of Pyrolysis Process, Pyrolysis of Cellulose, Pyrolysis of Hemicellulose, Pyrolysis of Lignins, Pyrolysis of Wood, Characteristics and location of fire causalities, nature of Injuries, causality rate per fire, Process of emergency evacuation, Evacuation modeling, model-1 EXIT, model-2 EGRESS, model-3 SIMULEX.

Module 5 (08 Hrs)

ECONOMICS AND INSURANCE: Computation of Loss, Fire Insurance Claims, Legal provisions for Fire Loss, Economics of Loss Prevention, Cost of Losses, Cost of Prevention, Level of Loss Prevention Expenditure, Insurance of Process Plant, Damage Insurance, Business Interruption Insurance, Other Insurance Aspects.,

Course Outcome:

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

1. Demonstrate salvage equipments and apparatus with evaluation of smoke control parameter in occupancy.
2. Design compartment fire zone and formulate the fire dynamics of given problem.
3. Explain fire loss investigation process and prepare fire investigation report.
4. Prepare evacuation plan of a given occupancy.
5. Explain the role of insurance agency in fire loss.

List of Text/Reference Books:

1. V.K. Jain. Fire Safety in Buildings. Taylor & Francis
2. D.J. Rasbash. Evaluation of Fire Safety, Willey.
3. Fire protection handbook volume-I section-III, NFPA.
4. Fire protection handbook volume-II section-IX, NPFA
5. Fundamental of fire fighting skills, NFPA
6. Scand Power. Handbook for Fire calculation and fire risk assessment in the process industry, AS Sintef-NBL.

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| HSMC-HS04 | Entrepreneurship & Principles of Management | 1L:0T:0P (1 Hrs) | 01 Credit |
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Course Objectives:

1. Explain Entrepreneurship and its importance
2. Describe the importance E-commerce
3. Explain the importance Digital Marketing in current scenario.
4. Describe the importance of planning and organization Structure.
5. Discuss the control process and its elements

Course Content:

Module 1

(08 Hrs)

Entrepreneurship: Definition, requirements to be an entrepreneur, entrepreneur and intrapreneur, entrepreneur and manager, growth of entrepreneurship in India, Types of Enterprises and Ownership Structure.

Module 2

(10 Hrs)

E-commerce and its Technological Aspects: Overview of developments in Information Technology and Defining E-Commerce: The scope of E commerce, Benefits and limitations of E-Commerce

Module 3

(08 Hrs)

Introduction to Digital Marketing: Evolution of Digital Marketing from traditional to modern era, Role of Internet, Search Engine Advertising, Display marketing, Social Media Marketing

Module 4

(08 Hrs)

Business Management: Definition, Functions, Process, Scope and Significance of Management. Nature of Management, Managerial Roles, Managerial Skills and Activities, Proprietorship, Ltd., Pvt. Ltd., Company act registration, Startup India, DPIIT, Yukti Portal, Gumasta Licences, Indian startup policy, MP startup policy, Closing a company, Leadership aspects.

Module 5

(10 Hrs)

Management Functions: Nature, Scope, Objective and Significance, Elements and Steps of Planning & organizing, Delegation and Decentralization. Formal and Informal Organizations

Directing: Effective Directing, Supervision, Different Theories of Motivation,

Controlling and Coordinating: Elements of Managerial Control, Control Systems, Management Control Techniques, Coordination Concept, Importance, Principles and Techniques of Coordination.

Course Outcomes:

After completion of the course student will be able to:

1. Understanding of basic concepts, principles and practices entrepreneurship.
2. Understanding of basic concepts & Importance of e-commerce.
3. Understanding of basic concepts of digital marketing
4. Understanding the planning and organizing & organization Structures.
5. Importance of Management Control Techniques

Text Books:

- 1 Chhabra T.N., Principles and Practice of Management. 10th ed Year 2018.
- 2 Murton- Gulab, Management Today. 3th ed.1998
- 3 KoontzH. and O'DonnelH., Essential of Management, 8th ed., McGraw-Hill, New Delhi, 2009.
- 4 Robbins, S. Fundamentals of Management. 5th ed., Pearson Education, Canada, 2008.
- 5 Mohanty SK; Fundamental of Entrepreneurship; PHI, 2005.

Reference Book:

- 1 Prasad L M, Principles and Practices of Management, S. Chand and Sons, New Delhi ,2018
- 2 Terry & Francklin, Principles of Management, Richard– Erwin.18th

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|-----------------|--------------------------------|-------------------------|-------------------|
| IFC-EC01 | Sensor & Automation | 2L:0T:0P (2 Hrs) | 02 Credits |
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Recommended Prerequisite: Basic Electronics, Electronics & Computer Workshop (ECW).

Course Objective:

1. Able to Identify and Select Appropriate Sensor for a given Application.
2. Analyze & Design a basic circuit building block of Sensor System.
3. Train the students to suggest appropriate solution for Industrial automation.

THEORY:

Module 1 (4 Hrs.)

Fundamental of Sensing:

Basic Sensor Technology, Sensor classifications and characteristics, Measurement Issues and Criteria, Introduction to various Signal & Conditioning models, Introduction & Classification of Transducer, Applications of Sensor & Transducer.

Module 2 (4 Hrs.)

Motion, Proximity and Ranging Sensor

Introduction to Capacitive and Inductive Displacement Sensors, LVDT, RVDT, Introduction to GPS, Bluetooth, Ultrasonic and Microwave Sensors, Laser Range Sensor (LIDAR). Optical and Radiation Sensors.

Module 3 (4Hrs.)

Force, Magnetic and Heading Sensors:

Shock and Vibration Sensors, Flow and Level Sensors, Force, Load and Weight Sensors, Humidity Sensors, Machinery Vibration Monitoring Sensors, Pressure Sensors, Strain Gauge, Temperature Sensors.

Module 4 (4 Hrs.)

Advanced Sensor Technologies:

Introduction to LASER, Characteristics of LASER, Types of LASER Sensors, Bar Code Sensors, Benefits of Bar Coding, RFID (Radio Frequency Identification), Biosensors, Chemical Sensors.

Module 5 (4 Hrs.)

Industrial Automation:

Concept, Automation Components, Necessity and Working Principle, Block Schematic of Programmable Logic Controller (PLC). Input & Output Modules (AI, DI, AO, DO), Introduction to Ladder Programming, Introduction to Distributed Control Systems (DCS). Industrial Automation Leads to Industrial IoT and Industry 4.0.

Assessment: Mid-term test, Assignment, Tutorial, Quiz and End semester exam.

Course Outcomes:

Students earning credits will develop ability to:

1. To understand the general principles of sensors.
2. To describe the working principle and characteristics Motion, Proximity and Ranging Sensors.
3. To describe the working principle and characteristics of force, magnetic and heading sensors.
4. To understand the working principle & application of advanced sensor and its technology.
5. To apply the advanced sensor technology for industrial automation.

Text/ Reference Books:

1. Jon S. Wilson, "Sensor Technology: Handbook", Elsevier, 2005
2. Patranabis D, Sensors and Transducers, 2nd Edition, PHI, New Delhi, 2011.
3. Smart Sensors, Measurement and Instrumentation by Subhas Chandra Mukhopadhyay, Springer Book Series.
4. Nikolay Kirianaki, Sergey Yurish, Nestor Shpak, Vadim Deynega, "Data Acquisition and Signal Processing for Smart Sensors", John Wiley & Sons Ltd, 2002.

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| LC-FT05(P) | Fire Prevention & Protection Measures | 0L:0T:2P (04 hrs) | 01 Credit |
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List of Experiment:

1. To measure the operating performance requirement for effective discharge time, fire rating suitability of water type fire Extinguisher on Class A Fire.
2. To measure the operating performance requirement for effective discharge time, fire rating suitability of Foam type Gas Cartridge fire Extinguisher on Class B Fire
3. To measure the burn back resistance time for different foam concentrates using film formation test apparatus.
4. To assess the effective time of film formation at fire surface for different foam concentrates using film formation test apparatus.
5. To Perform the Caking test on given sample of Dry Chemical Powder using procedures given in IS 4308.
6. To determine the moisture content for regular dry chemical powder using procedures given in IS 4308.
7. Determination of calorific value of diesel, petrol and LPG/Kerosene.
8. To determine the water repellency for regular dry chemical powder using water repellency test apparatus.

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| LC-FT06(P) | Heavy Vehicle Automobile Engg. & Safety | 0L:0T:2P (04 hrs) | 01 Credit |
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List of Experiment:

1. To study Electrical System of a Heavy Vehicle.
2. To Study the Lubrication system of an Automobile
3. To Study the cooling system of an Automobile
4. To study the Suspension System of an Automobile.
5. To study the braking system of an Automobile.
6. To Study the Transmission system of an Automobile
7. To Study the Differential and Drive Axles of an Automobile
8. To study the fuel feed system of a Petrol Engine.

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| LC-FT07(P) | Strength of Materials | 0L:0T:2P (04 hrs) | 01 Credit |
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List of Experiment:

1. Standard tensile test on MS and CI test specimen with the help of UTM
2. Direct/ cross Shear test on MS and CI specimen
3. Transverse bending test on wooden beams to obtain modulus of rupture
4. Fatigue test
5. Brinell Hardness tests
6. Vicker hardness test
7. Izod/Charpy test
8. Rockwell Hardness test

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| SBC-FT02(P) | Fire Fighting & Field Training | 0L:0T:2P (04 hrs) | 01 Credit |
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Course Objectives:

1. To learn about the different instruction of fire fighting appliance drill.
2. To learn about lifting, carrying, rolling and unrolling of fire fighting hose.
3. To learn about three men and four men hydrant drill.
4. To learn about four men and six men trailer pump drill.
5. To learn about the application and different ladder drill.

Course Content:

Module 1 (08 Hrs)

APPLIANCE DRILLS Instructions for officer incharge, Duty of drill incharge, Command and action meaning - crew number, Fall in, Fall out, Mount, Dismount, Get to work, Water ON, Knock-off, Make up, Carry ON, Stand from under, still, slip, Counter Balance, Step In, Step out, Extend, Lower, Pitch.

Module 2 (08 Hrs)

HOSE DRILLS Lifting a roll of delivery hose, Carrying of a roll delivery hose, Connecting a delivery hose, Unrolling a delivery hose, disconnecting a delivery hose, under- running delivery hose, Rolling up a delivery hose.

Module 3 (08 Hrs)

HYDRANT DRILL (THREE MEN) Requirement, Position of three crew members, Add one length of hose, Remove one length of hose, Replacing burst length of hose, Getting a branch to work, Dividing a line in to two line of hose, Collecting two hose line to make one line, Knock off and make off.

Module 4 (08 Hrs)

HYDRANT DRILL (FOUR MEN) Requirement, Position of four crew member, Function of individual crew member, Add one length of hose, Removing one length of hose, Replacing a burst length of hose use of dividing breeching, Use of collecting Breeching, Getting a branch to work, knock off and make up.

Module 5 (08 Hrs)

TRAILER PUMP DRILL (FOUR MEN AND SIX MEN) Requirement, Single delivery, Single suction, Double suction, Double delivery, Position of six crew members in trailer pump, Change round, Mount, Dismount, Close up position, Fall in position, Towing Tender, Ladder drill, Extension ladder, Position of four crew members, Position at Pitching, Fire Escape ladder drill requirement, close up position, Pitching.

Course Outcome:

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

1. Demonstrate different world of command used in appliance drill.
2. Apply hose drill performance and practice in fire fighting operation.
3. Apply hydrant drill performance and practice in fire fighting operation.
4. Apply trailer pump drill performance and practice in fire fighting operation.
5. Apply ladder drill performance and practice in fire fighting operation.

List of Text/Reference Books:

1. Drill Manual For Fire Services Of India By Govt. Of India.
2. Fire Fighters Skill Drill Manual By Nfpa.

List of Experiment:

1. To performed and practice different world of command used in appliance drill.
2. To performed and practice hose drill in a crew.
3. To performed and practice three men hydrant drill with hydrant post and hose pipe.
4. To performed and practice four men hydrant drill with hydrant post and hose pipe.
5. To performed and practice four men trailer pump drill with trailer pump, Suction pipe, hose pipe and hose fittings.
6. To performed and practice six men trailer pump drill with trailer pump, Suction pipe, hose pipe and hose fittings.
7. To performed and practice ladder drill and its application..

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| MLC- MLC02 | Constitution of India | 1L:0T:0P (1 Hrs) | 00 Credits |
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Course Objective:

The objective of this course is to familiarize the students with the feature of the Indian constitution, laws, democracy etc.

Course Content:

Module 1 (06 hrs)

Historical Background: Formation and working of constituent Assembly, Formation and working of Drafting committee, Commencement of Indian Constitution, Dr. Ambedkar's ideas of reservation in constitution

Module 2 (05 hrs)

Important Feature of the Constitution: Preamble, Fundamental Rights, Directive Principles of state policy, Fundamental Duties, Centre State Relation

Module 3 (06 hrs)

Parliamentary Democracy: Lok Sabha, Raj Sabha Central Executive President, Prime minister, and Central Ministry, Vidhan Sabha, Vidhan Parishad and State Executive (Governor, Chief Minister, Minister of State)

Module 4 (06 hrs)

Special Provisions in Indian Constitution: Finance Commission Contingency Fund, Consolidated Fund, Public Service Commissions, Election Commission, Safeguards for S.C. S.T. and Backward Classes, Provisions for Emergency and Constitutional Amendments, Indian Judiciary Supreme court and High court

Suggested Reading

1. The Indian Constitution - Granville Austin
2. India's Constitution - M.V. Pylee, S. Chand Publication
3. Ambedkar and Constitution, Raj Kumar, Commonwealth Publication Pvt. Ltd., New Delhi,