



IPS ACADEMY- INSTITUTE OF ENGINEERING & SCIENCE, INDORE

(An Autonomous Institute)

Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Scheme of Examination as per AICTE Flexible Curricula

VIII Semester Bachelor of Technology (B.Tech.)

[Fire Technology & Safety Engineering]

S. No.	Subject 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	PCC -FT801	Emergency Communication System	70	20	10	60	40	200	3	-	2	4
2	PCC-FT802	Fire Fighting Skills	-	-	-	60	40	100	-	-	2	1
4	PEC- FT801	Professional Elective V	70	20	10	-	-	100	3	-	-	3
5	POEC-FT801	Open Elective	70	20	10	-	-	100	3	-	-	3
6	PROJ – FT801	Project Phase-II	-	-	-	60	40	100	-	-	12	6
7	PROJ – FT802	GD/Seminar	-	-	-	-	100	100	-	-	4	2
		Total	210	60	30	180	220	700	9	-	20	19
Total Academic Engagement and Credits									29			19

Professional Elective Courses (PEC)-V	Suggestive Professional Open Electives Courses from Mechanical Engineering
PEC-FT801 (A) Safety in Construction Industry	POEC- FT801 (A) Safety in Rail & Road Transport
PEC-FT801 (B) Safety Management	POEC- FT801 (B) Structural Fire Safety

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

PCC-FT801	Emergency Communication System	3L:0T:2P (05 hrs)	04 Credits
------------------	---------------------------------------	--------------------------	-------------------

Course Objective:

1. To learn about the concept of telecommunication and modulation technique.
2. To learn about the internal communication of fire services and their types.
3. To learn about role of transducer in instrument and their Classification.
4. To learn about analog to digital, digital to analog conversion techniques.
5. To learn about the wireless voice centric communications and their design.

Course Content:

Module 1 **(08 Hrs)**

INTRODUCTION TO TELECOMMUNICATIONS: Communications Principles & Systems, Analog and Digital Communications, Mobile and Cellular communications, Satellite and Terrestrial Communications, Practical and Ideal Channels: Distortion & Noise Effects, Overview of transmission media used, Concept of Modulation: Baseband and Pass band Transmission, Amplitude, Phase & Frequency Modulation Techniques (AM/PM/FM).

Module 2 **(08 Hrs)**

INTERNAL COMMUNICATION OF FIRE SERVICES: Internal communication of fire services- Endorsement and memorandum, Reports and circular, Managerial communication, Agendas, Oral and written communication, Fire services radio system and their types- Wireless local loop, Cordless Phone, RFID, Portable Radios, Mobile Radios, Base/Fixed Station Radios, and Repeaters.

Module 3 **(08 Hrs)**

CLASSIFICATION OF TRANSDUCERS: Transducer: Classification of Transducers, Strain Gauge, Displacement Transducer- LVDT (Linear Variable Differential Transformer), Temperature Transducer- RTD (Resistance Temperature Detector), Thermistor, Thermocouple, Piezo Electric Transducer, Optical Transducer- Photo emissive, Photo conductive, Photo Voltaic, Photo- diode Photo Transistor.

Module 4 **(08 Hrs)**

DIGITAL MEASUREMENT AND INSTRUMENT: Advantage of Digital instrument over Analog Instrument, DAC (Digital Analog Converter), Variable resistive type, R-2R ladder type, Binary ladder, Weighted Converter using Op-amp and Transistor, ADC (Analog to Digital Converter) - Ramp Technique, Dual slope.

Module 5 **(08 Hrs)**

WIRELESS VOICE CENTRIC COMMUNICATIONS: Mobile and Cellular Telecommunications, Concept of cells, frequency reuse & handoffs, Channel transmission mechanisms: LOS, Reflection, Refraction, Diffraction & Scattering, 1G/2G/3G voice oriented wireless technology.

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

Course Outcome:

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

1. Know the basic idea of modulation technique.
2. Explain the basic idea of internal communication of fire services and their types.
3. Understand the basic idea of differentiate between the types of transducers available.
4. Analyze and design digital to analog converter & analog digital converter.
5. Demonstrate wireless voice centric communications and their design.

List of Text/Reference Books:

1. Simon Haykins, Communication System, John Willy
2. Singh & Sapre, Communication System, TMH
3. H.S. Kalsi, Electronics Instrument, TMH.
4. K. Sawhney, Instrumentation & Measurement, Dhanpat Rai & Co.
5. Wireless Communication and Networking – William Stallings, PHI, 2003.

List of Experiment:

1. To analyze characteristics of AM modulator & Demodulators.
2. To analyze characteristics of FM modulators & Demodulators.
3. To analyze and perform the basic operations of Digital Multimeter.
4. To analyze & perform Characteristics of NTC Thermistor.
5. Measurement of displacement using LVDT.
6. To analysis & perform Analog to Digital converter.
7. To analysis & perform Digital to Analog converter using R-2R ladder circuit.
8. Study of 1G/2G/3G voice oriented wireless technology.

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula (**B. Tech**)
Fire Technology & Safety Engineering

PCC-FT802	Fire Fighting Skills	0L:0T:02 (02 hrs)	01 Credits
------------------	-----------------------------	--------------------------	-------------------

Course Objective:

To command, practice and conduct squad and fire fighting drills associated with national fire service.

Course Content:

1. To command, practice and conduct different appliance drills used in fire service.
2. To command, practice and conduct hose drills associated with fire service.
3. To command, practice and conduct different types of hydrant drills.
4. To command, practice and conduct different types of ladder drills.
5. To command, practice and conduct different types of BA set drills.
6. To command, practice and conduct different types of trailer pump drills.
7. To command, practice and conduct different types of emergency evacuation drills.
8. To command, practice and conduct different types of first aid fire fighting appliances drills.

Course Outcome:

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

1. Command, practice and conduct squad and fire fighting drills associated with fire service.

List of Text/Reference Books:

1. AFS – Drill Manual
2. Drill manual for Fire Services of India by Govt. of India.
3. Fire Fighters Skill drill manual by NFPA.

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

PEC- FT801 (A)	Safety in Construction Industry	3L:0T:0P (03 hrs)	03 Credits
-----------------------	--	--------------------------	-------------------

Course Objectives:

To learn and understand the latest safety and health regulations and the Indian Standards applicable to the construction industry.

Course Content:

Module 1 (08 Hrs)

BASIC PHILOSOPHY: Building Bye laws for Residential Area, Cinemas, Theatres, Multiplex, Auditorium etc., Drive-in-Cinemas, Gasoline Filling Station, Basic Philosophy and parameters governing in construction such as site planning and layout, safe access and good housekeeping, safety in use of construction machinery, structural soundness, structural safety, accident causes and its effect.

Module 2 (08 Hrs)

WORKING AT HEIGHT: Fall protection in construction, OSHA 3146, Requirement for working at height, Work permit system, Height pass, Salient Features of safety and health in the Building & other Construction Workers (Regulation of employment and conditions of service) Act. 1996 and Central Rules 1998 IS & NB codes)

Module 3 (06 Hrs)

SAFETY IN DEMOLITION OPERATIONS: Planning & permit, Precautions prior to demolition, Protection of public, Precautions during demolition. Sequence of demolition operations from safety point of view, Safety measures with respect to building materials including cement, lime, timber, steel, glass, paints, varnishes, and petroleum products

Module 4 (08 Hrs)

SAFETY IN CONSTRUCTION OPERATIONS I : Underground works Excavation, drilling & blasting, trenching, strutting, piling & safety in using and operation machinery and equipment relating to above components. Above ground works, Scaffolding, Centering, Frame work, Ladders, Concreting wall and floor openings, staircases and railings. Structural steel work including welding, cutting erection, Safety in use of related machinery equipments,

Module 5 (08 Hrs)

SAFETY IN CONSTRUCTION OPERATIONS II : Under water operations, River draining, well sinking, Caissons, under water concreting, Cofferdams & special operation connected with irrigation works, Use of related machinery and equipments, Movement of Materials & personnel, Heavy/Long items, Railway wagons, Motor trucks, Vehicles and Hazardous materials, High rise building, bridges, roads, railways, asphaltting, pneumatic caissons, electrical, installations & lifts, safety in prevention and protection at work site including collapsing of structures

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

Course Outcome:

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

1. Understand philosophy and parameters governing in construction Industry.
2. Demonstrates the working at height operation and apply applicable rules and act in Indian scenarios.
3. Explain safety in demolition operations involved with construction industry.
4. Understand safety in construction operation specifically underground works excavation.
5. Understand safety in construction operation specifically under water operations.

List of Text/Reference Books:

1. Hinze, J.W. (1997) Construction Safety, Prentice Hall
2. Mac Collum, D.V. (1995) Construction Safety Planning, John Wiley & Sons
3. Reese, C.D. & Eidson, J.V. (2006) Handbook of OSHA Construction Safety and Health, Taylor & Francis.
4. Lingard, H. & Rowlinson, S. (2005) Occupational health and Safety in Construction Project Management, Spon Press.
5. Holt, A.S.J. (2005) Principles of Construction Safety, Wiley-Blackwell Publishers
6. MacCollum, D.V. (2007) Construction Safety Engineering Principles, McGraw Hill Publishers
7. Bhattacharjee, S.K. (2011) Safety Management in Construction, Khanna Publishers
8. Li, R.Y.M. & Poon, S.W. (2013) Construction Safety, Springer Publishers Few IS Codes & journal papers
9. Fulman, J.B., 1979 Construction Safety, Security & Loss Prevention, John Wiley and Sons,

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

PEC- FT801 (B)	Safety Management	3L:0T:0P (03 hrs)	03 Credits
-----------------------	--------------------------	--------------------------	-------------------

Course Objective:

1. Demonstrate knowledge and skills in the area of Basic Concepts and Techniques of Safety Management.
2. To understand the components of Safety Audit and Audit methodologies with relevant Government Agencies.
3. To understand the fundamentals of Accident Investigation and Reporting with its relevance in Accident Prevention.
4. To familiarize with different Accident Indices for Safety Performance monitoring.
5. To understand the importance of Safety Education and Training needs of an Organization.

Course Content:

Module 1

(08 Hrs)

CONCEPTS AND TECHNIQUES: History of Safety movement, Evolution of modern safety concept, General concepts of management, Planning for safety for optimization of productivity, Quality and safety, Line and staff functions for safety, Budgeting for safety, Safety policy. Incident Recall Technique (IRT), Disaster control, Job safety analysis, Safety survey, Safety inspection, Safety sampling, Evaluation of performance of supervisors on safety.

Module 2

(08 Hrs)

SAFETY AUDIT – INTRODUCTION: Components of safety audit, Types of audit, Audit methodology, Non conformity reporting (NCR), Audit checklist and report, Review of inspection, Remarks by government agencies, Consultants, Experts, Perusal of accident and safety records, Formats, Implementation of audit Indication, Liaison with departments to ensure coordination, Check list, Identification of unsafe acts of workers and unsafe conditions in the shop floor.

Module 3

(08 Hrs)

ACCIDENT INVESTIGATION AND REPORTING: Concept of an accident, Reportable and non reportable accidents, Reporting to statutory authorities, Principles of accident prevention, Accident investigation and analysis, Records for accidents, Departmental accident reports, Documentation of accidents, Unsafe act and condition, Domino sequence, Supervisory role, Role of safety committee, Cost of accident.

Module 4

(08 Hrs)

SAFETY PERFORMANCE MONITORING: Recommended practices for compiling and measuring work injury experience, Permanent total disabilities, Permanent partial disabilities, Temporary total disabilities, Calculation of accident indices, Frequency rate, Severity rate, Frequency severity incidence, Incident rate, Accident rate, Safety “t” score, Safety activity Rate, Problems.

Module 5

(08 Hrs)

SAFETY EDUCATION AND TRAINING: Importance of training, Identification of training needs, Training methods, Programmes, Seminars, Conferences, Competitions, Method of promoting safe practice motivation, Communication, Role of government agencies and private consulting agencies in safety training, Creating awareness, Awards, Celebrations, Safety posters, Safety displays, Safety pledge, Safety incentive scheme, Safety campaign, Domestic Safety and Training.

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

Course Outcome:

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

1. Apply adult learning theory to safety training methodology.
2. Conduct accident investigations and Accident Data Analysis.
3. Anticipate, recognize, evaluate, and develop control strategies for hazardous conditions at work practices.

List of Text/Reference Books:

1. Heinrich H.W. Industrial Accident Prevention McGraw - Hill Company, New York, 1980.
2. Krishnan N.V. Safety Management in Industry Jaico Publishing House, Bombay, 1997.
3. Lees, F.P., Loss Prevention in Process Industries Butterworth publications, London, 2nd edition, 1990.
4. John Ridley, Safety at Work, Butterworth and Co., London, 1983.
5. Dan Petersen, Techniques of Safety Management, McGraw- Hill Company, Tokyo, 1981.
6. Relevant India Acts and Rules, Government of India.
7. Relevant Indian Standards and Specifications, BIS, New Delhi.
8. Blake R.B., Industrial Safety Prentice Hall, Inc., New Jersey, 1973.
9. Safety and Good House Keeping, N.P.C., New Delhi, 1985.
10. Accident Prevention Manual for Industrial Operations, N.S.C. Chicago, 1982.
11. Journal by Insurance company surveyors and loss assessors – Mumbai – published by Insurance companies

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

POEC- FT801 (A)	Safety in Rail & Road Transport	3L:0T:0P (03 hrs)	03 Credits
------------------------	--	--------------------------	-------------------

Course Objectives:

To learn the basic working principles involved in various transportation systems and their safety aspects and to be able to identify defects in planning and design of transportation systems.

Course Content:

Module 1 **(08 Hrs)**

Railway Engineering: Permanent way- components. Rails- Functions, requirements, defects, rail joints and fastenings, check and guard rails, coning of wheels, creep of rails. Sleepers- functions, requirements, types, density. Ballast- functions, requirements types.

Module 2 **(08Hrs)**

Geometric Design- Horizontal curves, Super- elevation, Negative super elevation in branches, Length of transition curves- Grade compensation on curves, Widening of Gauge on curves.

Module 3 **(08 Hrs)**

Railway operation Control: Points and crossings- Design features of a turn out –Types of Railway track- Points- Details of Station Yards and Marshalling Yards- Signaling and interlocking- Principles of track circuiting- Control of train movement by absolute block system- Automatic block system- Centralized traffic control Systems.

Module 4 **(08 Hrs)**

Classification of highways- Historical development of road construction- Typical cross section of roads - Definition of various cross- sectional elements- Requirements & factors controlling alignment of roads - Basic Geometric design.

Module 5 **(06 Hrs)**

Traffic Engineering: Traffic characteristics- various traffic studies and their applications – Traffic Regulations and Controls- Traffic Control devices- Traffic signals- Classification of signals- carriage- way markings- Traffic islands- Highway intersections- Principles of highway lighting.

Course Outcome:

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

1. Understand working of railways and safety aspects in railway operation.
2. Familiarize with basic geometric design features of roads.
3. Know about traffic studies and traffic safety.
4. Understand basic layout and facilities of docks.

List of Text/Reference Books:

1. Railway Engineering ,Rangwala, S. C. (2012).. Charotar Book Distributors, Anand.
2. Railway Engineering , Chandra, S. & Agarwal, M. M. (2007).. Oxford University Press, New Delhi.
3. Highway Engineering, Khanna, S. K. and Justo, c. E. G. (2001). (9th ed).Nem Chand & Brothers, New Delhi.
4. Traffic Engineering and Transport Planning, Kadiyali, L. R. (2004).. Kharna Publishers, New Delhi
5. Dock and Tunnel Engineering, Srinivasan, R. (2013). Harbour,. Charotar Publishing House Pvt. Ltd, Anand

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

POEC- FT801 (B)	Structural Fire Safety	3L:0T:0P (03 hrs)	03 Credits
------------------------	-------------------------------	--------------------------	-------------------

Course Objectives:

To learn and understand the burning building collapse due to failure of structures at elevated temperature during fire.

Course Content:

Module 1 **(08 Hrs)**

CONSTRUCTION TERMS OF BUILDING DESIGN AND TYPES OF LOADS: General collapse information, General causes of collapse and its types, Constructive terms of building design-Arch, Beam and its types, Buttress, Deck, Façade, Fire cut beam, Girder gusset plate, types of wall, Lintel joist, suspended ceiling and braced frame construction. Types of loads and methods of application, Hierarchy of structural framing and zone of danger.

Module 2 **(08 Hrs)**

FIRE EFFECTS ON BUILDING: Effect of Fire, Natural ventilation, Smoke movement in buildings, Smoke movement in tall buildings, Stack effect, Wind effects, Influence of openings in tall buildings, Smoke shaft, Smoke control during building design, Control of smoke spread, Mechanical ventilation, Pressurization system and their types, Design of smoke control pressurization system for a building.

Module 3 **(06 Hrs)**

ANALYSIS OF STRUCTURAL DAMAGE: Wall collapse- Masonry wall, Concrete wall and wood frame walls. Roof collapse- Sloping peak roof, Timber truss roof, Flat roof and steel roof, Stairway collapse, Floor collapse-Terrazzo floor, wooden I beam, Precast concrete slabs, Column collapse.

Module 4 **(08 Hrs)**

POST FIRE ANALYSIS: Post fire analysis and fire protection to buildings Rain roof, Fire Retarding compartmentation, fire fact sheet, the fire diagram and fire photographic documentation, Fire planning and design, Confinement of fire site planning access to fire fighting appliances, Contribution of external walls and roof covering, Aspects of internal planning, reduction of fire spread, Concept of compartments and types, Construction of compartments, Space and circulation, Principles and types of fire and roof venting, Effect of wind on roof vent, Industrial building ventilation.

Module 5 **(08 Hrs)**

BUILDING CONSTRUCTION AND HAZARDS: Five standard types of building construction and their collapse hazards. Time temperature grading curves, Heat balance for an enclosure during a fire, Fire severity and factors controlling fire severity, Thermal properties of wall fixtures & geometrical properties of a room compartment, Thermal insulation heat transfer and radiation, Calculation of fire resistance of a compartment, fire spread within, outside and between the buildings, Flames outside buildings, Reduction of risk of fires explosions.

IPS Academy, Institute of Engineering & Science
(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)
New Scheme & Syllabus Based on AICTE Flexible Curricula **(B. Tech)**
Fire Technology & Safety Engineering

Course Outcome:

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

1. Identify the constructive terms of building design and general causes of collapse.
2. Describe effect of fire, smoke movement and smoke control pressurization system for a buildings.
3. Analyze structural damage for different load bearing and non load bearing elements..
4. Distinguish between post fire analysis and planning/design for reduction of fire spread.
5. Explain types of building construction with their collapse hazard.

List of Text/Reference Books:

1. Vincent Dunn, Collapse of Burning Buildings: A guide to fire ground safety, Penn well corporation.
2. Howard J. Hill, Failure Point: How to determine Burning building stability, Penn well corporation.
3. Glenn. P corbeti, Building construction for the fire service, Jones & Barl.
4. T Z Harmathy, Fire Safety Design and Concrete, Longman Group UK Limited.
5. Bernard J. "Ben" Klaene, Structural Fire Fighting, National Fire Protection Association.
6. J.A. Purkiss, Fire Safety Engineering Design of Structures, Butterworth Heinemann