Rajiv Gandhi Proudyogiki Vishwavidyalaya, Bhopal

Branch- Common to All Discipline

New Scheme Based On AICTE Flexible Curricula

BT401	**Mathematics-III**	**3L-1T-0P**	**4 Credits**

OBJECTIVES: The objective of this course is to fulfill the needs of engineers to understand applications of Numerical Analysis, Transform Calculus and Statistical techniques in order to acquire mathematical knowledge and to solving wide range of practical problems appearing in different sections of science and engineering. More precisely, the objectives are:

- To introduce effective mathematical tools for the Numerical Solutions algebraic and transcendental equations.
- To enable young technocrats to acquire mathematical knowledge to understand Laplace transformation, Inverse Laplace transformation and Fourier Transform which are used in various branches of engineering.
- To acquaint the student with mathematical tools available in Statistics needed in various field of science and engineering.

Module 1: Numerical Methods – 1: (8 hours): Solution of polynomial and transcendental equations – Bisection method, Newton-Raphson method and Regula-Falsi method. Finite differences, Relation between operators, Interpolation using Newton's forward and backward difference formulae. Interpolation with unequal intervals: Newton's divided difference and Lagrange's formulae.

Module 2: Numerical Methods – 2: (6 hours): Numerical Differentiation, Numerical integration: Trapezoidal rule and Simpson's 1/3rd and 3/8 rules. Solution of Simultaneous Linear Algebraic Equations by Gauss's Elimination, Gauss's Jordan, Crout's methods, Jacobi's, Gauss-Seidal, and Relaxation method.,

Module 3: Numerical Methods – 3: (10 hours): Ordinary differential equations: Taylor's series, Euler and modified Euler's methods. RungeKutta method of fourth order for solving first and second order equations. Milne's and Adam's predicator-corrector methods. Partial differential equations: Finite difference solution two dimensional Laplace equation and Poission equation, Implicit and explicit methods for one dimensional heat equation (Bender-Schmidt and Crank-Nicholson methods), Finite difference explicit method for wave equation.

Module 4: Transform Calculus: (8 hours): Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs by Laplace Transform method, Fourier transforms.

Module 5: Concept of Probability: (8 hours): Probability Mass function, Probability Density Function, Discrete Distribution: Binomial, Poisson's, Continuous Distribution: Normal Distribution, Exponential Distribution.

Textbooks/References:

1. P. Kandasamy, K. Thilagavathy, K. Gunavathi, Numerical Methods, S. Chand & Company, 2nd Edition, Reprint 2012.
2. S.S. Sastry, Introductory methods of numerical analysis, PHI, 4th Edition, 2005.
3. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.

4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
6. Veerarajan T., Engineering Mathematics, Tata McGraw-Hill, New Delhi, 2008.
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book Stall, 2003 (Reprint).
8. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
9. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968. Statistics

RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA, BHOPAL

New Scheme Based On AICTE Flexible Curricula

Fire Technology & Safety Engineering, IV-Semester

FT402 Rescue Equipments &Techniques

COURSE OBJECTIVE:

1. To give basic concepts of Rescue in Ordinary as well as special situations in Major Disasters.
2. To Understand the Respiratory and Non Respiratory Personal Protective Equipments used by Rescuer in Emergencies.
3. To learn about various types of Fire Dynamics in Fire Scenario.
4. To understand the basic Fundamentals of Fire Propagation.
5. To understand the Chemistry and Physics of fire.

COURSE CONTENT:

RESCUE MEANS

Rescue by ordinary means, Special and unusual type of rescue, Rescue work during major disaster such as high rise building, Highway accident, Water, Sewer and Mines, Nuclear radiation & poisonous gas environment.

RESPIRATORY AND NON-RESPIRATORY:

NON RESPIRATORY - Head protection, Eye & Face Protection, Hand and Arm Protection, Foot and Leg Protection, Body Protection, Safety Belt and Harness, Ear Protection- The IS specification with types and testing procedure for Head protection, Eye & Face Protection, Hand and Arm Protection, Foot and Leg Protection, Body Protection, Safety Belt and Harness, Ear Protection Equipment.

RESPIRATORY - General, Selection, Care & Special precaution for respiratory PPE`s, Canister type Respirators (IS 8523-1977), Chemical Cartridge Respirators (IS 8522-1977), Filter Type Particulate Respirators (IS 9473- 1980), Compressed Air Line Breathing Apparatus (IS 10245 Part-V -1982), Self Contained Breathing Apparatus (IS 10245 Part-II- 1982)

FIRE DYNAMICS:

Introduction- temperature, heat, specific heat, flash point, fire point, ignition, combustion; Ignition pilot ignition, spontaneous ignition, ignition sources; Types of combustion-rapid, spontaneous, explosion; Product of combustion-flame, heat, smoke, fire gases. Development of fire-incipient, smoldering, flame and heat stages; Diffusion flames-zones of combustion, smoldering combustion, characteristics of diffusion flame; Premixed flames-burning velocity, limits of flammability, explosion and expansion ratios, deflagration and detonation, characteristics of premixed flame; Explosion- physical explosion, chemical explosion; Special kinds of combustion- Flash fire, Pool fire, Deep seated fire, Spoillver, Boilover, Slopover, Dust explosion, BLEVE, UVCE; Classification of fire based on material.

FIRE PROPAGATION:

Spread of flames in solids and liquids, linear and three dimensional fire propagation; Smoke, Constituents of smoke, quantity and rate of production of smoke, quality of smoke, smoke density, Visibility in smoke, principles of spreading quantity of smoke, smoke movement; Pressurization modeling of smoke movement; Toxicity of smoke- effect of harmful agents preventing escape and causing injury or death - CO, CO2, Nitrogen oxide, Sulphur dioxide.

CHEMISTRY OF FIRE:

Principles of Fire, Heat Measurement and Heat Transfer, Fire Growth, Heat Release Rate, Fuel Loading, Classification of Fire, Theory of Fire Extinguishment with Water, Foam, DCP, Inert Gases and Halogenated Agents, Special Case of Fire Extinguishment.

COURSE OUTCOME

1. Students will able to demonstrate Rescue Operations by means of Special and unusual type.
2. Students will able to apply the proper use of Respiratory and Non Respiratory Personal Protective Equipments in Emergencies.
3. Students will able to explain fire dynamics in enclosed and open fire situations.
4. Students will able to explain fire propagation, smoke movement and its effect on surrounding.
5. Students will able to know Fire Physics and Chemistry, Fire Propagation and Fire Dynamics.

LABORATORY

Experiments as suggested by the course coordinator.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

AERB Safety Guideline for Personal Protective Equipments (Govt. of India)
Fire Protection Handbook Vol.I Section-I Basics of Fire and Fire Scenario
Elementary principles of rescue by Got. Of India, ministry of Home Affairs
Relevant ISI special appliances and equipments
Gupta R.S., A Hand Book of Fire Technology,
Raymond Friedman Principles of Fire Protection chemistry, National Fire Protection Association, 1996

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New Scheme Based On AICTE Flexible Curricula

Fire Technology & Safety Engineering, IV-Semester

FT403 Fire Prevention & Protection Measures

COURSE OBJECTIVE:

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

COURSE CONTENT:

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.

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.

FIRE AND GAS DETECTION

Fire Alarm system basic, classification of fire alarm system, Basic consideration for instation, Automatic fire detectors, heat detector, Smoke detector, Gas sensing fire detector, Radiant energy sensing fire, detectors, detector installation, maintenance & testing, Inspection, Testing & maintance shuetuting for Fire alarm system & its component gas & vapour fixed detection system, Sensers portable gas mainting instrument.

FIRE EXTINGUISHMENT

Basic concept of fire fighting with water, carbon dioxide, dry chemical powder, foam and inert gases, Extinguishing Properties of Water, Droplet size, Smoothening, 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.

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

1. Students will be able to explain fire resistance rating of different structural elements and fire resistance test on building material.
2. Students will be able to design evacuation routes and performed evacuation in tall buildings.

3. Students will be able to design fire alarm system with fire and gas detection apparatus in different types of occupancy.
4. Students will be able to demonstrate first aid fire fighting appliances and performed periodic care and maintenance for the same.
5. Students will be able to present model fire and life safety requirement in different type of buildings.

LABORATORY

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.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Barendra Mohan Sen, Fire protection and prevention the essential handbook, UBS publishers.
Dr. Than Singh Sharma, Fundamentals in building design.
Lon H. Ferguson, Fundamentals of Fire Protection for the safety professional, the scarecrow Press, Inc.
National Building code of India part-IV.
Fire protection hand book volume-II section-IX.

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Fire Technology & Safety Engineering, IV-Semester

FT404 Heavy Vehicle Automobile Engineering & Safety

COURSE OBJECTIVE:

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

COURSE CONTENT:

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.

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
Lubrication systems. Types, classification of systems. Lubricants. Cooling System – Air cooling, components, and working of cooling systems.

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.

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.

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
1. Students will be able to explain engines, their classifications and construction details.
2. Students will be able to 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. Students will be able to 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. Students will be able to apply CMV rules regarding safety devices for drivers, passenger fire fighting vehicles and special type of appliances.

5. Students will be able to have basic knowledge of operation of fire boats and rules and regulation of RTO with its testing.

LABORATORY

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.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Wills H. Crouse, Automobile chassis and body construction, Operation and Maintenance, Tata McGraw Hill 1976
Dr. D.S. Kumar, Automobile Engineering, S.K. Kataria & Sons 2015
Arther V. Judge, Modern Petrol Engine 1975
A.T. Walford, Ergonomies of Automation 1989
S.Adhey, Bormh Practical Automobile Engineering Illustrated, Asia Publishing House, 1983
G.B.S. Narrang, Automobile Engineering, Khanna Publisher
R.B. Gupta, Automobile Engineering, Satya Prakashan 2015
R.P. Sharma, A Course in Automobile"Engineering, Dhanpat Rai & Sons

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Fire Technology & Safety Engineering, IV-Semester

FT405 Strength of Materials

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

COURSE CONTENT:

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.

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.

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

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.

Columns & 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 should 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 necessary to design the structural elements and pressure vessels.

LABORATORY
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

EVALUATION

Evaluation Will Be Continuous An Integral Part Of The Class As Well Through External Assessment.

REFERENCES:

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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Fire Technology & Safety Engineering, IV-Semester

FT406 Fire Fighting & Field Training

COURSE OBJECTIVE:

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:

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.

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.

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.

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.

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

1. Students will able to demonstrate different world of command used in appliance drill.
2. Students will able to apply hose drill performance and practice in fire fighting operation.
3. Students will able to apply hydrant drill performance and practice in fire fighting operation.
4. Students will able to apply trailer pump drill performance and practice in fire fighting operation.
5. Students will able to apply ladder drill performance and practice in fire fighting operation.

LABORATORY

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.

EVALUATION

Evaluation will be continuous an integral part of the class as well through external assessment.

REFERENCES

Drill manual for Fire Services of India by Govt. of India.
Fire Fighters Skill drill manual by NFPA.