

# RAJIV GANDHI PROUDYOGIKI VISHWAVIDYALAYA BHOPAL

## *Choice Based Credit System*

### **FIRE TECHNOLOGY & SAFETY ENGINEERING, III-Semester**

#### **MATERIAL SCIENCE**

##### **COURSE OBJECTIVE:**

The course introduces several advanced concepts and topics in the rapidly evolving field of material science. Students are expected to develop comprehension of the subject and to gain scientific understanding regarding the choice and manipulation of materials for engineering applications

##### **COURSE CONTENT:**

**Crystal Atoms of Solid:** Structure of atom binding in solids metallic, space lattice and crystal system arrangement of atoms in BCC, FCC and HCP crystal. Mechanical , Electrical , thermal , Magnetic & optical Properties of materials Types of materials .

**Plastic deformations of metals:** Point and line defects in crystals, their relation to mechanical properties, deformation of metal by slip and twinning, stress strain curves of polycrystalline materials ,Cold and hot working of metals and their effect on mechanical properties .

**Alloy Formation and Binary diagram:** Phase in metal system solution and inter-metallic compounds. Hume-Rottery's rules, solidification of pure metals and alloy equilibrium diagrams of iso-morphous, eutectic, peritectic and eutectoid system Iron carbon equilibrium diagram.

##### **Hazardous Material-I:**

Explosive Materials Classification and their types, Gaseous Hazardous Materials and their physical and chemical properties, Cryogenic Classes and Hazard of Cryogenics, Flammable and Combustible Liquids and their properties, Flammable Solid Materials and Water Reactive Substances.

##### **Hazardous Material-II:**

Oxidizers and their Hazards, Toxic Materials and their classification, Radioactive Materials and their physical properties, Corrosive Materials, Properties of Acids and Bases, Hazards of Acids and Bases, Common Organic and Inorganic Acids, Common Organic and Inorganic Bases.

##### **OUTCOMES :**

1. To acquire basic understanding of advanced materials, their functions and properties for technological applications.
2. To emphasize the significance of materials selection in the design process
3. To understand the principal classes of bio-materials and their functionalities in modern medical science
4. To get familiarize with the new concepts of Nano Science and Technology
5. To educate the students in the basics of instrumentation, measurement, data acquisition, interpretation and analysis

##### **EVALUATION**

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

##### **REFERENCES:**

- Narula GK, KS and Gupta VK; Material science; Mc Graw Hill Education  
Askeland , Essentials of Material Science & Engineering CENGAGE Learning .  
R Balasubramaniam , Callister's Material Science ,Wiley Students edition  
Meyer Eugene; Chemistry of Hazardous Material; Brady Prentice- Hall, Inc.  
Varela Joe; Hazardous Materials Handbook for Emergency Responders; Van Nostrand Reinhold Thompson Publishing Inc.  
James F Shackelford ;Introduction to Material Science for Engineers PEARSON, Sixth edition.  
Raghavan V; Material science and Engineering, PHI Publication.

Sriniwasan R; Engineering materials and Metallurgy;  
Agarwal BK Introduction to Engineering Materials , Mc Graw Hills

**FIRE TECHNOLOGY & SAFETY ENGINEERING, III-Semester**

**TOWN PLANNING & SAFETY IN CONSTRUCTION**

**COURSE OBJECTIVE:**

1. To understand the basic concept of planning surveys, Types of roads & types of housing units.
2. Basic concept of Structural soundness, Accident, Hazard their causes and effect.
3. To understand the basic concept of Safety in construction operation.
4. To understand the basic concept of Safety in demolition operation.
5. To perform the safe working at heights with relevant code of practice.

**COURSE CONTENT:**

**TOWN PLANNING**

Principles of Town Planning, Site for an Ideal Town, Cost of Town Planning, Surveys, Types of Surveys, Use of Surveys, Zoning, Principles of Zoning, Advantages & Importance of Zoning, Housing, Requirements and Classification Residential Buildings, Rural Housing, Parks and Playgrounds, Classification of Parks, Park Systems and Design, Industries, Classification and Requirement of Industry, Measures to Control location of Industry, Industrial Township, Classification of Urban Roads, Types of Street Systems, Outer and Inner Ring Roads.

**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 .

**SAFETY IN CONSTRUCTION OPERATIONS**

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, 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.

**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.

**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)

**COURSE OUTCOME**

1. Graduate will be able to demonstrate various components of Town Planning Including planning surveys, topography, water supply & types of roads

2. Graduate will be able to apply the basics of architectural aesthetics and layout of housing with site orientation.
3. Graduate will be able to develop the basic philosophy of Safety in construction operation Including above Ground and Underwater operations
4. Graduate will be able to develop safety culture towards Occupational hazard & diseases related to construction industries
5. Graduate will be able to explain n maintain the importance of Construction worker acts and rule between workers n employers.

### **EVALUATION**

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

### **REFERENCES**

Accident prevention manual for Industrial operations, NSC, Chicago, 1982.

Fulman, J.B., Construction Safety, Security & Loss Prevention, John Wiley and Sons, 1979.

The Building and other construction workers (Regulation of Employment & conditions of service)Act 1996 and central rules 1998.

P.S. Rangwala, Town Planning, Charotar Publishing Housing Pvt. Ltd., 2008

**STRENGTH OF MATERIALS**

**COURSE OBJECTIVE:**

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.

**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.

**EVALUATION**

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

**REFERENCES:**

Beer FP, Johnson Mechanics of Materials ,Sixth Edition ;Mc Graw Hills  
Debabrata Nag & Abhijet Chanda :Strength of Materials : Wiley  
Rattan; Strength of materials;Second Edition , Mc Graw Hills  
Nash William; Schaum's Outline Series; forth Edition Strength of Materials;Mc Graw Hills  
Singh Arbind K; Mechanics of Solids; PHI  
Sadhu Singh; Strength of Materials; Khanna Pub.  
R Subramannian , Strength of materials OXFORD University Press ,Third Edition .  
S Ramamurthum , Strength of materials , Dhanpat Rai

**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

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**FIRE TECHNOLOGY & SAFETY ENGINEERING, III-Semester**

**HEAVY VEHICLES & 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 carburetors, 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 crash, State of the art Safety systems,

**COURSE OUTCOME**

1. Graduate will 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.
2. Graduate will 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.
3. Graduate will able to apply CMV rules regarding safety devices for drivers, passengers fire fighting vehicles and special type of appliances.
4. Graduate will 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

**FIRE TECHNOLOGY & SAFETY ENGINEERING, III-Semester**

**BUILDING PLANNING & ARCHITECTURE**

**COURSE OBJECTIVE:**

1. To develop the ability to perceive and measure spatial relationships
2. To draw geometric and organic shapes in space.
3. To understand the contrast in tone and texture.
4. To understand how light describes form and space.
5. To become familiar with the visual elements of drawing (line, shape, value, texture, scale, space, etc.)
6. To understand the importance of composition, organization, placement and positive and negative space.
7. To understand the importance of Fire safe Building Concept

**COURSE CONTENT:**

**Drawing of Building Elements:** Drawing of various elements of buildings like various types of footing, open foundation, raft, grillage, pile and well foundation, Drawing of frames of doors, window, various types of door, window and ventilator, lintels and arches, stairs and staircase, trusses, flooring, roofs etc.

**Building Planning:** Provisions of National Building Code, Building bye-laws, open area, set backs, FAR terminology, principle of architectural composition (i.e. unity, contrast, etc.), principles of planning, orientation.

**Building Services:** Introduction of Building Services like water supply and drainage, electrification, ventilation and lightening and staircases, fire safety, thermal insulation, acoustics of buildings.

**Design and Drawing of Building:** Design and preparation of detailed drawings of various types of buildings like residential building, institutional buildings and commercial buildings, detailing of doors, windows, ventilators and staircases etc.

**Perspective Drawing:** Elements of perspective drawing involving simple problems, one point and two point perspectives, energy efficient buildings.

**COURSE OUTCOME**

1. Graduate will be having basic knowledge various components of building construction that relate to the fire service & safety Engineering
2. Graduate will be able specifically focus on elements of construction and the design of structures that are shown to be key factors when inspecting buildings, pre-planning fire operations and emergency operations at fires.
3. Graduate will be able to calculate fire and smoke growth for masonry, steel, and concrete construction, and fire resistance wood construction.
4. Graduate will be able to manage required relationship between building types and Urban Search & Rescue Team capacity and Urban Interface building requirements



## **LABORATORY**

1. Sketches of various building components.
2. One drawing sheet of various building components containing doors, windows ventilators, lintels and arches stairs foundations etc.
3. One drawing sheet each for services and interiors of buildings.
4. One drawing sheet containing detailed planning of one/two bed room residential building (common to all student)
5. One drawing sheet each of residential and institutional building (Each student perform different drawing).
6. Use of AutoCAD for preparation of drawings.

## **EVALUATION**

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

## **REFERENCES**

Malik & Meo; Building Design and Drawing By  
Shah, Kale & Patki; Building Design and Drawing; TMH  
Gurucharan Singh & Jgdish Singh Building Planning, Design and Scheduling

**FIRE TECHNOLOGY & SAFETY ENGINEERING, III-Semester**

**Communication Skills**

Introduction: Communication, definition and role of communication, Process of communication, Importance of professional communication, Levels of communication, Types of communication, Challenges in communication. Non –verbal communication – Body language, personal appearance, posture, gesture and hand movement, eye contact, facial expressions, paralinguistic features - proxemics, haptics, chronemics. Oral presentations. Case studies.

**Books recommended:**

1. Business Communication, Mc Graw Hill Education, Matthukutty M. Monippally.
2. Effective Business Communication , Mc Graw Hill Education, Neera Jain, Shoma Mukherji.
3. Technical Communication , Cengage , P. Subba Rao, B. Anita Kumar, C. Hima Bindu.
4. Business Correspondence & Report Writing , Mc graw Hills. , R.C. Sharma & Krishna Mohan .
5. Technical Communication – Principles & Practice , Oxford , Meenakshi Raman.
6. Business Communication- Mc graw Hills , Peter Cordon.
7. Communication Skills , Oxford , Sanjay Kumar & Pushpa TMH.
8. Effective Technical Communication , M. Ashraf Rizvi ,Mc Graw Hill Education.

**Language Lab II**

Module 1 : Reading comprehension

Module 2 : Role plays

Module 3 : Debate

Module 4 : Group discussion

Module 5 : Resume writing

Module 6 : Interview skills

Module 7 : Body language

Module 8 : Oral presentations