Guru Nanak Dev Engineering College, Ludhiana

Civil Engineering Department

M.Tech. (Structural Engineering)

Program Outcomes (POs):

After completion of the program graduates will be able to

1. Apply the knowledge of science, mathematics, and engineering principles for developing problem solving attitude.
2. Identify, formulate and solve engineering problems in the domain of structural engineering field.
3. Use different software tools for Analysis and Design structural engineering domain.
4. Design and conduct experiments, analyze and interpret data, for development of simulation experiments.
5. Function as a member of a multidisciplinary team with sense of ethics, integrity and social responsibility.

First Semester									
Course Type	**Course Code**	**Course Name**	**Load Allocations**			**Marks Distribution**			**Credits**
			L	**T**	**P**	**Int**	**Ext**	**Total Marks**	
Core Theory	MST-101	Advanced Structural Analysis	3	0	0	50	100	150	3
Core Theory	MST-102	Finite Element Method in Structural Engineering	3	0	0	50	100	150	3
Elective	MST- AAA	Program Elective I	3	0	0	50	100	150	3
Elective	MST-BBB	Program Elective II	3	0	0	50	100	150	3
Core Lab I	LMST-101	Structural Design Lab	0	0	4	50	50	100	2
Core Lab II	LMST-102	Advanced Concrete Technology Lab	0	0	2	50	50	100	1
MLC	MRM-101	Research Methodology and IPR	3	0	0	50	100	150	3
Audit 1	MAC-102	Disaster Management	2	0	0	50	-	50	0
		Total	**17**	**0**	**6**	**400**	**600**	**1000**	**18**

Second Semester									
Course Type	**Course Code**	**Course Name**	**Load Allocations**			**Marks Distribution**			**Credits**
			L	**T**	**P**	**Int**	**Ext**	**Total Marks**	
Core Theory	MST-103	Advanced Solid Mechanics	3	0	0	50	100	150	3
Core Theory	MST-104	Structural Dynamics	3	0	0	50	100	150	3
Elective	MST- CCC	Program Elective III	3	0	0	50	100	150	3
Elective	MST- DDD	Program Elective IV	3	0	0	50	100	150	3

Core Lab III	LMST-103	Model Testing Lab	0	0	2	50	50	100	1
Core Lab IV	LMST-104	Numerical Analysis Lab	0	0	4	50	50	100	2
Core	LMPST-101	Project	0	0	4	50	50	100	2
Audit 2	MAC-101	English for research report / paper writing	2	0	0	50	-	50	0
		Total	**14**	**0**	**10**	**400**	**550**	**950**	**17**

Third Semester

Course Type	**Course Code**	**Course Name**	**Load Allocations**			**Marks Distribution**			**Credits**
			L	**T**	**P**	**Int**	**Ext**	**Total Marks**	
Elective	MST-EEE	Program Elective V	3	0	0	50	100	150	3
Open Elective	MOST-XXX	Open Elective	3	0	0	50	100	150	3
Pre-thesis	MPTST-101	Formulation of Research Problem	0	0	2*+ 18**	100	100	200	10
		Total	**6**	**0**	**20**	**200**	**300**	**500**	**16**

Fourth Semester

Course Type	**Course Code**	**Course Name**	**Load Allocations**			**Marks Distribution**			**Credits**
			L	**T**	**P**	**Int**	**Ext**	**Total Marks**	
Thesis	MTST-101	Thesis	0	0	4*+ 28**	100	200	300	16
		Total	**0**	**0**	**32**	**100**	**200**	**300**	**16**

* Max hours for teacher
** Independent study hours

List of Electives		
S. No.	**Course Name**	**Course Code**
1	Theory of Thin Plates and Shells	MST – 111
2	Theory of Structural Stability	MST – 112
3	Theory and applications of cement composites	MST – 113
4	Structural Optimization	MST – 114
5	Structural Health monitoring & Retrofitting	MST – 115
6	Bridge Engineering	MST – 116
7	Design of High Rise Structures	MST – 117
8	Design of Masonry Structures	MST – 118
9	Advanced Steel Structural Design	MST – 119
10	Advanced Design of Foundations	MST – 120
11	Industrial Structures	MST – 121
12	Soil-structure Interactions	MST – 122
13	Advanced Concrete Structural Design	MST – 123
14	Pre-stressed Concrete Structures	MST – 124
15	Fracture Mechanics of Concrete	MST – 125
16	Design of Plates and Shells	MST – 126

MST-101 Advanced Structural Analysis

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Develop Stiffness and flexibility matrices for skeletal structural systems
2. Analyze and evaluate the response of skeletal structural systems using force method.
3. Analyze and evaluate the response of skeletal structural systems using displacement method.
4. Apply member approach for analyzing higher order skeletal structural systems
5. Illustrate the use of matrix methods for analyzing skeletal structural systems subjected to secondary stresses due to lack of fit, temperature change and differential settlement
6. Comprehend and apply finite element approach for solving boundary value problems

Syllabus Content:

- **Application of Stiffness and Flexibility Methods:** Stiffness Matrix and Flexibility matrix in Local & Global Coordinates, Boundary Conditions, Solution of Matrix Equations, Calculation of Reactions and Member Forces; Analysis of Beams, Trusses, Rigid-Jointed Frames and Grids using the Structure Approach and the Member Approach
- **Influence Coefficients:** Physical Significance and use in structural analysis & design, their deviation for different structural elements/members; Effects of support settlements, Temperature change and Lack of Fit using the Member Approach and the Structure Approach
- **Boundary Value Problems**: Approximate Solution of Boundary Value Problems, Modified Galerkin Method for One-Dimensional problems, Matrix Formulation of the Modified Galerkin Method and its applications

Reference Books:

1. Matrix Analysis of Framed Structures, Weaver W, and Gere J. M., Van Nostrand Reinhold Company
2. Structural Analysis - A Matrix Approach, Pandit G.S. and Gupta S. P., Tata McGraw Hill
3. The Finite Element Method, Lewis P. E. and Ward J. P., Addison-Wesley Publication Co.
4. Computer Methods in Structural Analysis, Meek J. L., CRC Press
5. Introduction to Finite Element Method, Desai and Able, CBS Publishers

MST-102 Finite Element Method in Structural Engineering

(Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Learn elemental stiffness technique
2. Formulate finite element equation, equilibrium equation.
3. Apply the concepts of Finite Element Formulation and loads
4. Learn computer applications of FEM.

Syllabus Content:

- I**ntroduction:** History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress
- **Beam Elements:** Flexure Element, Element Stiffness Matrix, Element Load Vector.
- **Method of Weighted Residuals:** GalerkinFinite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, Polynomial Forms, Applications.
- **Types**:Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Isoparametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian Quadrature.
- **Application to Solid Mechanics:** Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.
- **Computer Implementation** of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software.

Reference Books:

1. Finite Element Analysis, Seshu P., Prentice-Hall of India
2. Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York
3. Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill
4. Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York
5. Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier
6. Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India

MST-103 Advanced Solid Mechanics

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Develop stress and strain tensors and perform transformations.
2. Solve the advanced practical problems related to the theory of elasticity, concepts of stress and strain, strain energy.
3. Learn about the elastic and plastic behavior of material and evaluate stress invariants, principal stresses and their directions and determine strain invariants, principal strains and their directions.
4. Develop constitutive relationships between stress and strain for linearly elastic solid.
5. Understand the concept of stresses and strains in 2D
6. Know the different theories for Torsion

Syllabus Content:

- **Elasticity:** Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity
- **Strain and Stress Field:** Elementary Concept of Stress and Strain at a Point; Principal Axes; Principal stresses and Strains; Compatibility Conditions; Stress Components on an Arbitrary Plane; Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.
- **Equations of Elasticity:** Equations of Equilibrium, Stress-Strain relations, Strain Displacement and Compatibility Relations, Co-axiality of the Principal Directions.
- **Two-Dimensional Problems of Elasticity:** Plane Stress and Plane Strain Problems, Airy's stress Function, Use of Airy's function in beam analysis; Two-Dimensional Problems in Polar Coordinates
- **Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes
- **Plastic Deformation:** Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von-Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

Reference Books:

1. Theory of Elasticity, Timoshenko S. and Goodier J. N., McGraw Hill
2. Elasticity, Sadd M.H., Elsevier
3. Engineering Solid Mechanics, Ragab A.R.and Bayoumi S.E., CRC Press
4. Computational Elasticity, Ameen M., Narosa
5. Solid Mechanics, KazimiS. M. A., Tata McGraw Hill
6. Advanced Mechanics of Solids, Srinath L. S., Tata McGraw Hill

MST – 111 Theory of Thin Plates and Shells

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Plate equation in Cartesian and polar coordinates
2. Analyze rectangular and circular plates with different boundary conditions and loads
3. Apply the concepts rectangular and circular plates with different boundary conditions and loads.
4. Analyze the shells.

Syllabus Content:

- **Introduction:** Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.
- **Static Analysis of Plates**: Governing Equation for a Rectangular Plate, Navier Solution for Simply-Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions
- **Circular Plates:** Analysis under Axi- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple
- Cases in Rectangular Plates
- **Static Analysis of Shells:** Membrane Theory of Shells - Cylindrical, Conical and Spherical Shells
- **Shells of Revolution with Bending Resistance** - Cylindrical and Conical Shells, Application to Pipes and Pressure Vessels
- **Thermal Stresses in Plate/ Shell**

Reference Books:

1. Theory of Plates and Shells, Timoshenko S. and Krieger W., McGraw Hill.
2. Stresses in Plates and Shells, Ugural Ansel C., McGraw Hill.
3. Thin Elastic Shells, Kraus H., John Wiley and Sons.
4. Theory of Plates, Chandra S. K.., Universities Press.
5. Design and Construction of Concrete Shells, Ramaswamy G.S.

MST – 112 Theory of Structural Stability

(Credits- 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Learn the basic requirements of structural design, including stability in addition to strength and stiffness. Understand the classical concept of stability of discrete and continuous systems, linear and nonlinear behaviour.
2. Determine the buckling loads for simple columns by analytical solution. Have appreciation of combined axial, flexural and torsion buckling.
3. Investigate stability of frames with respect to member buckling and global buckling. Find slenderness ratio of frame members.
4. Study stability of beams with respect to lateral torsion buckling.
5. Study the stability of plates like axial flexural buckling, shear flexural buckling, buckling under combined loads.
6. An appreciation of the fundamental basis of design rules concerned with structural instability.

Syllabus Content:

- **Criteria for Design of Structures:** Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.
- **Stability of Columns:** Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.
- **Stability of Frames:** Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.
- **Stability of Beams:** lateral torsion buckling.
- **Stability of Plates:** axial flexural buckling, shear flexural buckling, buckling under combined loads.

Reference Books:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall.
3. Structural Stability of columns and plates, Iyengar, N. G. R., Eastern West Press Pvt. Ltd.
4. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill.

MST-113 Theory and Applications of Cement Composites

(Credits- 3:0:0=3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Know different types of composite materials and their importance, utility
2. Classify these materials based upon the engineering properties and behavior
3. Learn about the construction / production techniques and behavior of materials
4. Use different available material models in the analysis and response prediction
5. Design structural members using the composite materials
6. Explore different application areas of composites

Syllabus Content:

- **Introduction:** Classification and Characteristics of Composite Materials- Basic terminology, Advantages & uses; Orthotropic and Anisotropic Materials; Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Theories for an Orthotropic Lamina.
- **Cement Composites:** Constituent Materials and their Properties; Fibre Reinforced Concrete, Ferrocement, SIFCON, Polymer Concretes; Construction Techniques, Preparation of Reinforcement, Casting and Curing.
- **Mechanical Behaviour & Material Models:** Mechanics of cement composite materials; Different material models and their developments; Review of different available models and their applications; Behavior of Fiber Reinforced Concrete and Ferrocement in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion
- **Analysis and Design of Cement Composite Structural Elements:** Ferrocement, SIFCON and Fibre Reinforced Concrete
- **Application of Cement Composites:** Fiber Reinforced Concrete and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures.

Reference Books:

1. Mechanics of Composite Materials, Jones R. M, 2nd Ed., Taylor and Francis, BSP Books
2. Ferrocement – Theory and Applications, Pama R. P., IFIC
3. New Concrete Materials, Swamy R. N., 1st Ed. Blackie, Academic and Professional, Chapman & Hall

MST-114 Structural Optimization

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Conceptualize and formulate an optimization research problem.
2. Understand the difference between classical and advanced optimization methodologies.
3. Select a methodology for carrying out optimization on a research problem.
4. Solve optimization problems using various techniques.
5. Perform optimization on a problem having single objective or multi-objectives.
6. Optimize a structural member under optimal conditions.

Syllabus Content:

- **Introduction:** Historical Development; Engineering applications of Optimization; Art of Modeling; Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems; Classification of optimization problems; Optimization techniques – classical and advanced techniques.
- **Optimization using Calculus:** Stationary points; Functions of single and two variables; Global Optimum**;** Convexity and concavity of functions of one and two variables**;** Optimization of function of one variable and multiple variables; Gradient vectors; Optimization of function of multiple variables subject to equality constraints;
- **Linear Programming:** Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations; Graphical method for two variable optimization problem; Simplex algorithm and construction of simplex tableau;
- **Dynamic Programming:** Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality; Recursive equations – Forward and backward recursions; Computational procedure in dynamic programming; Discrete versus continuous dynamic programming.
- **Integer Programming:** Integer linear programming; Concept of cutting plane method
- **Applications:** Structural Steel and Concrete Members

Reference Books:

1. Elements of Structural Optimization, Haftka, Raphael T., Gürdal, Zafer, Springer.
2. Variational Methods for Structural Optimization, Cherkaev Andrej, Springer

MST-115 Structural Health Monitoring and Retrofitting

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Understand the fundamentals of monitoring the structural health and its maintenance strategies.
2. Diagnose for serviceability and durability aspects of concrete.
3. Know the various techniques for Static and Dynamic Field Testing.
4. Decide the appropriate repair, strengthening, rehabilitation and retrofitting technique required for a case study building.
5. Use the modern techniques for Structural Heath Monitoring
6. Use an appropriate health monitoring technique and demolition technique.

Syllabus Content:

- **Structural Health:** Factors affecting Health of Structures, Causes of Distress, Regular Maintenance
- **Structural Health Monitoring:** Concepts, Various Measures, Structural Safety in Alteration
- **Structural Audit:** Assessment of Health of Structure, Collapse and Investigation, Investigation Management, SHM Procedures.
- **Static Field Testing:** Types of Static Tests, Simulation and Loading Methods, sensor systems and hardware requirements, Static Response Measurement.
- **Dynamic Field Testing:** Types of Dynamic Field Test, Stress History Data, Dynamic response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.
- **Introduction to modern techniques:** Piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique, adaptations of EMI technique.

Reference Books:

1. Structural Health Monitoring, Daniel Balageas, Claus Peter Fritzen, Alfredo Güemes, John Wiley and Sons
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons
3. Structural Health Monitoring and Intelligent Infrastructure, Vol.1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc.

MST-116 Bridge Engineering

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Learn bridge classification; selection of a suitable bridge type for a given set of constraints; criterion for deciding their layout; preliminary and detailed investigations *w.r.t.* the traffic and hydraulic design of bridges.
2. Understand the various primary loads, load combinations for obtaining a worst design load for the superstructure and substructure system of bridges.
3. Apply the concepts of structural design to obtain suitable member sizes/sections of bridges and they will be able to prepare and deliver rough sketches to the draftsman etc.
4. Perform the analysis and design of foundations.
5. Appreciate the role of modern construction methods and their impact on the analysis and the design of bridge components.
6. Perform necessary bridge inspection/maintenance and their rehabilitation.

Syllabus Content:

- **Introduction:** Definitions, Classification and Components of different bridge types; layout and planning of bridges; Loading.
- **Site investigations:** Preliminary data collection; Selection of appropriate bridge type; Hydraulic design of bridges; Traffic design of bridges
- **Analysis and design of superstructure** for straight and curved bridge decks -loadings details; specification-reinforced concrete and steel decks, Decks of various types, like slab, hollow and voided slab, beam-slab type, box girder etc.
- **Analysis and design of foundations:** Shallow foundations (open Foundations), Deep foundations-well foundations and caisson; design and constructional aspects of foundations.
- Latest developments in the bridge technology construction methods for concrete and steel bridges-their impact on the analysis and the design
- Inspection and maintenance and rehabilitation of bridges

Reference Books:

1. Bridge Deck Analysis, Pama & Gusens
2. Bridge deck Behavior, Edward V. Hambly
3. Essentials of Bridge Engineering, D. Johnson Vector

MST-121 Industrial Structures

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Carry out plastic design of structural elements.
2. Analyze the loads & stresses of gantry girder.
3. Analyze and design structures using light gauge material.
4. Analyze and design steel chimneys, storage structures and industrial building.

Syllabus Content:

- **Steel Gantry Girders:** Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.
- **Portal Frames:** Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures
- **Steel Bunkers and Silos:** Design of square bunker – Jansen's andAiry's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners..
- **Chimneys:** Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.
- **Water Tanks:** Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts
- **Design of pressed steel water tank:** Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation.

References Books:

1. Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., Lakshmi Publishers
2. Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers
3. Steel Structures - Design and Practice, Subramanian N.

LMST-101 Structural Design Lab

(Credits - 0:0:4 = 2)

Teaching Scheme
Lab: 4 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Understand the planning of multistory building.
2. Understand the latest IS code of practice for the design of steel and concrete structural elements.
3. Apply the fundamental concepts, techniques in analysis and design of reinforced concrete and steel element.
4. Apply the design principles by undertaking multistory building.
5. Apply the various codal requirements related to various members.
6. Produce structural drawing of detailing of Reinforced Concrete and Steel Elements

Syllabus Content:

Analysis, Design and detailing of multi-storied RC/Steel structures using latest relevant IS codes.

LMST-102 Advanced Concrete Technology Lab

(Credits - 0:0:2 = 1)

Teaching Scheme
Lab: 2 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Comprehend and illustrate the design requirements of different types of concrete
2. Design different grades of concrete mixes as per Indian code requirements
3. Design and judge the experiments for evaluating various properties of concrete
4. Evaluate and relate various strength test results to judge the requirements of a given concrete type
5. Decide and implement suitability of various non-destructive tests methods for evaluating condition of existing concrete structures

List of Experiments/Assignments:

- Concrete mix design for high strength concrete, steel fiber reinforced concrete, self-compacting concrete.
- Study of stress-strain curve of concrete samples (designed and cast as above); Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
- Non-Destructive testing of existing concrete members.

Reference Books:

1. Properties of Concrete, Neville A. M., Prentice Hall
2. Concrete Technology, Shetty M. S., S. Chand and Co.

MRM-101 Research Methodology and IPR

(Credits - 3:0:0 = 3)

Teaching Scheme
Lectures: 3 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. Understanding and formulation of research problem.
2. Analyze research related information.
3. Understand plagiarism and follow research ethics.
4. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
5. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
6. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Syllabus Content:

Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches, analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research proposal, Format of research proposal, a presentation and assessment by a review committee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development International Scenario: International cooperation on Intellectual Property. Procedure for
grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights, Licensing and transfer of technology, Patent information and databases. Geographical Indications

Unit 6: New Developments in IPR: Administration of Patent System, New developments in IPR; IPR of Biological Systems, Computer Software etc., Traditional knowledge Case Studies, IPR and IITs

Reference Books:

1. Research methodology: an introduction for science & engineering students, Stuart Melville and Wayne Goddard,
2. Research Methodology: An Introduction, Wayne Goddard and Stuart Melville
3. Research Methodology: A Step by Step Guide for beginners, Ranjit Kumar
4. Resisting Intellectual Property, Halbert, Taylor & Francis Ltd.
5. Industrial Design, Mayall, McGraw Hill
6. Product Design, Niebel, McGraw Hill
7. Introduction to Design, Asimov, Prentice Hall
8. Intellectual Property in New Technological Age, Robert P. Merges, Peter S. Menell, Mark A. Lemley
9. Intellectual Property Rights Under WTO, T. Ramappa, S. Chand

MAC-102 DISASTER MANAGEMENT

(Credits - 2:0:0 = 0)

Teaching Scheme
Lectures: 2 hrs/week

Course Outcomes:

On completion of the course, the student will have the ability to:

1. know about the various types of disaster and their components.
2. know about the measures and precautions at the time of a disaster.
3. know about various disaster-prone areas and various concepts about disaster preparedness, GIS and remote sensing.
4. assess risk caused by a disaster and learn about various mitigation measures.

Syllabus Content:

- **Introduction:** Disaster - Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural And Manmade Disasters: Difference, Nature, Types and Magnitude.
- **Repercussions of Disasters and Hazards**: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem; Natural Disasters - Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches; Man-made disasters - Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.
- **Disaster Prone Areas in India:** Study of Seismic Zones; Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards With Special Reference to Tsunami; Post-Disaster Diseases and Epidemics
- **Disaster Preparedness and Management:** Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.
- **Risk Assessment:** Disaster Risk - Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival
- **Disaster Mitigation:** Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India

Reference Books:

1. R. Nishith, Singh A.K, Disaster Management in India: Perspectives, issues and strategies, New Royal book Company
2. Sahni P. et al., Disaster Mitigation Experiences and Reflections, Prentice Hall of India
3. Goel S.L., Disaster Administration and Management Text and Case Studies, Deep & Deep Publication Pvt. Ltd.