ACADEMIC REGULATIONS

PROGRAM STRUCTURE

and

DETAILED SYLLABUS

Master of Technology

(Structural Engineering)

(Two Year Regular Programme)

(Applicable for Batches admitted from 2018)

Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad- 500 090

Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

Department of Civil Engineering

Structural Engineering

I YEAR - I SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	Core I	Matrix Methods In Structural Analysis	3	-	-	3	30	70	100
2	**Core II**	**Advanced Solid Mechanics**	**3**	**-**	**-**	**3**	**30**	**70**	**100**
3	**PE I**	1.Advanced Concrete Technology 2.Theory and Applications of Cement Composites 3.Theory of Structural Stability	3	-	-	3	30	70	100
4	**PE II**	1. Analytical and Numerical Methods for Structural Engineering 2.Structural Health Monitoring 3.Structural Optimization	3	-	-	3	30	70	100
5	Core	Structural Design Lab	-	-	4	2	30	70	100
6	Core	Advanced Concrete Lab	-	-	4	2	30	70	100
7	Core	Research Methodology and IPR	2	-	-	2	30	70	100
8	Audit	Audit course -1	2	-	-	0	30	70	100
Total			**16**	**-**	**8**	**18**	**240**	**560**	**800**

I YEAR - II SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	Core III	FEM Structural engineering	3	-	-	3	30	70	100
2	Core IV	Structural Dynamics	3	-	-	3	30	70	100
3	**PE III**	1.Advanced Steel Design 2.Design of Formwork 3.Design of High Rise Structures 4.Design of Masonry Structures	3	-	-	3	30	70	100
4	**PE IV**	1.Design of Advanced Concrete Structures 2.Advanced Design of Foundations 3.Soil Structure Interaction 4.Design of Industrial Structure	3	-	-	3	30	70	100

5	Core	Model Testing Lab	-	-	4	2	30	70	100
6	Core	Numerical Analysis Lab	-	-	4	2	30	70	100
7	Audit	Audit course – 2	2	-	-	2	30	70	100
8	Core	Mini-Projects	2	-	-	0	30	70	100
Total			**16**	**-**	**8**	**18**	**240**	**560**	**800**

II YEAR - I SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	**PE V**	1.Design of Pre-stressed Concrete Structures 2.Analysis of Laminated Composite Plates 3.Fracture Mechanics of Concrete Structures 4. Theory of Thin Plates and Shells	3	-	-	3	30	70	100
2	**Open Elective**	1. Business Analytics 2. Industrial Safety 3. Operations Research 4. Cost Management of Engineering Projects 5. Composite Materials 6. Waste to Energy	3	-	-	3	30	70	100
3	Dissertation	Dissertation Phase – I	-	-	20	10	30	70	100
Total			**6**	**-**	**20**	**16**	**90**	**210**	**300**

II YEAR - II SEMESTER

Sl. No	Group	Subject	Credits			Credits	Int. Marks	Ext. Marks	Total Marks
			L	T	P				
1	Dissertation	Dissertation Phase – II	-	-	32	16	30	70	100
Total					**32**	**16**	**30**	**70**	**100**

Audit course 1 & 2

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Indian Constitution
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills.

I - SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MATRIX METHODS IN STRUCTURAL ANALYSIS

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives:

- The student learn how to idealise statically and kinematically determinate and indeterminate structures and their ill effects.
- The student learn the difference between local and global co-ordinates systems and its role in preparation of stiffness matrix.
- To understand the effective usage of stiffness matrix method in indeterminate Structures.
- Understand about static condensation and sub structuring.
- The student learn about shear walls and their role in multi storied structures.

Course Outcomes: At the end of the course, students will be able to

- Evaluate the static and kinematic indeterminacy and generate stiffness and flexibility matrices.
- Analyse the skeleton structures using stiffness method.
- Use stiffness method to analyse different structures.
- Analyse various types' structural members using special analysis procedures.
- Know the usage of shear walls in multi storied constructions.

UNIT I

Introduction to matrix methods of analysis - static indeterminacy and kinematic indeterminacy - degree of freedom - coordinate system - structure idealization stiffness and flexibility matrices - suitability element stiffness equations - elements flexibility equations - mixed force - displacement equations - for truss element, beam element and tensional element. Transformation of coordinates - element stiffness matrix - and load vector - local and global coordinates.

UNIT II

Stiffness Matrix Assembly of Structures and its Applications to Simple Problems: Stiffness Matrix in Global Coordinates, Boundary Conditions, Solution of Stiffness Matrix Equations.

UNIT III

Calculation of Reactions and Member Forces: Beams, Plane Trusses, Plane Rigid Jointed Frames by Stiffness method.

UNIT IV

Special analysis procedures - static condensation and sub structuring - initial and thermal stresses.

UNIT V

Shear walls- Necessity - structural behaviour of large frames with and without shear walls - approximate methods of analysis of shear walls.

TEXT BOOKS:

1. William Weaver J.R and James M.Geve, Matrix Analysis of Frames structures, CBS Publications, Delhi 2004.
2. Ashok.K.Jain, Advanced Structural Analysis, New Channel Brothers, 1996.
3. C.S.Reddy, Structural Analysis, 3rd edition, 2010.

REFERENCES:

1. Kanchi, Matrix Structural Analysis, 1995.
2. J.Meek, Matrix Methods of Structural Analysis, 3rd edition, 1980.
3. Ghali and Neyveli, Structural Analysis, 3rd edition, December, 1990.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED SOLID MECHANICS

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives:

- To explain the theory, concepts and principles of Elasticity
- To generalize the equations of elasticity and their correlations.
- To demonstrate the Two-Dimensional Problems of Elasticity in terms of Cartesian and polar coordinates
- To apply principles of elasticity to analyze the torsion in prismatic bars
- To extend the principles of stress/strain for plastic deformation to study the modes of failure

Course Outcomes: At the end of the course, students will be able to

- Develop equations of equilibrium and draw relations among stress, strain and displacements
- Utilize equations of elasticity such as equilibrium equations, compatibility equations and various boundary conditions to analyze elastic problems.
- Gain the understating of Two-Dimensional Problems of Elasticity in Cartesian and polar coordinates system
- Apply the principles of elasticity to solve torsional problems in prismatic bars and tubes.
- Use the concepts of stresses and strains for plastic deformation to comprehend the yield criteria of materials.

UNIT I

Introduction to Elasticity: Notation for forces and stresses - Components of stresses - Components of strain – Hooke's law, Strain and Stress Fields, Stress and strain at a Point, Stress Components on an Arbitrary Plane, Hydrostatic and Deviatoric Components, Saint- Venant's principle

UNIT II

Equations of Elasticity in Two-dimensional problems in rectangular and polar coordinates: Equations of Equilibrium, Stress- Strain relations, Strain –Displacement and Compatibility Relations, Boundary conditions, Plane stress and plane strain analysis - stress function -Two dimensional problems in rectangular coordinates - solution by polynomials

UNIT III

Analysis of stress and strain in three dimensions in rectangular and polar coordinates - principal stresses - stress ellipsoid-determination of principal stresses - max shear stresses-equations of equilibrium in terms of displacements

UNIT IV

Torsion of Prismatic Bars: Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, use of soap films in solving torsion problems, Bending of Prismatic Bars: Stress function - bending of cantilever – circular cross section

UNIT V

Concepts of plasticity, Plastic Deformation, Strain Hardening, Idealized Stress- Strain curve, Yield Criterions, Plastic Stress-Strain Relations

References:

1. Theory of Elasticity, Timoshenko S. And GoodierJ. N., McGraw Hill, 1961.
2. Elasticity, Sadd M.H., Elsevier, 2005.
3. Engineering Solid Mechanics, RagabA.R., BayoumiS.E., CRC Press,1999.
4. Computational Elasticity, AmeenM., Narosa, 2005.
5. Solid Mechanics, KazimiS. M. A., Tata McGraw Hill, 1994.
6. Advanced Mechanics of Solids, SrinathL.S. Tata McGraw Hill, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
ELECTIVE I

ADVANCED CONCRETE TECHNOLOGY

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives:

- To study the physical and chemical properties of cement and admixtures. And also to know about hydration and SEM analysis.
- To study the properties and conduct the tests on fresh and hardened concrete.
- To acquire the practical knowledge on mix design principles, concepts and methods.
- To get an adequate knowledge about the special concretes and their applications in the Diverse construction field.
- To design the forms of different materials for the different types of works under different conditions.

Course Outcomes: At the end of the course, students will be able to

- List out the types of cement, admixture and decide the suitable cement and admixture for specific purpose.
- Determine the properties of concrete ingredients i.e. cement, fine aggregate and coarse aggregate by conducting different tests such as workability etc.,
- Design the mix proportion of ordinary, standard and high strength concrete by using different methods and how the strength of concrete can be modified by changing the proportions.
- Decide suitable concrete for different structures considering the prevailing weathering conditions and Design economic concrete mix proportion for different exposure conditions and intended purposes with special concrete.
- Design the forms for a specific work and decide the time of removal of forms for the different elements in different situations.

UNIT I

Concrete Making Materials: Cement- Bogues compounds – Hydration Process– Alkali silica reaction -Admixtures – Chemical and Mineral admixtures. Studies on Micro structure of concrete and applications of SEM (Scanned Electronic Microscope)

UNIT II

Fresh and Hardened Concrete: Fresh Concrete - workability tests on Concrete Setting times of Fresh Concrete - Segregation and bleeding. Hardened Concrete: Abram's law- Gel space ratios, Maturity Concept – Stress Behavior – Creep and Shrinkage – Durability tests on concrete - Nondestructive testing of concrete.

UNIT III

High Strength Concrete –Use of Nano materials – Manufacturing and Properties- Design of HSC Using Erintroy Shaklok Method- Ultra High Strength Concrete. High Performance Concrete- Requirements and properties of High Performance Concrete- Design Considerations.

UNIT IV

Special Concretes: Self Compacting concrete – Polymer concrete – Fiber reinforced concrete –Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete, Bacterial concrete Concrete mix design: Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method, Mix Design for Blended concretes.

UNIT V

Form work for concrete – materials – structural requirements – form work systems – connections – specifications – slip forms, permanent form work, latest form work– design of form work – shores – removal of forms – reshoring – failure of form work-case studies.

Text Books:

1. A.M.Neville, Properties of Concrete, ELBS publications, 4th pointing DECLO, 1996.
2. A.K. Santhakumar, Concrete Technology, Oxford Press, 2002.
3. M.S.Shetty, Concrete Technology, S.Chand & Co, 2005.

Reference Books:

1. Rajat Siddique, Special Structural concretes, Galgotia Publications, 3rd edition, 1994.
2. N.Krishna Raju, Design of Concrete Mixes, CBS Publications, 2014.
3. P.K.Mehta, Concrete: Micro Structure, ICI, Chennai.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY AND APPLICATIONS OF CEMENT COMPOSITES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives:

- To acquire knowledge on classification and characteristics of composite material.
- To get an adequate knowledge on special concretes.
- To obtain the practical knowledge on mix design principles, concepts and methods.
- To determine the mechanical properties of cement composites.
- To get an adequate knowledge on applications in the diverse construction field.

Course Outcomes: At the end of the course, students will be able to

- Classify and recognize an importance of the composite materials.
- Identify the type of special concrete.
- Design the mix proportion of ordinary, standard and high strength concrete by different methods.
- Determine the mechanical properties of cement composites.
- Recommend the cement composites for various applications.

UNIT I

Cement Composites: Constituent Materials and their Properties - Classification and Characteristics of Composite Materials- Basic Terminology and Advantages. Admixtures – Chemical and Mineral admixtures. Studies on Micro structure of concrete and applications of SEM (Scanned Electronic Microscope).

UNIT II

Special Concretes: Fiber reinforced concrete - Self Compacting concrete – Polymer concrete —Reactive Powder concrete – Requirements and Guidelines – Advantages and Applications. Light weight concrete, Bacterial concrete and Geopolymer concrete. High Strength and high performance Concrete – Ultra High Strength Concrete -Use of Nano materials.

UNIT III

Concrete Mix Design: Quality Control - Quality assurance - Quality audit- Mix Design method - BIS method, ACI method, DOE method, Mix Design for Blended concretes and Design of HSC Using Erintroy Shaklok Method. High Performance Concrete- Requirements and properties of High Performance Concrete.

UNIT IV

Mechanical Properties of Cement Composites: Behavior of Ferrocement, Fiber Reinforced Concrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion. Durability tests on concrete - Nondestructive testing of concrete.

UNIT-V

Application of Cement Composites: FRC and Ferrocement- Housing, Water Storage, Boats and Miscellaneous Structures. Composite Materials- Orthotropic and Anisotropic behaviour, Constitutive relationship and Elastic Constants.

Reference Books:

1 .Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis, BSP Books, 1998.

2. Ferrocement – Theory and Applications, Pama R. P., IFIC, 1980.

3. New Concrete Materials, Swamy R.N., 1stEd. Blackie, Academic and Professional, Chapman &Hall, 1983

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

THEORY OF STRUCTURAL STABILITY

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives:

- To understand the importance of vibration analysis and modelling of dynamic systems
- To analyze for dynamic response of Single Degree of Freedom System subjected to different types of loading.
- To obtain the dynamic response of structures using numerical methods.
- To examine the dynamic response of Multiple Degree of Freedom System using lumped mass and distributed mass approach.
- To illustrate the dynamic effects of Wind Loads, Moving Loads and Vibrations caused by Traffic, Blasting and Pile Driving.

Course Outcomes: At the end of the course, students will be able to

- Comprehend and model the systems subjected to vibrations and dynamic loads
- Analyze and obtain dynamics response of single degree freedom system using fundamental Theory and equations of motion.
- Obtain dynamics response of systems using numerical methods.
- Analyze and obtain dynamics response of Multi degree of freedom system idealized as lumped and distributed mass systems.
- To explain the dynamic effects of Wind Loads, Moving Loads and Vibrations caused by Traffic, Blasting and Pile Driving, Industrial Machinery.

UNIT I

Criteria for Design of Structures: Stability, Strength, and Stiffness, Classical Concept of Stability of Discrete and Continuous Systems, Linear and nonlinear behaviour.

UNIT II

Stability of Columns: Axial and Flexural Buckling, Lateral Bracing of Columns, Combined Axial, Flexural and Torsion Buckling.

UNIT III

Stability of Frames: Member Buckling versus Global Buckling, Slenderness Ratio of Frame Members.

UNIT IV

Stability of Beams: lateral torsion buckling.Stability of Plates: axial flexural buckling, shear flexural buckling, buckling under combined loads.

UNIT V

Introduction to Inelastic Buckling and Dynamic Stability.

Reference Books:

1. Theory of elastic stability, Timoshenko and Gere, Tata McGraw Hill,1981
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
3. Structural Stability of columns and plates, Iyengar, N. G. R., and Eastern west press Pvt. Ltd.
4. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYTICAL AND NUMERICAL METHODS FOR STRUCTURAL ENGINEERING

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to:

- To analyse the performance of various interpolation technique and perform error analysis.
- To develop the skill of solving linear algebraic systems by direct and iteration methods.
- To compare various numerical differentiation and integration techniques.
- To explain the various techniques to study Initial and Boundary value problems in Ordinary Differential Equations.
- To solve a range of problems on applicable software.

Course Outcomes: At the end of the course, students will be able to

- To analyse the performance of various interpolation technique and perform error analysis.
- Solve linear algebraic system by direct and iteration methods and apply the knowledge of Eigen values and Eigen vectors to some contents in engineering.
- Apply the knowledge of interpolation and extrapolation of uniform and non-uniform data to certain contents of Civil Engineering.
- Apply the knowledge of numerical differentiation and integration to some contents of Civil Engineering.
- Solve ordinary and partial differential equations in structural mechanics using numerical methods.

Unit I

Fundamentals of Numerical Methods: Error Analysis, Floating-Point Approximation of a Number; Loss of Significance and Error Propagation; Stability in Numerical Computation. **Curve Fitting:** Linear Interpolation - Higher Order Interpolation - Lagrange Interpolation Interpolating polynomials using finites differences- Hermite Interpolation -piece-wise and spline Interpolation; Richardson's extrapolation.

Unit II

Elements of Matrix Algebra: Solution of Systems of Linear Equations-Direct method – Cramer's rule, Guass – Elimination Method-Gauss Jordan elimination – Triangulation (LU Decomposition) method – Iterative methods -Jacobi – Iteration method – Gauss – Siedel iteration, Eigen Value Problems- Jacobi method for symmetric matrices- Power method.

Unit III

Solution of Nonlinear Algebraic and Transcendental Equations

Bisection Method; Fixed-Point Iteration Method; Secant Method; Newton Method ; Rate of Convergences; Solution of a System of Nonlinear Equations; Unconstrained Optimization.

Unit IV

Numerical Differentiation & Integration: Solution of Ordinary and Partial Differential Equations - Numerical Integration – Double integration using Trapezoidal and Simpson's method. Euler's method – Backward Euler method – Midpoint method – single step method-Taylor's series method- R-K Methods-Boundary value problems-Boundary value problems by finite difference method

Unit V

Finite Difference scheme: Implicit & Explicit scheme

Computer Algorithms: Numerical Solutions for Different Structural Problems, Fuzzy Logic and Neural Network.

Reference Books:

1. An Introduction to Numerical Analysis, Atkinson K.E., J. Wiley and Sons, 1989.
2. Theory and Problems of Numerical Analysis, Scheid F, McGraw Hill Book Company, (Shaum Series), 1988.
3. Introductory Methods of Numerical Analysis, Sastry S. S, Prentice Hall of India, 1998.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL HEALTH MONITORING

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To make the student to understand the Health of the structure.
- To train the student to diagonise the distress due to various causes & Faults and identify the distress for documentation.
- To prepare the student to assess the health of structure using static field methods.
- To prepare the student to assess the health of structure using dynamic field tests.
- To motivate the student to suggest Repairs, Rehabilitation & Retrofitting of the structure.

Course Outcomes : At the end of the course, student will be able to

- Understand the Health of the structure.
- Diagonise the distress due to various causes & Faults.
- Identify the distress and document.
- Assess the health of structure using static & dynamic field methods.
- Suggest Repairs, Rehabilitation & Retrofitting of the structure.

UNIT I

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance. Structural Health Monitoring: Concepts, Various Measures.

UNIT II

Structural Audit: Assessment of Health of Structure, Collapse and Investigation, Structural Health Monitoring Procedures.

UNIT III

Static Field Testing: Types of Static Tests, Simulation and Loading Methods, Static Response Measurement.

UNIT IV

Dynamic Field Testing: Types of Dynamic Field Test, Dynamic Response Methods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

UNIT V

Introduction to Repairs and Rehabilitations of Structures: 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, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL OPTIMIZATION

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- Introduce the concept of optimization.
- Provide knowledge on various optimization techniques.
- Teach the applications of linear and non-linear programs.
- Teach the applications of other programming techniques.
- Understand the design concepts using optimization techniques.

Course Outcomes: At the end of the course, students will be able to

- Formulate mathematical models for the problems in structural components to study Failures.
- Use variational principle for optimization
- Analyse problems using linear and nonlinear programming.
- Analyse problems using geometric, Stochastic programming.
- Apply optimization techniques to structural steel and concrete members.

Unit I

Introduction: Simultaneous Failure Mode and Design, Classical External Problems.

Unit II

Calculus of Variation: Variational Principles with Constraints,

Unit III

Linear Programming, Integer Programming, Nonlinear Programming, Dynamic Programming,

Unit IV

Geometric Programming and Stochastic Programming.

Unit V

Applications and design: Structural Steel and Concrete Members, Trusses and Frames. Frequency Constraint, Design of Layouts.

Text Books:

1. Introduction to Optimization Techniques by Dr.S.S.Rao
2. Introduction to operation research by Hamdy A Taha, Prentice Hall of India.

Reference Books:

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

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

RESEARCH METHODOLOGY AND IPR

Course Code: GR18D51 **L/T/P/C: 2/0/0/2**

Course Objectives: On completion of this Course the student shall be able to

- To formulate the research problem and Identify solutions for a research problem
- To realize the importance of research ethics and development of research proposal.
- To comprehend the process and procedure to apply for patents
- To grasp the understanding of the patent rights.
- To bring awareness about the IPR protection procedures

Course Outcomes: At the end of this course, students will be able to:

- Formulate the research problem and Identify solutions for a research problem
- Implement research ethics during development of research proposal.
- Have in-depth understanding of procedure to apply for patents
- Realize that when IPR would take such important place in growth of individuals & Nation.
- Emphasise the need of information about Intellectual Property Right to be promoted among students in general &engineering in particular.

Unit I

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 II

Effective literature studies approaches, analysis Plagiarism, and Research ethics.

Unit III

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 IV

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

Unit V

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. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd, 2007.
5. Mayall, "Industrial Design", McGraw Hill, 1992.
6. Niebel, "Product Design", McGraw Hill, 1974.
7. Asimov, "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, "Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL DESIGN LAB

Course Code: GR18D51 **L/T/P/C: 0/0/4/2**

Course Objectives: On completion of this Course the student shall be able to

- To make the student to understand the concept of structural design.
- To prepare the student to estimate the loads including loads given in IS 875.
- To train the student to analyze and design the framed structure.
- To train the student to design a complete Multi-Story Frame Building.
- To motivate the student to have full clarity on detailing of reinforcement**.**

Course Outcomes: At the end of the course, student will be able to

- Understand the concept of structural design.
- Estimate the loads including loads given in IS 875.
- Analyze & Design the framed structure.
- Design a complete Multi-Story Frame Building.
- Have full clarity in reinforcement, curtailment, lapping etc.

Lab Design & Drawing Exercises:

1. Design of all the Structural Components of Frame Buildings manually, using latest relevant IS codes and special publications of BIS.
2. Detailing and preparation of drawings of all the Structural Components of Frame Buildings by individual student using latest relevant IS codes.
3. Structural design of complete G+3 Multi-Storey Frame Building by Staad-*pro*.
4. Structural design of complete G+3 Multi-Storey Frame Building manually, using latest relevant IS codes and special publications of BIS.
5. Detailing and preparation of all drawings of complete G+ 3 structures by individual student using latest relevant IS codes.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED CONCRETE LAB

Course Code: GR18D51 **L/T/P/C: 0/0/4/3**

Course Objectives: On completion of this Course the student shall be able

- To analyze the stress-strain curve of high strength concrete.
- To develop correlation between cube and cylinder of high strength concrete.
- To determine the mechanical properties of high strength concrete.
- To conduct Non-Destructive testing methods on existing concrete members.
- To study the behaviour of beams under flexure, shear and torsion.

Course Outcomes: At the end of the course, students will be able t

- Design high strength concrete and study the parameters affecting its performance.
- Determine the mechanical properties and analyze the stress-strain curve of high Strength concrete.
- Develop correlation between cube and cylinder of high strength concrete.
- Assess the quality of existing concrete members by Non-Destructive testing Methods.
- Analyze the behavior of beams under flexure, shear and torsion.

List of Experiments/Assignments:

1. Conduct basic tests on cement and aggregates.
2. Design the mix proportions for high strength concrete.
3. Study the stress-strain curve of high strength concrete.
4. Study the correlation between cube and cylinder of high strength concrete.
5. Determine the split tensile strength of high strength concrete
6. Determine the modulus of rupture of high strength concrete.
7. Study the effect of cyclic loading on steel.
8. Determine the compressive strength of existing concrete members by Non-Destructive testing method.
9. Assess the quality of existing concrete members by Non-Destructive testing method.
10. Study the flow properties of self-compacting concrete.
11. Evaluation of air content in concrete.
12. Optimization of dosage of super plasticizer in Mortars.

Reference Books:

1. Properties of Concrete, Neville A. M., 5th Edition, Prentice Hall, 2012.
2. Concrete Technology, Shetty M. S., S. Chand and Co., 2006

II-SEMESTR

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FEM IN STRUCTURAL ENGINEERING

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- Understand the usage of minimum potential energy principle and generating global stiffness matrices.
- To enable the student should learn to formulate the global load vectors for flexure elements.
- Understand the effective usage of Galerkin method and formulation of interpolation functions in finite element analysis.
- To introduce of Iso-parametric, Axi-symmetric elements and estimate error using Numerical methods
- Understand the non-linear analysis.

Course Outcomes: At the end of the course students will be able to

- Use minimum potential energy principle in Finite Element Method.
- Analyse one dimensional elements like beam element using FEM approach.
- Formulate interpolation functions and evaluation of structural deformation using Galerkin approach.
- Evaluation of stress and strains in 2D, 3D elements using iso-parametric and axi-Symmetric element approach.
- Predict the error using Gauss quadrature method.

Unit I

Introduction: History and Applications. Spring and Bar Elements, Minimum Potential Energy Principle, Direct Stiffness Method, and Nodal Equilibrium equations, Assembly of Global Stiffness Matrix, Element Strain and Stress.

Unit II

Beam Elements: Flexure Element, Element Stiffness Matrix, Element Load Vector.

Unit III

Method of Weighted Residuals: Galerkin Finite Element Method, Application to Structural Elements, Interpolation Functions, Compatibility and Completeness Requirements, polynomial Forms, Applications.

Unit IV

Types: Triangular Elements, Rectangular Elements, Three-Dimensional Elements, Iso-parametric Formulation, Axi-Symmetric Elements, Numerical Integration, Gaussian-Quadrature.

Unit V

Introduction to non – linear analysis, various methods and their limitations.

Text Books:

1. G.S.Krishna Murthy, Finite Element Analysis, theory and programming, 3rd edition, 1994
2. Finite Element Methods in Engineering, Belegundu A.D., Chandrupatla, T.R., Prentice Hall India, 1991.
3. Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005.

Reference Books:

1. Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
2. Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.
3. Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
4. Finite Element Method, Zienkiewicz O.C. & Taylor R.L. Vol. I, II & III, Elsevier, 2000.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRUCTURAL DYNAMICS

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To understand the importance of vibration analysis and modelling of dynamic systems
- To analyze for dynamic response of Single Degree of Freedom System subjected to different types of loading.
- To obtain the dynamic response of structures using numerical methods.
- To examine the dynamic response of Multiple Degree of Freedom System using lumped mass and distributed mass approach.
- To illustrate the dynamic effects of Wind Loads, Moving Loads and Vibrations caused by Traffic, Blasting and Pile Driving.

Course Outcomes: At the end of the course students will be able to

- Comprehend and model the systems subjected to vibrations and dynamic loads
- Analyze and obtain dynamics response of single degree freedom system using fundamental Theory and equations of motion.
- Obtain dynamics response of systems using numerical methods.
- Analyze and obtain dynamics response of Multi degree of freedom system idealized as lumped and distributed mass systems.
- To explain the dynamic effects of Wind Loads, Moving Loads and Vibrations caused by Traffic, Blasting and Pile Driving, Industrial Machinery

UNIT I

Introduction: Objectives, Importance of Vibration Analysis, Nature of Exciting Forces, Mathematical Modeling of Dynamic Systems. Elements of vibratory system - Degrees of Freedom - Continuous System - Lumped mass idealization - Oscillatory motion - Simple Harmonic motion - Vectorial representation of S.H.M. - Free and forced vibrations - undamped and damped vibrations - critical damping - Logarithmic decrement– Phase angle

UNIT II

Single Degree of Freedom System: Formulation of equations of motion by different methods Free and Forced Vibration with and without Damping, Response to Harmonic Loading, Response to General Dynamic Loading using Duhamel's Integral, Fourier analysis for Periodic Loading

UNIT III

Multiple Degree of Freedom System (Lumped parameter): Selection of the degrees of Freedom - Evaluation of structural property matrices - Formulation of the MDOF equations of motion - Undamped free vibrations - Solutions of Eigen value problem for determination of natural frequencies and mode shapes - Inverse Iteration Method for Determination of Natural Frequencies and Mode Shapes, Dynamic Response by Modal Superposition Method, Direct Integration of Equation of Motion.

UNIT IV

Numerical Solution to Response using Stodola method, Holzer method, Newmark Method and Wilson Methods.

Continuous systems: Flexural vibrations of beams - Elementary case – Derivation of governing differential equation of motion - Analysis of undamped free vibrations of beams in flexure - Natural frequencies and mode-shapes of simple beams with different end conditions

UNIT V

Special Topics in Structural Dynamics(Concepts only): Dynamic Effects of Wind Loading, Moving Loads, Vibrations caused by Traffic, Blasting and Pile Driving, Foundations for Industrial Machinery, Excitation by rigid base translation.

Reference Books:

1. Dynamics of Structures, Clough R. W. and Penzien J., McGraw Hill.
2. Structural Dynamics and Introduction to Earthquake Engineering, Chopra A. K.
3. Vibration of Structures - Application in Civil Engineering Design, Smith J. W., Chapman and Hall.
4. Dynamics of Structures, Humar J. L., Prentice Hall.
5. Structural Dynamics - Theory and Computation, Paz Mario, CBS Publication.
6. Dynamics of Structures, Hart and Wong.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED STEEL DESIGN

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- Learn the behaviour and design of structural steel components.
- Study and analyse beams for stability, strength and drift.
- Study and analyse columns for stability and strength.
- Study and design steel structures/ components by different design processes.
- Study and design welded and bolted connections.

Course Outcomes: At the end of the course, students will be able to

- Describe the mechanical properties of Steel and different failure modes of structural steel and determine their design strengths.
- Analyse and design beams and columns for stability.
- Analyse and design for strength and drift.
- Design steel structures/ components by different design processes.
- Design welded and bolted connections.

Unit I

Properties of Steel: Mechanical Properties, Hysteresis, Ductility.

Hot Rolled Sections: Compactness and non-compactness, slenderness, residual stresses.

Unit II

Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design Criteria

Stability, Strength, Drift.

Stability of Beams: Local Buckling of Compression Flange &Web, Lateral Torsional Buckling.

Stability of Columns: Slenderness Ratio, Local Buckling of Flanges and Web, Bracing of Column about Weak Axis.

Unit III

Strength Criteria: Beams - Flexure, Shear, Torsion, Columns - Moment Magnification Factor, Effective Length, PM Interaction, Biaxial Bending, Joint Panel Zones.

Drift Criteria: P Effect, Deformation Based Design;

Unit IV

Method of Designs: Allowable Stress Design, Plastic Design, Load and Resistance Factor Design;

Unit V

Connections: Welded, Bolted, Location Beam Column, Column Foundation, Splices.

Reference Books:

1. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
2. Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.
3. The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R., HeymanJ., ELBS.
4. Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.
5. IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
6. SP – 6 - Handbook of Structural Steel Detailing, BIS,1987

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF FORMWORK

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To make the student to understand the necessity and types of form work for various structures of Civil Engineering.
- To prepare the student to select proper type of form work, accessories and materials required.
- To train the student to carry out the design the form work for various structural elements like beam, slab, column, wall & foundation and for special structures like shells, retaining walls, bridges, bunkers & water tanks.
- To make the student to understand the working of flying form work like tunnel forms, slip forms and table forms.
- To motivate the students to Judge the form work failures and to assess the form work issues in multi – storey building construction through case studies.

Course Outcomes (CO_s): At the end of the course student will be able to

- Understand the necessity and types of form work for various structures of civil Engineering and select proper type of form work, accessories and materials required.
- Design the form work for various structural elements like beam, slab, column, wall & foundation.
- Design the form work for special structures like shells, retaining walls, bridges,Sylos, bunkers & water tank.
- Understand the working of flying form work like tunnel forms, slip forms and table forms.
- Judge the form work failures from case studies.

UNIT I

Introduction to formwork, Requirements and Selection of Formwork, Formwork Materials-Timber, Plywood, Steel, Aluminium, Plastic, and Accessories. Horizontal
And Vertical Formwork Supports.

UNIT II

Formwork Design: Concepts, Formwork Systems and Design for Foundations, Walls, Columns, Slab and Beams.

UNIT III
Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead Water Tanks, Natural Draft Cooling Tower and Bridges.

UNIT V
Flying Formwork: Table Form, Tunnel Form, Slip Form, Formwork for Precast Concrete, Formwork Management Issues –Pre- and Post-Award.

UNIT V
Formwork Failures: Causes and Case studies in Formwork Failure, Formwork Issues in Multi Story Building Construction.

Reference Books & Codes:

1. Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015.
2. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, False work for Concrete Structures – Guidelines; BIS, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF HIGH RISE STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To make the student to understand the types and nature of High Rise Structures and the concept of design for High Rise Structures; Application of software in analysis and design.
- To train the student for analysis and design of tall structures like Transmission/TV towers, Mast and Trestles.
- To train the student for analysis and design of RCC and Steel chimneys.
- To train the student for analysis and design of tall building structures.
- To prepare the students for Reinforcement detailing of all high rise structures.

Course Outcomes : At the end of the course, student will be able to

- Understand the concept of design for High Rise Structures and practice the design of Transmission/TV towers, Mast and Trestles.
- Analyze and design the chimneys of RCC and Steel.
- Dynamic approach to seismic design.
- Understanding IS provisions for Fire Fighting.
- Understand the application of software for analysis and design of tall building/High Rise Structures.

UNIT I

Design of transmission/ TV tower, Mast and trestles: Configuration, bracing system, analysis and design for vertical transverse and longitudinal loads.

UNIT II

Analysis and Design of RC and Steel Chimney, Foundation design for varied soil strata.

UNIT III

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach.

UNIT IV

Structural design considerations and IS code provisions. Firefighting design provisions.

UNIT V

Application of software in analysis and design.

Reference Books:

1. Structural Design of Multi-storeyed Buildings, Varyani U. H., 2nd Ed., South Asian Publishers, New Delhi, 2002.
2. Structural Analysis and Design of Tall Buildings, Taranath B. S., McGraw Hill, 1988.
3. Illustrated Design of Reinforced Concrete Buildings (GF+3storeyed), Shah V. L. & Karve S. R., Structures Publications, Pune, 2013.
4. Design of Multi Storeyed Buildings, Vol. 1 & 2, CPWD Publications, 1976.
5. Tall Building Structures, Smith Byran S. and Coull Alex, Wiley India. 1991.
6. High Rise Building Structures, Wolfgang Schueller, Wiley. 1971.
7. Tall Chimneys, Manohar S. N., Tata McGraw Hill Publishing Company, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF MASONRY STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To give an understanding to the students of the masonry design approaches
- To prepare the students for Analyze Reinforced Masonry Members
- To prepare the students to determine interactions between members studies in the Field of engineering.
- To motivate the student to perform elastic and inelastic analysis of masonry walls in Engineering with deep interest.
- To expose the students to check the stability of walls for public utility

Course Outcomes: At the end of the course students will be able to

- Understand the masonry design approaches.
- Analyze the reinforced masonry members.
- Determine the shear strength interactions between structural members.
- Analysis of the structural stability of walls.
- Perform pushover analysis of masonry walls.

Unit I

Introduction: Historical Perspective, Masonry Materials, Masonry Design Approaches, Overview of Load Conditions, Compression Behaviour of Masonry, Masonry Wall Configurations, Distribution of Lateral Forces.

Unit II

Flexural Strength of Reinforced Masonry Members: In plane and Out-of-plane loading.

Unit III

Interactions: Structural Wall, Columns and Pilasters, Retaining Wall, Pier and Foundation.

Shear Strength and Ductility of Reinforced Masonry Members.

Unit IV

Prestressed Masonry - Stability of Walls, Coupling of Masonry Walls, Openings, Columns,

Beams.

Unit V

Elastic and Inelastic Analysis- Modeling Techniques, Static Pushover Analysis and use of Capacity Design Spectra.

Text Books:

1. Brick and reinforced brick structures - P. Dayaratnam, Oxford & IBH 1987.
2. Design of reinforced concrete and brick masonry structures by Purushothama raj
3. Design of Masonry Structures, by AW Hendry - 2004

Reference Books:

1. Design of Reinforced Masonry Structures, Narendra Taly, ICC, 2nd Edn,
2. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.
4. Earthquake-resistant Design of Masonry Buildings,Toma_evi_Miha, Imperial College Press, 1999.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF ADVANCED CONCRETE STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To acquire knowledge on modeling of loads and material characteristics.
- To analyse and design reinforced concrete elements like strut, deep beam, corbel and shear wall.
- To design the steel structures for stability and buckling.
- To analyse the special structures by understanding their behavior.
- To design and prepare detail structural drawings for execution citing relevant IS codes.

Course Outcomes: At the end of the course, students will be able to

- Choose the loads and materials for modeling the structures.
- Analyse and design reinforced concrete strut, deep beam and corbel.
- Design the reinforced concrete shear wall.
- Design the steel structures for stability and buckling for pure, flexural and lateral.
- Design of beam-columns and fatigue resistant.

UNIT-I

Design philosophy, Modelling of Loads and Material Characteristics.

UNIT-II

Reinforced Concrete - Design of Deep Beam and Corbel; IS. Design of piles and pilecaps.

UNIT-III

Reinforced Concrete - Design of Shear Walls, Compression Field Theory for Shear Design, and Design of plain concrete walls.

UNIT-IV

Retaining walls and tanks: Stability requirements, design of counter fort retaining wall. Design of Intze type overhead tank and staging.

UNIT-V

Bridge Engineering – Design of Deck Slab Bridge as per IRC loadings, economic span, effective method, and design.

References Books:

1. Reinforced Concrete Design, Pillai S. U. and MenonD., Tata McGraw-Hill, 3rd Ed, 1999.
2. Design of Steel Structures, SubramaniamN., Oxford University Press, 2008.
3. Reinforced Concrete Structures, Park R.andPaulayT. , John Wiley & Sons, 1995.
4. Advanced Reinforced Concrete Design, Varghese P. C., Prentice Hall of India, New Delhi.
5. Unified Theory of Concrete Structures, Hsu T. T. C. and Mo Y. L., John Wiley & Sons, 2010.
6. Steel Structures Design and Behavior Emphasizing Load and Resistance Factor Design, SalmonC. G., Johnson J. E. and Malhas F. A., Pearson Education, 5th Ed, 2009.
7. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
8. Plastic Methods of Structural Analysis, Neal B.G., Chapman and Hall London.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ADVANCED DESIGN OF FOUNDATIONS

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To select the appropriate shallow foundation type by estimating the bearing capacities and allowable settlements using suitable in-situ field and lab data.
- To understand the load transfer mechanism of deep foundations and estimating the vertical and lateral capacities of pile/pile groups with analytical approaches and load tests.
- To illustrate the design of well foundations by different methods and Indian standards.
- To provide the information on different types of shoring systems for open cuts by understanding soil arching effect and estimation of tunnel pressures.
- To analyze and design of cofferdams under uplift loads with soil structure interaction.

Course Outcomes: At the end of the course, students will be able to

- Decide the suitability of soil strata for different projects.
- Design shallow foundations deciding the bearing capacityof soil.
- Analyze and design the pile and well foundation.
- Soil arching and estimation of tunnel support pressures.
- Analysis and design of coffer dams with soil structure interaction.

UNIT I

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, and Methods of Borings along with Various Penetration Tests.

UNIT II

Shallow Foundations, Requirements for Satisfactory Performance of Foundations, Methods of Estimating Bearing Capacity, Settlements of Footings and Rafts, Proportioning of Foundations using Field Test Data, Pressure - Settlement Characteristics from Constitutive Laws.

UNIT III

Deep Foundations, Methods of Estimating Load Transfer of Piles, Settlements of Pile Foundations, Pile Group Capacity and Settlement, Laterally Loaded Piles, Pile Load Tests, Analytical Estimation of Load- Settlement Behavior of Piles, Proportioning of Pile

Foundations, Lateral and Uplift Capacity of Piles, Well Foundation, IS and IRC Code Provisions, Elastic Theory and Ultimate Resistance Methods.

UNIT IV

Tunnels and Arching in Soils, Pressure Computations around Tunnels.

Open Cuts, Sheeting and Bracing Systems in Shallow and Deep Open Cuts in Different Soil Types.

UNIT V

Coffer Dams, Various Types, Analysis and Design, Foundations under uplifting loads, Soil-structure interaction

Reference Books:

1. Design of foundation system, N.P. Kurian, Narosa Publishing House
2. Foundation Analysis and Design, J. E. Bowles, Tata McGraw Hill New York
3. Analysis and Design of Substructures, Sawmi Saran, Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SOIL STRUCTURE INTERACTION

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: The objective of this course is to provide

- To understand the behaviour of soil.
- Application of FEM and Finite Difference Method.
- Preparation of Comprehensive Design Oriented Computer Programs.
- Analysis of Different Types of Frame Structures.
- Determination of Pile Capacities.

Course Outcomes: At the end of the course, students will be able to

- Understand soil structure interaction concept and complexities involved.
- Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method.
- Analyze soil-structure interaction considering different Models for various soil conditions.
- Prepare comprehensive design oriented computer programs for interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.
- Analyze different types of frame structure founded on stratified natural deposits with linear and non-linear stress-strain characteristics.

Unit I

Critical study of conventional methods of foundation design, Nature and complexities of soil structure interaction.

Unit II

Application of advanced techniques of analysis such as FEM and Finite Difference Method. Relaxation and Interaction for the evaluation of soil structure interaction for different types of structure under various conditions of loading and subsoil characteristics.

Unit III

Preparation of comprehensive design oriented computer programs for specific problems, Interaction problems based on theory of sub grade reaction such as beams, footings, rafts etc.

Unit IV

Analysis of different types of frame structures founded on stratified natural deposits with Linear and Non-linear stress-strain characteristics.

Unit V

Determination of pile capacities and negative skin friction, Action of group of piles considering stress-strain characteristics of real soils, Anchor piles and determination of pullout resistance.

Reference Books:

1. Analytical and Computer Methods in Foundation, Bowels J.E.,McGraw Hill Book Co., New York, 1974.
2. Numerical Methods in Geotechnical Engineering, Desai C.S. and Christian J.T., McGraw Hill Book Co., New York.
3. Soil Structure Interaction - The real behaviour of structures, Institution of Structural Engineers.
4. Elastic Analysis of Soil Foundation Interaction, Developments in Geotechnical Engg. Vol-17, Elsevier Scientific Publishing Company.
5. Elastic Analysis of Soil-Foundation Interaction, Selvadurai A.P.S., Elsevier Scientific Publishing Company.
6. Analysis & Design of substructures, Swami Saran, Oxford & IBH Publishing Co. Pvt. Ltd.
7. Design of Foundation System- Principles & Practices, Kurian N. P., Narosa Publishing.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF INDUSTRIAL STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Outcomes: On completion of this Course the student shall be able to

- Analyse and Design Steel Gantry Girders.
- Analyse and Design Steel Portal Frames and Gable Frames.
- Analyse and Design Steel Bunkers and Silos.
- Analyse and Design Chimneys
- Analyse and Design Water Tanks.

Course Outcomes: At the end of the course, the student will be able to:

- Design Steel Gantry Girders.
- Design Steel Portal Frames and Gable Frames.
- Design Steel Bunkers and Silos.
- Design Chimneys
- Design Water Tanks.

Unit I

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.

Unit II

Portal Frames – Design of portal frame with hinge base, design of portal frame with fixed base - Gable Structures – Lightweight Structures

Unit III

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.

Unit IV

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.

Unit V

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.

Reference Books:

1. Design of Steel Structure, Punmia B. C., Jain Ashok Kr., Jain Arun Kr., 2nd Ed., LakshmiPublishers, 1998.
2. Design of Steel Structures, Ram Chandra, 12th Ed., Standard Publishers, 2009.
3. Design of Steel Structures, Subramaniyam.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

MODEL TESTING LAB

Course Code: GR18D51 **L/T/P/C: 0/0/4/2**

Course Objectives: On completion of this Course the student shall be able to

- The student can idealize the effect of structures against extreme loading.
- The student can idealize the response of structure under deferent loading.
- The student can learn about free and forced vibration.
- The student can know the advantage of shear walls.
- The student can know the usage of isolation of foundations under vibrations.

Course Outcomes: At the end of the course, students will be able to

- Evaluate the response of structure under Static and Dynamic loading.
- Generate and analyze the various structure for free and forced vibrations against prepared models using appropriate software's.
- Develop models and test for Static and Dynamic loading.
- Develop models and test for force and free vibrations.
- Check the stability of shear walls against lateral loading.

List of Experiments:

1. Generate models like shear walls, portal frames etc., and using appropriate software's.
2. Model testing for frames.
3. Modal testing of plates, shells under static loading**.**
4. Modal testing for free and forced vibrations on frames.
5. Evaluation of dynamic modulus for given structure under loading.
6. Assess the capacity of shear walls under lateral loading.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

NUMERICAL ANALYSIS LAB

Course Code: GR18D51 **L/T/P/C: 0/0/4/2**

Course Objectives: On completion of this Course the student shall be able to

- Find Roots of non-linear equations by Bisection method and Newton's method.
- Do curve fitting by least square approximations.
- Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/Gauss - Jorden Method.
- Integrate Numerically Using Trapezoidal and Simpson's Rules.
- Find Numerical Solution of Ordinary Differential Equations by Euler's Method, Runge-Kutta Method.

Course Outcomes: At the end of the course, students will be able to

- Find Roots of non-linear equations by Bisection method and Newton's method.
- Do curve fitting by least square approximations.
- Solve the system of Linear Equations using Gauss - Elimination/ Gauss - Seidal Iteration/Gauss - Jorden Method.
- Integrate Numerically Using Trapezoidal and Simpson's Rules.
- Find Numerical Solution of Ordinary Differential Equations by Euler's Method & Runge- Kutta Method.

Syllabus:

1. Find the Roots of Non-Linear Equation Using Bisection Method.
2. Find the Roots of Non-Linear Equation Using Newton's Method.
3. Curve Fitting by Least Square Approximations.
4. Solve the System of Linear Equations Using Gauss - Elimination Method.
5. Solve the System of Linear Equations Using Gauss - Seidal Iteration Method.
6. Solve the System of Linear Equations Using Gauss - Jorden Method.
7. Integrate numerically using Trapezoidal Rule.
8. Integrate numerically using Simpson's Rules.
9. Numerical Solution of Ordinary Differential Equations by Euler's Method.
10. Numerical Solution of Ordinary Differential Equations by Runge- Kutta Method.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
MINI PROJECT WITH SEMINAR

Course Code: GR18D51 **L/T/P/C: 2/0/0/2**

Course Objectives: On completion of this Course the student shall be able to

- Understand the behaviour and properties of various materials
- Provide knowledge in contemporary software's
- Estimating the ultimate strength and failures due to application of loads.
- Asses the behaviour of materials under different load applications.
- Analyse behaviours of complex structures using software's and analytical procedures

Course Outcomes: At the end of the course, the student will be able to

- Identify structural engineering problems reviewing available literature.
- Demonstrate the project results with real application for sustainable constructions sustainable environment techniques.
- Study different techniques used to analyse complex structural systems.
- Describe about solutions highlighting individuals' contribution and present solution by using his/her technique applying engineering principles.
- Justify the results of selected project at the end of semester

Syllabus Contents:

Mini Project will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions highlighting individuals' contribution.

Continuous assessment of Mini Project at Mid Sem and End Sem will be monitored by the Departmental committee.

III-SEMESTER

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- To develop an advanced understanding regarding behaviour of prestressing members.
- Be able perform in analysis and design statically determinate PSC members.
- To demonstrate the stresses with anchorage system in prestressed concrete members.
- Be able perform in analysis and design statically indeterminate PSC members.
- Be able perform in analysis and design of precast and prestress composite constructions

Course Outcomes: At the end of the course students will be able to

- Find out losses in the pre-stressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.
- Analysis and Design for ultimate strength of statically determinate prestressed concrete structures.
- Design of end blocks for prestressed members.
- Analysis and Design for ultimate strength of statically indeterminate pre-stressed concrete structures.

- Design composite structures using pre-stressed concrete

Unit I

Introduction to pre-stressed concrete: types of pre-stressing, systems and devices, materials,

Losses in pre stress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads, ultimate strength in flexure, code provisions.

Unit II

Statically determinate PSC beams: design for ultimate and serviceability limit states for

flexure, analysis and design for shear and torsion, code provisions.

Unit III

Transmission of pre-stress in pre-tensioned members; Anchorage zone stresses for post tensioned members.

Unit IV

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy. Analysis and design of pre-stressed concrete pipes, columns with moments

Unit V

Composite construction with precast PSC beams and cast in-situ RC slab - Analysis and design, creep and shrinkage effects. Partial prestressing - principles, analysis and design concepts, crack width calculations.

TEXT BOOKS:

1. Prestressd Concrete by N.KrishnaRaju, Tata Mc.Graw Hill Publications.
2. Prestressed Concrete by N.Rajasekharan, Narosa Publications

Reference Books:

1. Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955.
2. Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981.
3. Limited State Design of PrestressedConcrete,GuyanY., Applied Science Publishers, 1972.
4. IS: 1343- Code of Practice for Prestressed Concrete
5. IRC: 112

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ANALYSIS OF LAMINATED COMPOSITE PLATES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- Analyse the rectangular composite plates using the analytical methods.
- Understand the governing equations for different boundary conditions.
- Know the Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.
- Analyse the composite plates using advanced finite element method.
- Analysis of Rectangular Composite Plates using Analytical Methods.

Course Outcomes: At the end of the course students will be able to

- Analyse the Displacement Field Approximations for CLPT and FSDT.
- Analyse the Solutions for Bending of Rectangular Laminated Plates using CLPT.
- Analyse the Naiver Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates.
- Understand the Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT and FSDT.
- Develop the computer programs for the analysis of composite plates.

Unit I

Introduction: Displacement Field Approximations for Classical Laminated Plate Theory (CLPT)and First Order Shear Deformation Theory (FSDT), Analytical Solutions for Bending of Rectangular Laminated Plates using CLPT.

Unit II

Governing Equations: Naiver Solutions of Cross-Ply and Angle-Ply Laminated Simply-

Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary

Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates using FSDT.

Unit III

Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses.Finite Element Solutions for Bending of Rectangular Laminated Plates using CLPT.

Unit IV

Finite Element Solutions for Bending of Rectangular Laminated Plates using FSDT.

Finite Element Model, C0Element Formulation, Post Computation of Stresses.

Unit V

Analysis of Rectangular Composite Plates using Analytical Methods.

Reference Books

1. Mechanics of Laminated Composites Plates and Shells, Reddy J. N., CRC Press.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FRACTURE MECHANICS OF CONCRETE STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: On completion of this Course the student shall be able to

- Apply knowledge of fracture mechanics to identify crack pattern in concrete structures.
- Identify different crack patterns & crack locations in structures.
- To apply knowledge of continuum mechanics to prepare crack & band models.
- Apply crack concepts & numerical modelling to high strength concrete & fibre reinforced concrete.
- Study crack criteria by using Griffith's Criteria, Stress Intensity Factors, R curves.

Course Outcomes: At the end of the course, students will be able to

- Identify and classify cracking of concrete structures based on fracture mechanics.
- Implement stress intensity factor for notched members
- Apply fracture mechanics models to high strength concrete and FRC structures.
- Compute J-integral for various sections understanding the concepts of LEFM.
- Analyze Crack pattern & types of cracks.

Unit I

Introduction: Basic Fracture Mechanics, Crack in a Structure, Mechanisms of Fracture.

Unit II

Study of cracks: Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking Service Failure Analysis

Unit III

Stress at Crack Tip: Stress at Crack Tip, Linear Elastic Fracture Mechanics, Griffith's Criteria, Stress Intensity Factors, Crack Tip Plastic Zone, Erwin's Plastic Zone Correction, R curves, Compliance, J Integral, Concept of CTOD and CMD.

Unit IV

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics.

Unit V

Applications: Applications to High Strength Concrete, Fiber Reinforced Concrete, Crack Concepts and Numerical Modeling.

Reference Books:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.

2. Elementary Engineering Fracture Mechanics, BroekDavid, 3rd Rev. Ed. Springer, 1982.

3. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEM Report, Chapman and Hall, 1989.

4. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACI SP 118, ACI Detroit, 1989.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

FRACTURE MECHANICS OF CONCRETE STRUCTURES

Course Code: GR18D51 **L/T/P/C: 3/0/0/3**

Course Objectives: Students will be able to

- Achieve fundamental understanding of the classical theory of elastic plates and introduce analytical, numerical solution techniques in thin plate theory
- Apply theory of plates to the problems involving various geometrics and boundary conditions.
- Apply Navier and Levi's method to plates with different end conditions.
- Know different theories and procedure for analysis of shells.
- Know design procedure for different shells.

Course Outcomes: On successful completion of this course, it is expected that students should be able to

- Analyse bending of plates and understand small deflection theory
- Analyse plates using Navier's and Levi's method.
- Analyse Circular plates.
- Use appropriate theory to analyse the shell structure.
- Design shell structures of singly curved and doubly curved

UNIT I

Cylindrical Bending: Different kind of plates – Assumptions - Derivation of differential equation for cylindrical bending of long rectangular plates - Analysis of uniformly loaded rectangular plates with edges simply supported and fixed subjected to uniform load.

Pure Bending of Plates: Slope and curvature of slightly bent plates – Relations between moments and curvature - Particular cases of pure bending - Strain energy in pure bending – Energy methods like Ritz and Galerkin Methods to rectangular plates subjected to simple loadings.

UNIT II

Small Deflection Theory of Thin Rectangular Plates : Assumptions – Derivation of governing differential equation for thin plates- Boundary conditions- supported plate under simply sinusoidal load- Navier's solution- Application to cases – Levy's solution for various boundary conditions subjected to different loadings like uniform and hydrostatic pressure.

UNIT III

Circular Plates : Symmetrical loading – Relations between slope, deflection, moments and curvature – Governing differential equation – Uniformly loaded plates with clamped and

simply supported edges – Central hole – bending by moments and shearing forces uniformly distributed.

UNIT IV

Shells –functional behaviour –examples –structural behaviour of shells, classification of shells –Definitions –various methods of analysis of shells –merits and demerits of each method –2D -Membrane equation. Equations of equilibrium: Derivation of stress resultants –cylindrical shells –Flugges simulations equations.

UNIT V

Derivation of the governing DKJequation for bending theory. Schorer's theory, to the analysis and design of short and long shells. Beam theory of cylindrical shells: Beam and arch action, Analysis using beam theory.

Introduction to the shells of Double curvatures: Geometry, analysis and design of elliptic paraboloid,conoid and hyperbolic paraboloid shapes and inverted umbrella type.

Text Books:

1. Timoshenko, Theory of Plates and Shells, McGraw Hill Book Co., New York, 2nd edition, 2003.
2. P. Szilard, Theory and Analysis of Plates, Prentice Hall, 1973.
3. G.S.Ramaswami, Analysis and design of concrete shell roofs, 3rdEdition, 1994.
4. Chaterjee, Design of concrete shell roofs, 3rdEdition, 1990.

Reference Books:

1. Chandrasekhar, Theory of Plates, University Press, 2001.
2. N. K. Bairagi, Plate Analysis, Khanna Publishers, New Delhi, 1986.
3. Billington, Design of concrete shell roofs, 3rdEdition, 1990.
4. N.K.Bairagi, Shell Analysis.
5. Dr.N.Krishna Raju, Advanced R.C Design

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISSERTATION PHASE I / INDUSTRIAL PROJECT

Course Code: GR18D51 **L/T/P/C: 0/0/20/10**

Course Objectives: On completion of this Course the student shall be able to

- To identify the topic by reviewing literature.
- To develop methodology to carry project thesis work.
- Based on the topic, setting objectives to carryout project thesis work
- To identify the topic by conferences
- To identify the topic by journals

Course Outcomes: At the end of the course, the student will be able to

- Identify topics in thrust areas of Structural engineering and use appropriate techniques to analyze complex structural systems.
- Take up critical review of literature on the chosen topic
- Carryout independent research work on the topic by experimental / analytical approaches for structural engineering problems reviewing available literature.
- Apply engineering and management principles through efficient handling of project
- Documentation and presentation of the research work

Syllabus Contents:

Dissertation-I will have mid semester presentation and end semester presentation. Mid semester presentation will include identification of the problem based on the literature review on the topic referring to latest literature available.

End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions and must bring out individuals contribution.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISSERTATION PHASE II

Course Code: GR18D51 **L/T/P/C: 0/0/32/16**

Course Objectives: On completion of this Course the student shall be able to

- To identify the topic by reviewing literature
- To develop methodology to carry project thesis work
- To carryout project thesis work based on the chosen topic
- To identify the topic by conferences
- To carryout experimental/analytical programme and critical analysis of results on the identified topic in thrust areas of Structural engineering.

Course Outcomes: At the end of the course, the student will be able to:

- Exhibit good communication skill to the engineering community and society.
- Demonstrate professional ethics and work culture.
- Carryout independent research work on the topic by experimental or analytical approaches with engineering and management principles through efficient handling of project.
- Identify structural engineering problems and apply the principles, tools and techniques to analyze complex structural systems using appropriate techniques.
- Apply Prepare document and critical analysis of the results of research work and presentation

Syllabus Contents:

Dissertation – II will be extension of the work on the topic identified in Dissertation – I.

Continuous assessment should be done of the work done by adopting the methodology decided involving numerical analysis/ conduct experiments, collection and analysis of data, etc. There will be pre submission seminar at the end of academic term. After the approval the student has to submit the detail report and external examiner is called for the viva-voce to assess along with guide.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS ANALYTICS

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

UNIT I

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

UNIT II

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.

UNIT III

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes.

Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

UNIT IV

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models .Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

UNIT V

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making. Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism.

Reference Books:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, persons Education.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

INDUSTRIAL SAFETY

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

UNIT I

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

UNIT II

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

UNIT III

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

UNIT IV

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one Machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

UNIT V

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical

and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Reference Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, Mcgrew Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

BUSINESS ANALYTICS

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

UNIT I

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models.

UNIT II

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming.

UNIT III

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

UNIT IV

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

UNIT V

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation.

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI,2008
2. Wagner, Principles of Operations Research, PHI, Delhi,1982.
3. J.C. Pant, Introduction to Optimization: Operations Research, Jain Brothers, Delhi,2008
4. Hitler Libermann Operations Research: McGraw Hill Pub.2009
5. Pannerselvam, Operations Research: Prentice Hall of India2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India2010

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COST MANAGEMENT OF ENGINEERING PROJECTS

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

Unit I

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Unit II

Project: meaning, Different types, why to manage, cost overruns centers, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities. Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Unit III

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints. Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.

Unit IV

Budgetary Control; Flexible Budgets; Performance budgets; Zero-based budgets. Measurement of Divisional profitability pricing decisions including transfer pricing.

Unit V

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

Reference Books:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi.
2. Charles T. Horngren and George Foster, Advanced Management Accounting.
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting.
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher.
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co.Ltd.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

COMPOSITE MATERIALS

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

UNIT I

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

UNIT II

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

UNIT III

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

UNIT IV

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

UNIT V

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

Text Books:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.

Reference Books:

1. Hand Book of CompositeMaterials-ed-Lubin.
2. Composite Materials –K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L.Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W.Tasi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

WASTE TO ENERGY

(OPEN ELECTIVE)

Course Code: **L/T/P/C: 3/0/0/3**

Unit I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

Unit II

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

Unit III

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation.

Unit IV

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

Unit V

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

Reference Books:

1. Non-Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd.,1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd.,1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd.,1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

ENGLISH FOR RESEARCH PAPER WRITING

Course Code: **L/T/P/C: 2/0/0/2**

Course objectives:

- To state how to put research on paper
- To demonstrate how to write an abstract
- To apply the process of research
- To appraise the key skills involved in writing the title, abstract, introduction and review of literature
- To compose a paper which is good and has the qualities of acceptance and publication

Course Outcomes:

- Will be able to understand how to write a research paper
- Will outline the drafting of an abstract
- Will acquire the skills of various elements of research
- Will be in a position to write a good paper
- Will result in increasing the chance of publication

Unit I

Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness.

Unit II

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, and Introduction.

Unit III

Review of the Literature, Methods, Results, Discussion, Conclusions, the Final Check.

Unit IV

Key skills are needed when writing a Title, key skills are needed when writing an abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit V

Skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusion.

Unit VI

Useful phrases, how to ensure paper is as good as it could possibly be the first- time submission.

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)

2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press

3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman's book .

4. Ian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

DISASTER MANAGEMENT

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically understand the strengths and weaknesses of disaster management approaches,
- Planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes:

- Capacity to integrate knowledge and to analyze, evaluate and manage the different public health aspects of disaster events at a local and global levels, even when limited information is available.
- Capacity to describe, analyze and evaluate the environmental, social, cultural, economic, legal and organizational aspects influencing vulnerabilities and capacities to face disasters.
- Capacity to work theoretically and practically in the processes of disaster management (disaster risk reduction, response, and recovery) and relate their interconnections, particularly in the field of the Public Health aspects of the disasters.
- Capacity to manage the Public Health aspects of the disasters.
- Capacity to obtain, analyze, and communicate information on risks, relief needs and lessons learned from earlier disasters in order to formulate strategies for mitigation in future scenarios with the ability to clearly present and discuss their conclusions and the knowledge and arguments behind them.

Unit I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit II

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 disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit III

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

Unit IV

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.

Unit V

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.

Unit VI

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 AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company
2. Sahni, Pardeep Et.Al. (Eds.)," Disaster Mitigation Experiences and Reflections", Prentice Hall Of India, New Delhi.
3. Goel S. L., Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

SANSKRIT FOR TECHNICAL KNOWLEDGE

Course Code: **L/T/P/C: 2/0/0/2**

Course objectives:

- To get a working knowledge in illustrious Sanskrit, the scientific language in the world
- Learning of Sanskrit to improve brain functioning
- Learning of Sanskrit to develop the logic in mathematics, science & other subjects
- Enhancing the memory power
- The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

Course Outcomes*:*

- Understanding basic Sanskrit alphabets and Understand tenses in Sanskrit Language.
- Enable students to understand roots of Sanskrit language.
- Students learn engineering fundamentals in Sanskrit.
- Students can attempt writing sentences in Sanskrit.
- Ancient Sanskrit literature about science & technology can be understood

Unit 1: Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Unit 2: Order, Introduction of roots, Technical information about Sanskrit Literature

Unit 3: Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

Reference Books:

1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

VALUE EDUCATION

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- Understand value of education and self- development
- Imbibe good values in students
- Let the should know about the importance of character
- To understand the significance of human conduct and self-development
- To enable students to imbibe and internalize the value and Ethical behaviour in personal and professional lives.

Course outcomes: Students will be able to

- Knowledge of self-development
- Learn the importance of Human values
- Developing the overall personality
- Student will be able to realize the significance of ethical human conduct and self-development
- Students will be able to inculcate positive thinking, dignity of labour and religious tolerance.

Unit 1: Values and self-development –Social values and individual attitudes, Work ethics, Indian vision of humanism, Moral and non- moral valuation, Standards and principles, Value judgement.

Unit 2: Importance of cultivation of values, Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness. Honesty, Humanity. Power of faith, National Unity. Patriotism. Love for nature, Discipline

Unit 3: Personality and Behavior Development - Soul and Scientific attitude, Positive Thinking, Integrity and discipline, Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labour, Universal brotherhood and religious tolerance, True friendship, Happiness vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature.

Unit 4: Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation. Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

Reference Books:

1. Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY
INDIAN CONSTITUTION

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
- To address the growth of Indian opinion regarding modern Indian intellectuals' constitutional
- Role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
- To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.
- To understand the role and functioning of Election Commission of India.

Course Outcomes: Students will be able to:

- Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
- Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
- Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
- Discuss the passage of the Hindu Code Bill of 1956.
- Discuss the significance of Election Commission of India.

Unit 1: History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working).

Unit 2: Philosophy of the Indian Constitution: Preamble Salient Features.

Unit 3: Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties.

Unit 4: Organs of Governance: Parliament-Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions.

Unit 5: Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: Zila Pachayat. Elected officials and their roles, CEO Zila Pachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.

Unit 6: Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women.

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PEDAGOGY STUDIES

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- Review existing evidence on the review topic to inform Programme design and policy making
- Undertaken by the DFID, other agencies and researchers.
- Identify critical evidence gaps to guide the development.
- Establishing coordination among people in order to execute pedagogy methods.
- To study pedagogy as a separate discipline.

Course Outcomes: Students will be able to understand

- What pedagogical practices are being used by teachers in formal classrooms in developing countries?
- What pedagogical practices are being used by teachers in informal classrooms in developing countries?
- Synergy from the work force.
- What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
- How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Unit 1: Introduction and Methodology: Aims and rationale, Policy background, Conceptual framework and terminology Theories of learning, Curriculum, Teacher education. Conceptual framework, Research questions**.** Overview of methodology and Searching.

Unit 2: Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries. Curriculum, Teacher education.

Unit 3: Evidence on the effectiveness of pedagogical practices, Methodology for the in-depth stage: quality assessment of included studies. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy? Theory of change. Strength and nature of the body of evidence for effective pedagogical practices. Pedagogic theory and pedagogical approaches. Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4: Professional development: alignment with classroom practices and follow- up support, Peer support, Support from the head teacher and the community, Curriculum and assessment, Barriers to learning: limited resources and large class sizes

Unit 5: Research gaps and future directions: Research design, Contexts, Pedagogy, Teacher education, Curriculum and assessment, Dissemination and research impact.

Reference Books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, 'learning to read' campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

STRESS MANAGEMENT BY YOGA

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- To achieve overall Good Health of Body and Mind.
- To lower blood pressure and improve heart health.
- To become non-violent and truthfulness.
- To increase the levels of happiness.
- To eliminate all types of body pains.

Course Outcomes: Students will be able to

- Develop healthy mind in a healthy body thus improving social health also improve efficiently.
- Develop body awareness. Learn how to use their bodies in a healthy way. Perform well in sports and academics.
- *Will balance, flexibility,* and stamina, strengthen *muscles* and connective tissues enabling good *posture*.
- Manage stress through breathing, awareness, meditation and healthy movement.
- Build concentration, confidence and positive self-image.

Unit 1: Definitions of Eight parts of yog. (Ashtanga)

Unit 2: Yam and Niyam. Do`s and Don't's in life. Ahinsa, satya, astheya, bramhacharya and aparigraha Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3: Asan and Pranayam, Various yog poses and their benefits for mind & body. Regulaization of breathing techniques and its effects-Types of pranayam

Reference Books:

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY

PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Course Code: **L/T/P/C: 2/0/0/2**

Course Objectives:

- To learn to achieve the highest goal happily
- To become a person with stable mind, pleasing personality and determination
- To awaken wisdom in students
- To differentiate three types of happiness (Sukham)
- To describe the character traits of a spiritual devotee

Course Outcomes:

- Study of Shrimad- Bhagwad-Gita wiil help the student in developing his personality and achieve the highest goal in life
- The person who has studied Geeta will lead the nation and mankind to peace and prosperity
- To develop self-developing attitude towards work without self-aggrandizement
- To develop tranquil attitude in all favorable and unfavorable situations
- To develop high spiritual intelligence

Unit 1: Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Unit 2: Approach to day to day work and duties.

- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

Unit 3: Statements of basic knowledge.

- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

Reference Books:

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari's Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.