DEPARTMENT OF CIVIL ENGINEERING

M.TECH IN STRUCTURES

Program Educational Objectives:

PEO1	To impart concepts of structural engineering through the use of analytical techniques, experiments, computer simulation methods, and other modern engineering tools in the analysis and effective design of variety of civil engineering structures.
PEO2	To imbibe critical thinking in analyzing a complex problem in structural engineering field.
PEO3	To develop skills of communicating structural design effectively and undertake research in upcoming areas.

Program Outcomes (PO's):

PO1	Acquire and be able to evaluate, analyze and synthesize current body of knowledge in structural engineering.
PO2	Be able to identify, formulate and solve complex structural engineering problems with independent judgment.
PO3	Be able to conceptualize and design Civil Engineering Structures with appropriate consideration for public health and safety, environmental, cultural and societal considerations.
PO4	Be able to explore and extract information of complex problems including design of experiments and tools, analyze and interpret data for development of technical knowledge in Structural Engineering.
PO5	Be able to apply appropriate resources, techniques & tools to various problems in Structural Engineering.
PO6	Be able to function effectively as an individual as well as a member or leader of a multi-disciplinary team.
PO7	Be able to understand critical issues for professional practice such as detailing work and the interaction with various agencies during project life cycle.
PO8	Be able to communicate effectively on complex engineering problems by written oral and visual means to the stake holders.
PO9	Be able to recognize the need and have an ability to engage lifelong learning process.
PO10	Be able to understand and commit to professional ethics and responsibilities while carrying out research and design activities.
PO11	Be able to critically analyze, scrutinize and rectify one's decisions and actions and apply self-corrective measures

Program Specific Outcomes (PSO)

The post graduates will be able to:

PSO1. Excel in the research, innovation, design and problem solving in structural engineering domain.

PSO.2 Interact with stakeholders effectively and execute quality work within the stipulated resources.

Shri Guru Gobind Singhji Institute of Engineering &Technology, Nanded-431 606.
Department of Civil Engineering

M. Tech. (Structural Engineering)

Teaching Scheme from Academic Year (2018-19) Semester- I

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 1 PCC-SE501	Finite Element Analysis of Structures	3	0	2	**4**
2	Core 2 PCC- SE502	Behavior of Concrete Structures	3	0	0	**3**
3	Core 3 CES- SE503	Structural Dynamics	3	1	0	**4**
4	PEC-SE504-506	Program Specific Elective-I	3	1	0	**4**
	PEC-SE504	Numerical Methods				
	PEC-SE505	Pre Stressed Concrete				
	PEC-SE506	Bridge Analysis and Design				
5	PEC-SE507-509	Program Specific Elective-II	3	0	2	**4**
	PEC-SE507	Computer Aided Analysis & Design of Structures				
	PEC-SE508	Theory of Elasticity & Plasticity				
	PEC-SE509	Design of Tall Buildings				
6	OEC-8AA	Open Elective	3	0	0	**3**
7	AUD-9@	Audit Course	2	0	0	**0**
						22

Semester- II

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	Core 4 PCC-SE510	Structural Stability	3	1	0	**4**
2	Core 5 PCC-SE511	Theory of Plates and Shells	3	1	0	**4**
3	PEC-SE512-514	Program Specific Elective-III	3	1	0	**4**
	PEC-SE512	Neo Construction Materials				
	PEC-SE513	Fracture Mechanics of concrete structures				
	PEC-SE514	Seismic analysis & Design of Structures				
4	PEC-SE515-517	Program Specific Elective-IV	3	0	2	**4**
	PEC-SE515	Structural Masonry				
	PEC-SE516	Rehabilitation of Structures				
	PEC-SE517	Reliability Analysis of Structures				
5	MCC-590	Research Methodology and IPR	2	0	0	**2**
6	MAC-591	English for Research Paper Writing	2	0	0	**0**
7	PRJ-SE518	Mini Project & Seminar	0	0	4	**2**
						20

Semester- III

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	DIS-SE601	Dissertation –I	0	0	28	**14**

Semester- IV

Sr. No.	Course Type/Code	Course Name	Teaching Scheme			Credits
			L	T	P	
1	DIS-SE602	Dissertation –II	0	0	28	**14**
					Total	**70**

List of Open Elective Courses	List of Audit Courses
OEC-801 Business Analytics	AUD-901 Project Management
OEC-802 Industrial Safety	AUD-902 Disaster Management
OEC-803 Operations Research	AUD-903 Sanskrit for Technical Knowledge
OEC-804 Cost Management of Engineering Project	AUD-904 Value Education
OEC-805Composite Materials	AUD-905 Constitution of India
OEC-806 Waste to Energy	AUD-906 Pedagogy Studies
	AUD-907 Stress Management By Yoga
	AUD-908Personality Development through Life Enlightenment Skills

EXAMINATIONS

Examination system: Students are informed to see the examination scheme given in the rules and regulation book published by the institute.

SEMESTER - I
PCC-SE501 Finite Element Analysis of Structures
(3 –0 – 2) 4 Credits

Course Outcomes:

1. To recall the fundamentals of engineering mathematics and theory of structures.
2. To understand the energy principles, finite element concept, stress analysis, meshing, nonlinear problems and its applications.
3. To apply basic concept of finite element method to solve solid mechanics problems.
4. Analyze and provide approximate solution to any finite element problems.
5. Evaluate the performance of one dimensional and two-dimensional problems.

Course Syllabus:

UNIT – I
Principles and discretization, Elements stiffness formulation based on direct and, variational techniques, Rayleigh Ritz Method for Bar and Beam analysis.

UNIT – II
Shape functions, Finite Element Formulation using Cartesian Coordinates, Application to 1D problems, Convergence criteria.

UNIT – III
Triangular and Rectangular element formulation using Cartesian Coordinates, Application to 2D stress analysis.

UNIT – IV
Natural coordinates, Isoparametric elements, Application to 1D Problems, Isoparametric elements for two-dimensional stress analysis.

UNIT – V
Shape Functions for three Dimensional Stress analysis, Axi-symmetric Stress Analysis.

UNIT – VI
Modelling techniques and solution technique, Numerical integration.

Book Recommended:

1. Finite Element Method: Its Basic and Fundamentals by O.C. Zeinkiewicz, 6th Edition, Butterworth Heinemann, 2007.
2. Concepts and Applications of Finite Element Analysis by R D Cook, Willey Publication, 1995.
3. The Finite Element Method in Engineering by SS Rao, Elsevier Publication, 2009.
4. Finite Element Method by Chandrupatla Belegundu, McGraw-Hill,1997.
5. Textbook of Finite Element Analysis by P Seshu, 1st Edition, PHI, 2009.
6. Finite Element Analysis –Theory and Programming by C.S. Krishna Murthy, 2nd Edition, TMH, 2005.
7. Finite Element Analysis in Engineering Design by Rajasekaran S, S. Chand &Co. Ltd. New Delhi, 1999.

PCC-SE502 Behavior of Concrete Structures
(3-0-0) 3 Credits

Course Outcomes:

1. To remember the basics of concrete technology, Design of RCC structures.
2. To Understand the background of structural components and behavior of beams in Flexure and of columns in bi-axial bending.
3. To apply fundamentals of RCC design to check behavior of various concrete structures.
4. Analyze various structural components with respect to serviceability, deflection etc.
5. Evaluate RC members as per Indian Standards Codes of Practice and specifications.

Course Syllabus:

UNIT I:
Introduction to LSM, Analysis, Design and detailing of flexural members.

UNIT II:
Analysis and design of compression members, Interaction diagrams, Biaxial bending, Design for bi-axial bending.

UNIT III:
Yield Line Theory: Introduction, Assumptions, Location of yield lines, Methods of Analysis, Analysis of one-way and two-way slabs.

UNIT IV:
Serviceability design of RC Structures, Serviceability, Deflection, Significance of Span to depth ratio- Short term-Long term deflection due to Shrinkage, Creep- Cracking-Crack width calculation.

UNIT V:
Analysis, Design and detailing of Silos.

UNIT VI:
Analysis, Design and detailing of retaining wall.

Book recommended:

1. Reinforced Cement Concrete Structures by R. Park and T. Paulay, MISL- WILEY Series, Wiley India Pvt. Ltd 2009.
2. Reinforced concrete designer's handbook by Reynolds, C. E., Steedman, J. C., &Threlfall, A. J. (2007) CRC Press.
3. Limit State Theory & Design of Reinforced Concrete (I.S. 456 - 2000) by Dr. S. R. Karve and Dr. V. L. Shah, Structures publication 8th edition.
4. Advanced Reinforced Concrete Design (IS 456-2000) by N Krishna Raju, CBS publishers and distributors pvt ltd.

PCC-SE503 Structural Dynamics PCC
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To recall fundamentals of Mathematics and Engineering Mechanics.
2. To Understand the effects of system/model parameters on dynamic response.
3. To apply and formulate dynamic equilibrium equations for SDOF and MDOF systems.
4. To analyze SDOF and MDOF systems using classical and numerical methods.
5. To evaluate and obtain the response of SDOF, MDOF systems and conduct modal analysis of MDOF Systems.

Course Syllabus:

UNIT I:
Introduction to structural Dynamics, Static and Dynamic load types, Basic definitions, Degree of freedom, SHM, Vibrations of SDOF system- undamped free vibrations, Derivation and solution of equation of motion, Natural frequency and time period.

UNIT II:
Vibrations of SDOF system- Damped free vibrations, Types of damping, Measurement of damping- Logarithmic decrement method. Damped force vibrations, Response of SDOF system to harmonic excitation, Damped and undamped harmonic excitations.

UNIT III:
Response to periodic Loading- Fourier series, Response to impulsive loading- Duhamel integral- Rectangular and triangular impulse. Two Degree of freedom system- free vibrations of undamped system, damped free vibrations.

UNIT IV:
Multi-degree of Freedom Systems- Free vibration Analysis- undamped systems, Natural frequency and mode shapes - Vanello Stodola and Matrix iteration methods, Orthogonality and Normality principles, damped system, Forced Vibrations.

UNIT V:
Time stepping method - Methods based on interpolation of excitation – central difference method- Newark's method - Rayleigh Ritz Methods - Vibrations of building frames - Modal Analysis. Numerical evaluation of dynamic response.

UNIT VI:
Response Spectrum- Introduction, Design Spectra, concepts of PGA, Development of Tripartite plot, Response spectrum analysis and Time history analysis.

Books recommended:

1. Structural Dynamics - Theory & Computations by Mario Paz, 2nd Edition, CBS Pub, 2010.
2. Vibration Problems in Engineering by Timoshenko, Van Nostrand Co.Inc,1955.
3. Dynamics of Structures by Clough and Penzien, 5th Edition, McGraw Hill Book Co., 1975.
4. Dynamics of Structures by A.K. Chopra 3rd Edition, Pearson, 2007.

Elective - I
PEC-SE504 Numerical Methods (Elective-I)
(3–1–0) 4 Credits

Course Outcomes:

1. To recall the fundamentals of various numerical methods.
2. To understand common numerical methods and its use to obtain approximate solutions to otherwise intractable mathematical problems.
3. To apply the different numerical methods to solve the algebraic equations and to solve system.
4. To analyze the different numerical methods for regression, solving set of ordinary differential equations and solving of partial differential equation.
5. To evaluate the performance of different numerical methods with MATLAB/ EXCEL/ C-programming.

Course Syllabus:

UNIT – I

Modeling, Computers and error analysis: Mathematical modeling and engineering problem solving. Role of computers and software. Approximations and errors. Significant figures, accuracy and precision, Errors, round-off and truncation errors, error propagation, Numerical differentiation and integration.

UNIT – II

Curve fitting- Principle of least square, Linear, Laws reducible to the linear, fitting of the other curves.

UNIT – III

System of linear, Cramer's rule, Matrix inversion method, Gauss elimination method, Gauss-Jordan method, Factorization methods. Iterative methods, nonlinear algebraic equation.

UNIT – IV

Ordinary differential equations- IVP methods like Picard's method, Taylor's series method, Euler's and modified Euler's method, R-K methods, predictor corrector method, Simultaneous first ODE, second order ODE, BVP methods.

UNIT – V

Partial differential equations- Different schemes, implicit and explicit schemes, Accuracy convergence and stability, Method of characteristics.

UNIT – VI

Application of above studied numerical techniques to real world problems of structural engineering.

Book Recommended:

1. Mathematical Numerical Analysis by S.C. Scarborough, Oxford and IBH Publishing Company.
2. Introductory methods in Numerical Analysis by S.S. Sastry, Prentice Hall of India.
3. Theory and problems in Numerical Methods by T. Veeranjan and T.Ramachandran, TMH Pub. Co. New Delhi 2004.
4. Numerical Methods for Mathematics Sciences and Engineering by John H. Mathews, Prentice Hall of India, New Delhi 2003.

PEC-SE505 Pre-Stressed Concrete (Elective-I)
(3–1–0) 4 Credits

Course Outcomes:

1. To remember basics of concrete technology and structural engineering and IS codes related to prestressed concrete.
2. To develop an understanding the philosophy of pre-stressing design.
3. To apply basic concepts of prestressed concrete in construction industry.
4. To analyze, formulate and solve engineering problems pertaining to prestressed concrete.
5. To design special prestressed structures.

Course Syllabus:

UNIT – I

Introduction to prestressed concrete, types of prestressing, systems and devices, materials, losses in prestress. Analysis of PSC flexural members: basic concepts, stresses at transfer and service loads.

UNIT – II

IS1343 – 2012 codal provisions, Limit state of collapse and serviceability for analysis and design of rectangular, I and box sections for flexure and shear, control of deflection, Transmission of pre-stress in pre-tensioned members; Anchorage zone stresses for post-tensioned members.

UNIT – III

Statically indeterminate structures - analysis and design of continuous beams and frames Choice of cable profile - linear transformation - concordancy.

UNIT – IV

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

UNIT – V

Analysis and design of prestressed concrete slabs – one way and two way Analysis and design of prestressed concrete pipes, tanks.

UNIT – VI

Introduction to prestressed concrete flat slabs, grids, folded plates and shells, railway sleepers (No numerical problems).

Book Recommended:

1. Design of Pre-stressed Concrete Structures by Lin, T.Y. and Burns, N.H.
2. Reinforced and Prestressed Concrete Structures by F.K. Kong and R.H. Evans 3rd Edition, Spon Press, 1990.
3. Prestressed Concrete by N. Krishnaraju, 3rd edition, Tata McGraw Hill Publishing Co., 2004.
4. Prestressed concrete by S.K. Mallick and A.P.Gupta, Oxford and IBH Publishing Co., New Delhi.
5. Prestressed Concrete Design by Praveen Nagarajan, PEARSON Publishing Co., Delhi, 2013.

PEC-SE506 Bridge Analysis and Design (Elective-I)
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To recall the fundamentals of water recourses engineering.
2. To understand the components of bridges, its classifications and importance.
3. To apply various theories of lateral load distribution for component design of bridge.
4. To analyze any given type of bridge.
5. To get exposure to evaluation of sub structures, type of foundations, importance of bearings, lessons from bridge failures.

Course Syllabus:

UNIT I:
Introduction and selection of type of Bridges, Loads and forces.

UNIT II:
Theories of Lateral Load distribution, and design of Super-Structure.

UNIT III:
Design of Composite Bridges (Steel and Concrete), Box culvert bridges.

UNIT IV:
Design of Abutments, piers and their foundations.

UNIT V:
Design of Bearings Construction methods and maintenance of Bridges.

UNIT – VI
Analysis and design of plate girder bridge.

Book Recommended:

1. Concrete Bridge Design By Rowe R.E, C.R. books; John Wiley & Sons; Stated First Edition edition 1962.
2. Design of Bridges By Victor Johnson Oxford, 6th edition 2017.
3. Design of Bridge Structures by Jagadeesh T.R. Prentice Hall India Learning Private Limited; 2 edition 2009.
4. Design of Bridge by Krishna Raju , Oxford & Ibh 5th edition 2005.
5. Concrete Bridge Practice: Analysis, Design and Economics by Raina V.K., Shroff Publishers; Fourth edition 2014.

(Elective-II)
PEC-SE507 Computer Aided Analysis & Design of Structures (Elective-II)
(3-0-2) 4 Credits

Course Outcomes:

1. To define different types of structures with respect to degree of freedom.
2. To understand the concept of computer aided analysis using stiffness method.
3. To apply the matrix stiffness method to model the behavior of planar trusses, beams, and frames.
4. To analyze any multistoried building using matrix methods of structural analysis.
5. To implement the method developing their own computer program to analyze structures.

Course Syllabus:

UNIT- I

Introduction to stiffness and flexibility approach, Stiffness matrix for spring, Bar, torsion, Beam (including 3D), Frame and Grid elements, Displacement vectors, Local and Global co-ordinate system, Transformation matrices, Global stiffness matrix and load vectors, Assembly of structure stiffness matrix with structural load vector, application to spring and bar problems.

UNIT- II

Stiffness method for plane truss, beams and plane frames.

UNIT- III

Stiffness method for plane grid and space frames.

UNIT- IV

Analysis for member loading (self, temperature & Imposed), inclined supports, lack of fit, initial joints displacements.

UNIT- V

Effect of shear deformation. Internal member end releases.

UNIT- VI

Solution technique with banded & skyline technique, band minimization, frontal techniques.

Book Recommended:

1. Matrix Method of Structural Analysis by Gere. W. and Weaver J. M., 3rd Edition, Van Nostrand Reinhold New York 1990.
2. Matrix Method of Structural Analysis by Meghre A.S. & Deshmukh S.K., 1 st edition Charotar publishing house, Anand, 2003.
3. Matrix Method of Structural Analysis by Kanchi, M. B., 2nd Edition John Willey & Sons, 1999.
4. Matrix Methods of Structural Analysis by Godbole P., Sonparote R., Dhote S., PHI Learning Pvt. Ltd. 2014.

PEC-SE508 Theory of Elasticity & Plasticity (Elective-II)
(3-0-2) 4 Credits

Course Outcomes:

1. To recall the basics of Mathematics, Strength of Materials and Mechanics of Solids.
2. To Understand the theoretical concepts of material behavior with particular emphasis on their elastic and plastic properties.
3. To Analyze the behavior of elastic solids under different loading conditions.
4. To apply mathematical model to assess the behavior of two dimensional elastic solids.
5. To evaluate the performance of elastic and plastic bodies subjected to different types of loads.

Course Syllabus:

UNIT- I

Introduction to Theory of Elasticity, Introduction to Two Dimensional Stress Analysis, Types of forces, Components of stresses and strains, Stress-strain relation, Plane stress and plane strain, Strain & stress at a point.

UNIT- II

Differential equation of equilibrium, Boundary conditions and compatibility equations (rectangular coordinates), Derivation of Airy's Stress function using the boundary conditions, equilibrium equations, compatibility conditions.

UNIT- III

Hooke's Law and problems on interrelationship between stress and Strain in three dimensions Introduction to Three Dimensional Stress Analysis, Components of stress, Principal stresses, Stress invariants, Maximum shearing stress, Differential equation of equilibrium, Boundary conditions and compatibility equations.

UNIT- IV

Bending of cantilever of narrow rectangular section loaded at end, bending of simply supported beam with uniform load, torsion of non-circular and elliptical cross section.

UNIT- V

Theory of elastic failures, Maximum Principal stress theory (due to Rankine), Maximum shear stress theory (Guest-Tresca), Maximum Principal strain theory (Saint-Venant), Total strain energy per unit volume theory (Haigh).

UNIT- VI

Introduction to plasticity: Criterion of yielding strain hardening rules of plastic flow different stress strain relation, total strain theory, theorem of limit analysis, elasto-plastic bending and torsion of bars.

Book Recommended:

1. Theory of Elasticity by Timoshenko and Goodier McGraw Hill, 2010.
2. Theory of Elastic Stability 2nd Edition by Timoshenko, S.P. and Gere J. M Mc-Graw Hill Book Company, New Delhi,1963.
3. Mechanics of deformable solids by Shames. I. H. 1964.
4. Advanced mechanics of solids by Srinath. L. S. Tata McGraw-Hill 2003.
5. Theory of plasticity by Chakrabarty. J. Butterworth-Heinemann (2012).

PEC-SE509 Design Tall Building (Elective-II)
(3 –0 – 2) 4 Credits

Course Outcomes:

1. To remember the basics of Structural Engineering.
2. To understand IS codes related to earthquake and wind load.
3. To apply mathematical modeling techniques to design high rise structures.
4. To analyze the high-rise structures by considering various loads.
5. To evaluate and perform the design of RCC structures with ductile detailing.

Course Syllabus:

UNIT- I
Performance of buildings, behaviors of various type of buildings in past earthquakes. modes of failures, influence of unsymmetry, infill walls, foundations, soft story & detailing of reinforcements in buildings.

UNIT- II
Frames shear walled buildings, mathematical modeling of building with different structural systems Analysis of frames shear walled buildings, Analysis of coupled shear walled building.

UNIT- III
Special aspects in Multi-story buildings, Effect of torsion, flexible first story, P-delta effect, soil-structure interaction on building response, drift limitation.

UNIT- IV
Strength, ductility and energy absorption, ductility of reinforced members subjected to flexure, axial loads & shear. Detailing of RCC members, beam, column, Beam-column joints for ductile behaviors, IS code provisions.

UNIT- V
Sequential loading, creep and shrinkage effects on tall buildings.

UNIT- VI
Design of multi-story buildings with bracings & infills.

Book Recommended:

1. Seismic design of R C & Masonry Buildings by Paulay, T. & Prestiley, M.J.N., John Willey & Sons 2nd Edition, 1999.
2. Handbook on Seismic Analysis and Design of Structures by Farzad Naeim, Kluwer Academic Publisher, 2001.
3. Concrete Structures in Earthquake Regions by Booth, E., Longman Higher Education, 1994.
4. Advance Reinforced Concrete Design by Verghese P.C., Prentice hall of India, New Delhi, 2001.

SEMESTER - II
PCC-SE510 Structural Stability
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To remember the basics of Strength of Materials, Theory of Structures.
2. To understand the behavior of various structural elements subjected to lateral buckling.
3. To analyze various structural elements using different mathematical and engineering problems.
4. To apply the fundamentals of energy and mathematical methods to solve various structural elemental problems.
5. To evaluate the performance of structural elements using energy and mathematical methods.

Course Syllabus:

UNIT I:
Buckling of Columns, Introduction, Methods of finding critical loads, critical loads for straight columns with different end conditions and loading, Inelastic buckling of axially loaded columns.

UNIT II:
Energy methods, Prismatic and non-prismatic columns under discrete and distributed loadings , General Principles of elastic stability of framed structures, Mathematical Treatment of Stability Problems, Critical loads for discrete systems, Discrete Eigen value problem.

UNIT III:
Buckling of continuous systems, Continuous Eigen value problem, Orthogonality relation, Methods of converting continuous, Eigen value problem to a discrete problem, Buckling of Thin Walled Members of Open Cross Section, Torsion of thin-walled bars, Warping, Non-uniform torsion, Torsional buckling under axial loading, Combined bending and torsion buckling.

UNIT IV:
Lateral Buckling of Beams, Beams under pure bending, Cantilever and simply supported beams of rectangular and I sections, I Beams under transverse loading, Energy methods, Solution of simple problems.

UNIT V:
Buckling of Rectangular Plates, Plates simply supported on all edges and subjected to constant compression in one or two directions, Plates simply supported compression in one or two directions, Plates simply supported along two opposite sides perpendicular to the direction of compression and having various edge conditions along the other two sides.

UNIT VI:
Buckling of shells, Introduction to buckling of axially compressed cylindrical shells.

Book Recommended:

1. Theory of Elastic Stability by Timoshenko and Gere, 2nd Edition, TMH,2010.
2. Engineering Analysis - A Survey of Numerical Procedures by Stephen H. Crandall Krieger Publishing Co., 1986.
3. Buckling of Metal Structures by by Bleich, McGraw Hill Book Co., New York, 1952.
4. Principles of Structural Stability Theory by by Alexander Chajes, Prentice Hall Inc.,1974.

PCC-SE511 Theory of Plates and Shells
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To remember the fundamentals of theory of elasticity, theory of structures.
2. To Understand behavior of plates and shells for UDL, hydrostatic, concentrated load cases.
3. To analyze cylindrical bending of long rectangular plates, pure bending of rectangular and circular plates, and small deflection theories for various boundary conditions.
4. To apply concepts of bending theory.
5. To evaluates the shells and its geometry and to explain the concept of membrane theory for shells

Course Syllabus:

UNIT – I

Development of governing differential equations by Kirchoff's theory with reference to thin rectangular plates with various boundary conditions. Symmetrical bending of laterally loaded circular plates with different boundary conditions.

UNIT- II

Study of Simply supported plates under different loadings. Navier's solution. Introduction to Levis solution. Finite difference method.

UNIT – III

Introduction to shear deformation theories for plates.

UNIT – IV

Classification of Shells. Membrane theory of cylindrical shells with different directrix such as circular, cycloidal, catenary, and parabolic.

UNIT – V

Bending theory of cylindrical shells, Finster walder, Schorer's, and D-K-J theory.

UNIT – VI

Approximate analysis of cylindrical shells by beam arch method.

Book Recommended:

1. Theory of Plates and Shells by Timoshenko S.P and Krieger S.W, 2nd Edition, McGraw-Hill Book Company, New Delhi, 1970.
2. Theory of Plates by Chadrashekhara K, Theory of Plates, 1st Edition, Universities Press (India) Ltd, Hyderabad, 2001.
3. Design of Concrete Shells by Ramaswamy, G.S, , Krieger Publ. Co., 1984.
4. Thin Shells (Theory and Problems) by Ramachandran S., 1 st Edition, Universities Press (India) Ltd, Hyderabad.
5. Theory and Analysis of Plates by Szilard R., , Prentice Hall Publication, 1974.
6. Mathematical elasticity Vol.II: Theory of plates by Philipee G Ciarlet, , 1st Edition, Elsevier Science B V, 1997.

Elective-III
PEC-SE512 Neo Construction Materials (Elective-III)
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To remember the fundamentals of concrete technology.
2. To understand structural, physical and long-term performance of building materials.
3. To analyze mechanical and non-mechanical behavior of materials as FRC, Ferro cement, SCC, RAC, LWAC.
4. To apply advanced materials used in construction as SCC, Light weight aggregate, Concrete, recycled aggregate concrete, fiber based concretes.
5. To identify crucial problem areas in manufacture and applications of building materials.

Course Syllabus:

UNIT I:
Introduction, Historical back ground of Light weight aggregate concrete, Artificial aggregates, Physical properties of aggregates.

UNIT II:
Light weight aggregate concrete, Applications of light weight aggregate concrete, Properties of green light weight aggregate concrete.

UNIT III:
Effect of size aggregate on the strength properties of LWAC made with palm oil shells, Recycled aggregate, High performance concrete, applications, Pre placed aggregate concrete, Fiber reinforced concrete, Behavior of steel fibers in concrete, Glass fiber.

UNIT IV:
Reinforced concrete, GFRC in construction, Natural fiber reinforced concrete, High strength concrete, Effect of RHA on the properties of HSC, Self-Compacting Concrete, Concrete made with waste rubber, Changes in concrete with respect to time, Corrosion in concrete and its protection.

UNIT V:
Corrosion of rebars in concrete, Influence of fly ash on the corrosion steel bar in concrete, Industrial waste materials in concrete, Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics, Adhesives in construction industry, Acrylics.

UNIT VI:
Bridge bearings, Rapid wall panels, Nano Concrete, Moisture Barriers.

Book Recommended:

1. Properties of Concrete Concrete Microstructure by by A.M. Neville, 5th Edition, PHI, 2012.
2. Properties and Materials by Kumar Mehta. P and Paulo J M Monteiro McGraw Hill, 2006.
3. Concrete Technology: Theory and Practice by M.L. Gambhir McGraw Hill Education; Fifth edition 2017.
4. Concrete Technology by MS Shetty S Chand 2006.

PEC-SE513 Fracture Mechanics of Concrete Structures (Elective-III)
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To recall the concepts of Mathematics and Theory of Elasticity.
2. To Understand the concepts of LEFM and compute J-Integral for various sections.
3. To analyze stress intensity factor and implement to notched members.
4. To apply fracture mechanics models to high strength concrete and FRC structures.
5. To evaluate and classify cracking in concrete structures based on fracture mechanics principles.

Course Syllabus:

UNIT I:
Introduction, Basic Fracture Mechanics, Crack in a structure , Mechanisms of fracture and crack growth, Cleavage fracture, ductile fracture, Fatigue cracking.
UNIT II:
Environment assisted cracking, Service failure analysis.

UNIT III:
Stress at crack tip, Stress at crack tip, linear elastic fracture mechanics, Griffith's criteria.
UNIT IV:
Stress intensity factors, Crack tip plastic zone, Erwin's plastic zone correction, R curves, compliance, J Integral, Concept of CTOD and CMD.

UNIT V:
Material models, General concepts, crack models, band models, Models based on continuum damage mechanics.

UNIT VI:
Applications to high strength concrete, fibre reinforced concrete, crack concepts and numerical modelling.

Book Recommended:

1. Fracture Mechanics by C.T Suri and Jin Z.H., 1st Edition, Elsevier academic Press, 2012.
2. Elementary Engineering Fracture by David Broek, 3rd Revised Edition, Mechanics Springer, June 1982.
3. Fracture Mechanics of Concrete Structures Theory and Applications by L. Elfgreen, Rilem Report Chapman and Hall, 1989.
4. Fracture Mechanics Applications to Concrete by Victor, C. Li, and Z.P. Bazant ACI SP 118, ACI Detroit, 1989.

PEC-SE514 Seismic Analysis & Design of Structures (Elective-III)
(3 –1 – 0) 4 Credits

Course Outcomes:

1. To remember the concepts of Structural Dynamics.
2. To understand the behavior of structures subjected to earthquake.
3. To analyze Earthquake Resistant buildings and Water Tanks as per IS Code Specifications.
4. To apply various earthquake analysis methods to evaluate performance of building and water tanks.
5. To evaluate earthquake resistant RC buildings as per IS Code.

Course Syllabus:

UNIT 1:
Concepts of seismic design, Seismic design and seismic performanc, Seismic design limit states, serviceability, damage, survival limit states, Structural properties, strength stiffness and ductility, Definition of design quantities, philosophy of capacity design.

UNIT 2:
Essentials of structural systems for seismic resistance, Structural systems, frames, walls, dual systems, Response in elevation, plan, Influence of building configuration, structural classification.

UNIT 3:
Causes and effects of earthquakes, Seismic waves, earthquake magnitude and intensity Characteristics of earthquakes, Accelerograms, attenuation, earthquake analysis of linear systems, Response history analysis, Modal analysis, modal response, Response spectrum analysis.

UNIT 4:
Reinforced concrete ductile frames, Structural modeling, assumptions, Regularity in framing systems, moment redistribution, Principles of design of beams, columns, beam column joints, Ductility demand, soft story concept.

UNIT 5:
Base isolation, Isolation systems, effectiveness of base isolation, Blast resistant design, Introduction, Effect of blast, above ground and below ground structures.

UNIT 6:
Earthquake resistant design of common structures, Multistoried building frames, water tanks, chimneys, IS code method.

Book Recommended:

1. Seismic Design of RC and Masonry Buildings by T. Paulay and MJN Priestley John Wiley Inter Science, 1992.
2. Design of Multi-storey RC buildings for Earthquake Motions by J.A. Blume, Newmark and Corning, Portland Cement Association, 1961.
3. Design of Earthquake Resistant Buildings by Minoru Wakabayashi, McGraw Hill, 1985
4. Earthquake Resistant Design and Risk Reduction by D.J. Dowrick, 2nd Edition, Wiley India, 2011.
5. Dynamics of Structures by A.K. Chopra Prentice Hall, 3rd edition, 2007.
6. Criteria for Earthquake Resistance IS: 1893 (Part - I) – 2002
7. Design of Structures Bureau of Indian Standards, New Delhi, 2002.

PEC-SE515 Structural Masonry (Elective-IV)
(3 –0– 2) 4 Credits

Course Outcomes:

1. To recall the fundamentals of Mechanics of Solids and Theory of Elasticity.
2. To understand the behavior of masonry structures under gravity and lateral loads.
3. To apply strengthening techniques for repair and rehabilitation of masonry structures.
4. To analyze masonry structures for gravity, wind and seismic loads.
5. To evaluate masonry infill as shear walls for lateral action.

Course Syllabus:

UNIT I:
Introduction, Masonry construction, National and International perspective, Historical development, Modern masonry, Principles of masonry design, Masonry standards: IS 1905 and others.

UNIT II:
Material Properties, Masonry units: clay and concrete blocks, Mortar, grout and reinforcement, Bonding patterns, Shrinkage and differential movements, Masonry in Compression, Prism strength, Eccentric loading, Kern distance.

UNIT III:
Masonry under Lateral loads, In-plane and out-of-plane loads, Analysis of perforated shear walls, Lateral force distribution, flexible and rigid diaphragms.

UNIT IV:
Behavior of Masonry, Shear and flexure, Combined bending and axial loads, Reinforced and unreinforced masonry, Cyclic loading and ductility of shear walls for seismic design, Infill masonry.

UNIT V:
Structural design of Masonry, Working and Ultimate strength design, In-plane and out-of-plane design criteria for load-bearing and infills, connecting elements and ties, Consideration of seismic loads, Code provisions.

UNIT VI:
Seismic evaluation and Retrofit of Masonry, In-situ and non-destructive tests for masonry, properties, Repair and strengthening of existing masonry, structures for seismic loads.

Book Recommended:

1. Brick and Reinforced Brick Structures by Dayaratnam, P., Oxford & IBH Publishing Co,1987.
2. Masonry Structures: Behaviour & Design by Drysdale, R. G. Hamid, A. H. and Baker, L.R., Prentice Hall Hendry, 1994.
3. Design of Masonry Structures by A.W. Hendry, B.P. Sinha and Davis, S.R., E & FN Spon, UK, 1997.
4. Structural Masonry by Sahlin, S., Prentice Hall, Englewood Cliffs, NJ, 1971.
5. Reinforced Masonry Design by R.S. Schneider and W.L. Dickey Prentice Hall, 3rd edition, 1994.
6. Seismic Design of Reinforced Concrete and Masonry Buildings by Paulay, T. and Priestley, M.J.N. John Wiley, 1992.

PEC-SE516 Rehabilitation of Structures (Elective-IV)
(3 –0 – 2) 4 Credits

Course Outcomes:

1. To recall the fundamentals of Concrete Technology.
2. To understand NDT for condition assessment of structures, identify damages in RC Structures.
3. To analyze the causes for distress and deterioration of structures.
4. To apply the repair material and retrofitting strategy suitable for distress
5. To evaluate the guidelines for repair management of deteriorated structures.

Course Syllabus:

UNIT I:

Introduction - An overview of present repair practices, distress identification and repair management, Causes of distress in concrete structures, Holistic Models for deterioration of concrete, Permeability of concrete, aggressive chemical agents, durability aspects.

UNIT II:

Survey, Definition, objectives, different stages, Preliminary inspection, planning stage, visual inspection, field laboratory testing stage, consideration for repair strategy, Non-Destructive evaluation tests, Concrete strength assessment, Rebound hammer test, Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing,

UNIT III:

Chemical tests, Carbonation tests and chloride content, Corrosion potential assessment, cover meter survey, half-cell potentiometer test, resistivity measurement, Discussion of case studies of RCC buildings subjected to distress, Identification and estimation of damage.

UNIT IV:

Fire damage assessment, structural integrity and soundness assessment, interpretation and evaluation of results, Evaluation of reserve strength of existing structures, analysis necessary to identify critical sections, active and passive repairs, modeling of repaired composite structures, Selection of repair materials for concrete, Essential parameters for repair materials, Strength and durability aspects, cost and suitability aspects, Materials for repair, Premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy and epoxy systems including epoxy mortars and concrete, polyester resins, coatings.

UNIT V:Rehabilitation and retrofitting methods-repair options, performance requirements of repair systems, important factors to be considered for selection of repair methods, Discussion of case studies-RCC buildings, water tanks, industrial structures, Identifying a suitable repair option for certain damage in a structure, Repair stages, Repair methods, guniting, shortcreting, polymer concrete system, reinforcement replacement, strengthening concrete by surface impregnation, polymer and epoxy overlays , Repair methods.

UNIT VI:

Resin/polymer modified slurry injection, plate bonding technique, ferrocement jacketing, RCC jacketing, propping and supporting, Repair methods, fiber wrap technique, foundation rehabilitation methods, chemical and electrochemical method of repair, Repair/Rehabilitation strategies, Stress reduction technique, repair and strengthening of columns and beams, Rehabilitation strategies-Compressive strength of concrete, cracks/joints, masonry, foundation, base isolation, Guidelines for framing terms and conditions for repair and rehabilitation works contracts, engagement of consultants, contractors, execution of work, post repair inspection.

Book Recommended:

1. Learning from failures - Deficiencies in Design Construction and Service by R.N. Raikar, Rand Centre (SDCPL), Raikar Bhavan, Bombay, 1987.
2. Concrete Technology by Santhakumar A.R., Oxford University Press, New Delhi, 2007.
3. Repair and Rehabilitation of RCC buildings CPWD Handbook on Govt of India Press, New Delhi, 2002.

PEC-SE517 Reliability Analysis of Structure (Elective-IV)
(3 –0– 2) 4 Credits

Course Outcomes:

1. To recall the fundamentals of Mechanics of Solids and Theory of Elasticity.
2. To understand Probabilistic analysis for various loads as wind loads and gravity loads.
3. To analyze reliability indices for simple structural engineering problems as beams, Truss.
4. To apply reliability based design to structural problems as trusses and frames.
5. To evaluate the Safety of structures as per NBC, CEB and LRFD format.
6.

Course Syllabus:

UNIT I:
Introduction, Structural safety, variations, Probability distributions, Random variables, Allowable stresses for specified reliability, Probabilistic analysis of loads.

UNIT II:
Gravity loads, Wind loads, Wind speeds, return periods Structural Reliability, Reliability of structural components, beams, axially loaded columns.

UNIT III:
Reliability Methods, Classification (Level 1- level 2-level 3) - First order second moment method, Reliability index, Computation of reliability index, simple problem.

UNIT IV:
Reliability based design, Determination of partial safety factors, Safety checking formats, NBC format, CEB format, LRFD format, Optimal safety factors.

UNIT V:
Reliability of Structural systems, System reliability, Series system, Parallel redundant system-mixed system.

UNIT VI:
Modeling of truss system, Modeling of frames.

Book Recommended:

1. Methods of Structural Safety by H.O. Madsen, S. Krenk, and N.C. Lind Dover Publications, 2006.
2. Structural Reliability Analysis and Design by R. Ranganathan, 1st Edition, Jaico Publishing House, 1999
3. Structural Reliability Analysis and Prediction by Melchers, 2nd Edition, John Wiley & Sons, 1999.
4. Structural Reliability Theory and its Applications by Thoft C.P, and Baker M.J., Springer Verlag, 1982.

MCC-590 Research Methodology and IPR
(2-0-0)2 Credits

Course Objectives:

1. To explain formulation and analysis of research problem.
2. To describe research ethics and technical writing.
3. To understand IPR and patent rights.
4. To demonstrate new developments in IPR with the help of case studies.
5.

Course Syllabus:

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, 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.

Unit V:
Patent rights: Scope of patent rights. licensing and transfer of technology. patent information and databases. geographical indications.

Unit VI:
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.

Course Outcomes:

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

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

References:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science and engineering students”.
2. Wayne Goddard and Stuart Melville, “Research Methodology: An Introduction”.
3. Ranjit Kumar, 2 nd Edition , “Research Methodology: A Step by Step Guide for beginners”.
4. Halbert, “Resisting Intellectual Property”, Taylor and 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.

MAC-591 English for Research Paper Writing
(2-0-0)0 Credits

Course objectives:

1. To understand that how to improve your writing skills and level of readability.
2. To learn about what to write in each section.
3. To understand the skills needed when writing a title.
4. To ensure the good quality of paper at very first-time submission.
5.

Course Syllabus:

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 criticizing, paraphrasing and plagiarism, sections of a paper, abstracts. 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, skills are needed when writing the conclusions.

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

Course Outcomes:

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

1. Understand how to plan and prepare concise writings by using appropriate words and structured paragraphs.
2. Explain how to write different sections such as abstracts, introduction, survey, methodology, results, conclusions, etc. in paper and reports.
3. Describe key skills needed for writing title of a paper or report.
4.

References:

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

PRJ-SE518 Mini Project and Seminar
(0-0-4)2 Credits

The mini-project should be done on any topic in Civil Engineering to be decided by the students and the supervisor concerned. Mini project work shall be in the form of demo, report and/ presentation to be submitted by the student at the end of the semester. The candidate will deliver the talk on the project for half an hour and assessment will be made by two internal examiners, one of them will be supervisor.

SEMESTER - III
DIS-SE601 Dissertation -I
(0-0-28)14 Credits

Dissertation shall consist of: Research work done by the candidate in the areas related to the chosen specialization, or Comprehensive and critical review of any recent development in the chosen specialization, or Design and/or development of a product related to the programme done by the candidate.

Following shall be the guidelines for evaluation of dissertation part I:

1. Dissertation Part I shall consist of the following components (whichever applicable) Extensive literature survey, Data collection from R&D organizations, Industries, etc.
2. Study of the viability, applicability and scope of the dissertation.
3. Detailed Design (H/W and S/W as applicable), Partial implementation.
4. A candidate should prepare the following documents for examination.
5. A term paper in the format of any standard journal based on the work.
6. A detailed report of the work done by the candidate related to dissertation.

Every candidate should present himself (for about 30 min.) before the panel of examiners (which will evaluate the dissertation I for TW and Oral marks) consisting of Head of Department, M. Tech. Coordinator or his nominee, all supervisors.

SEMESTER - IV
DIS-SE601 Dissertation -II
(0-0-28)14 Credits

The dissertation shall be assessed internally by a panel of examiners (similar to the one in dissertation part- I) before submission. The candidate shall submit the dissertation in triplicate to the Head of the institution, duly certified that the work has been satisfactorily completed. The Practical examination (viva-voce) shall consist of a defense presented by the candidate or his/her work in the presence of examiners appointed by the University/ Institute one of whom will be the supervisor and the other will be an external examiner.

Open Elective
OEC-801 Business Analytics
(3-0-0)3 Credits

Course objectives:

1. To understand the role of business analytics within an organization.
2. To analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.
3. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.
4. To become familiar with processes needed to develop, report, and analyze business data.
5. To use decision-making tools/Operations research techniques.
6. To mange business process using analytical and management tools.
7. To analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Syllabus:

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 modeling, sampling and estimation methods overview.

Unit II:
Trendiness and regression analysis: Modeling 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 modeling, predictive analytics analysis, data mining, data mining methodologies, prescriptive analytics and its step in the business analytics process, prescriptive modeling, 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.

Unit VI:
Recent trends in : Embedded and collaborative business intelligence, visual data recovery, data storytelling and data journalism.

Course Outcomes:

1. At the end of this course, students will be able to:
2. Demonstrate knowledge of data analytics.
3. Demonstrate the ability of think critically in making decisions based on data and deep analytics.
4. Demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
5. Demonstrate the ability to translate data into clear, actionable insights.

References:

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

OEC-802 Industrial Safety
(3-0-0)3 Credits

Course Syllabus:

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 and 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 treeconcept, 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:

1. Maintenance Engineering Handbook, Higgins and 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 and Hall London.

OEC-803 Operations Research
(3-0-0)3 Credits

Course Syllabus:

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

Course Outcomes:

1. At the end of this course, students will be able to:
2. Apply the dynamic programming to solve problems of discreet and continuous variables.
3. Apply the concept of non-linear programming.
4. Carry out sensitivity analysis.
5. Model the real world problem and simulate it.

References:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008.
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008.
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009.
5. Pannerselvam, Operations Research: Prentice Hall of India 2010.
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010.

OEC-804 Cost Management of Engineering Projects
(3-0-0)3 Credits

Course Syllabus:

Unit I:
Introduction and overview of the strategic cost management process.

Unit II:
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. project: meaning, different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. project execution as conglomeration of technical and nontechnical 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. budgetary control; flexible budgets; performance budgets; zero-based budgets. measurement of divisional profitability pricing decisions including transfer pricing.

Unit IV:
Quantitative techniques for cost management, linear programming, PERT/CPM, transportation problems, assignment problems, simulation, learning curve theory.

References:

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 and Cost Accounting.
4. Ashish K. Bhattacharya, Principles and Practices of Cost Accounting A. H. Wheeler publisher.
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

OEC-805 Composite Materials
(3-0-0)3 Credits

Course Syllabus:

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.

References and 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 and Sons, NY, Indian edition, 2007.
3. Hand Book of Composite Materials-ed-Lubin.
4. Composite Materials – K.K.Chawla.
5. Composite Materials Science and Applications – Deborah D.L. Chung.
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

OEC-806 Waste to Energy
(3-0-0)3 Credits

Course Syllabus:

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.

References:

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 and 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 and Sons, 1996.

Audit Course
AUD-901 Project Management
(2-0-0)0 Credits

Course objective:

1. Understand the fundamental principles of Project management and also have a good knowledge of responsibilities of project manager and how to handle these.
2. To do the Project Scheduling, tracking, Risk analysis, Quality management and Project Cost estimation using different techniques.
3. To highlight different techniques for software cost estimation and activity planning.

Course Syllabus:

Unit-I:
Project Management: Concept of Project Management, Principles of Project Management, Functions of Project Management: Planning, Organizing, Staffing, Directing & Controlling, Project Scope Verification , Functional & Matrix Organization Structure.

Unit-II:
Project Network Analysis: Project Network Diagram: Precedence Diagramming Method (PDM), Activity-on-Node (AON) & Arrow Diagramming Method (ADM), Work Breakdown Structure (WBS), Gantt Chart, Milestone Chart, Project Network Analysis (Critical Path Method and PERT), Cost Analysis of Project, Resource Allocation, Resource Smoothening & Leveling, Resource Histograms, Use of Computer Software (PRIMAVERA & MICROSOFT PROJECT) in Project Network Analysis.

Unit-III:
Project Network Case Studies: Thermal Power Project, Fertilizer Project, Turnkey Construction Project, Software Creation & Installation Project, Project Related to Mechanical Industry, Projects Related to Electronic & Communication Industry.

Unit-IV:
Project Economics & Project Value Analysis: Project Formulation, Project Plan, Project Appraisal Techniques: Net Present Value, Internal Rate of Return, Payback Period, Benefit Cost Ratio, Value Engineering job plan, Project Life Cycle Costs.

Unit-V:
Project Quality , Risk & Procurement Management: Project Quality Planning, Assurance & Control, Project Quality Management Techniques: Kaizen & Just-inTime, Total Quality Management, Risk-Management Plan, Uncertainty, Risk Factors and Risk Tolerances, Project Quantitative Risk Analysis (Monte Carlo Analysis & Decision Tree), Project Risk Monitoring & Control, Procurement Management Plan, Project Contract Administration.

Unit-VI:
Computerized Project Management: Project Information Cell, Management Information System, Software Project Management, Categorization of Software Projects , Project portfolio Management, Software Process and Process Models, Choice of Process Models: Mental Delivery, Rapid Application Development, Agile Methods, Extreme Programming, SCRUM, Software Estimation, Effort and Cost Estimation Techniques, COSMIC Full Function Points, COCOMO II A Parametric Productivity Model, Project Tracking, Software Configuration Management, Staffing Pattern, Methods of staff selection, The Oldham-Hackman job characteristic model.

Course Outcomes:

1. Understand the concepts and functions of project management.
2. Apply the project plan planning and monitoring techniques.
3. Analyze the project value, risk and quality.
4. Design and develop projects at each stage of the software development life cycle (SDLC).

References:

1. Chitkara K.K., Construction Project Management, Tata McGraw Hill Publications.
2. Barrie D.S. & Paulson B.C,Professional Construction Management,McGraw Hill.
3. R.Flagnan and G.Norman, Risk Managemnt & Construction, Blackwell Scientific Publishers.
4. L.W. Zimmwerman and G.D. Hart, Value Engineering, CBS Publishers.
5. Robert K. Wysocki “Effective Software Project Management” – Wiley Publication, 2011.
6. Walker Royce: “Software Project Management”- Addison-Wesley, 1998.

AUD-902 Disaster Management
(2-0-0)0 Credits

Course Contents Objectives:

1. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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 Contents:

UNIT I:

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.

Suggested Readings:

1. R. Nishith, Singh A.K., "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 and Deep Publication Pvt. Ltd., New Delhi.

AUD-903 Sanskrit for Technical Knowledge
(2-0-0)0 Credits

Course Contents Objectives:

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

Course Contents Outcomes:

At the end of the Course Contents students will be able to

1. Understanding basic Sanskrit language.
2. Ancient Sanskrit literature about science and technology can be understood.
3. Being a logical language will help to develop logic in students.
4.

Course Contents:

UNIT I:
Alphabets in Sanskrit.

UNIT II:
Past/Present/Future Tense.

UNIT III: Simple Sentences, Order.

UNIT IV:
Introduction of roots.

UNIT V:
Technical information about Sanskrit Literature.

UNIT VI:
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics.

Suggested reading:

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.

AUD-904 Value Education
(2-0-0)0 Credits

Course Contents Objectives:

1. Understand value of education and self- development.
2. Imbibe good values in students.
3. Let the students know about the importance of character.

Course Contents Outcomes:

1. Knowledge of self-development.
2. Learn the importance of Human values.
3. Developing the overall personality.

Course Contents:

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

UNIT II:
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 III:
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.

UNIT IV:
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 V:
Character and Competence –Holy books vs Blind faith. Self-management and Good health. Science of reincarnation.

UNIT VI:
Equality, Nonviolence, Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively.

Suggested reading:

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

AUD-905 Constitution of India
(2-0-0)0 Credits

Course Contents Objectives:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. 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.
3. To address the role of socialism in India after the commencement of the Bolshevi Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Contents Outcomes:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. 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.
4. Discuss the passage of the Hindu Code Bill of 1956.

Course Contents:

UNIT I:
History of Making of the Indian Constitution: History, Drafting Committee, (Composition and Working)

UNIT II:
Philosophy of the Indian Constitution: Preamble, Salient Features.

UNIT III:
Contours of Constitutional Rights and 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 IV:
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 V:
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 VI:
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.

Suggested reading:

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.

AUD-906 Pedagogy Studies
(2-0-0)0 Credits

Course Contents Objectives:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Course Contents Outcomes:

At the end of the Course Contents students will be able to

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

Course Contents:

UNIT I:
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 II:
• Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.
• Curriculum, Teacher education.

UNIT III:
• 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?

UNIT IV:
• 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.

UNITV:
• 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 VI:
Research gaps and future directions

- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

Suggested reading:

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.

AUD-907 Stress Management By Yoga
(2-0-0)0 Credits

Course Contents Objectives:

1. To achieve overall health of body and mind.
2. To overcome stress.

Course Contents Outcomes:

At the end of the Course Contents students will be able to

1. Develop healthy mind in a healthy body thus improving social health also.
2. Improve efficiency.

Course Contents

UNIT I:
Definitions of Eight parts of yog. (Ashtanga)

UNIT II:
Yam and Niyam.

UNIT III:
Do`s and Don't's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT IV:
Do`s and Don't's in life.
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT V:
Asan and Pranayam
i) Various yog poses and their benefits for mind and body

UNIT VI:
Asan and Pranayam
Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading:

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.

AUD-908 Personality Development Through Life Enlightenment Skills
(2-0-0)0 Credits

Course Contents Objectives:

1. To learn to achieve the highest goal happily.
2. To become a person with stable mind, pleasing personality and determination.
3. To awaken wisdom in students.
4.

Course Contents Outcomes:

At the end of the Course Contents students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life.
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity.
3. Study of Neetishatakam will help in developing versatile personality of students.
4.

Course Contents

UNIT I:

Neetisatakam-Holistic development of personality

• Verses- 19,20,21,22 (wisdom)
• Verses- 29,31,32 (pride and heroism)
• Verses- 26,28,63,65 (virtue)

UNIT II:

• Verses- 52,53,59 (dont's)
• Verses- 71,73,75,78 (do's)

UNIT III:

Approach to day to day work and duties.

• Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,

UNIT IV:

• Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
• Chapter 18-Verses 45, 46, 48.

UNIT V:

Statements of basic knowledge.

• Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
• Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT VI:

• 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

Suggested reading:

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