ANNAMACHARYA INSTITUTE OF TECHNOLOGY AND SCIENCES: TIRUPATI
(AUTONOMOUS)

Department of Civil Engineering

Specialization: Structural Engineering (SE)
Effective for the batches admitted from 2022-23

M. Tech – I Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	22DPC2001	Matrix Methods of Structural Analysis	3	0	0	3	40	60	100
2	PC	22DPC2002	Advanced Solid Mechanics	3	0	0	3	40	60	100
3	PE		**Program Elective-I**	3	0	0	3	40	60	100
		22DPE2001	1. Structural Optimization							
		22DPE2002	2. Advanced Concrete Materials and Technology							
		22DPE2003	3. Stability of Structures							
4	PE		**Program Elective-II**	3	0	0	3	40	60	100
		22DPE2004	1. Analytical and Numerical Methods for Structural Engineering							
		22DPE2005	2. Energy Efficient Buildings							
		22DPE2006	3. Theory of Thin Plates and Shells							
5	ML	22MBA0110	Research Methodology and IPR	2	0	0	2	40	60	100
6	MC		**Audit course 1**	2	0	0	0	40	-	40-
		22DMC9901	1. English for Research Paper Writing							
		22DMC2001	2. Disaster Management							
		22DMC9902	3. Sanskrit for Technical Knowledge							
		22DMC9903	4. Value Education							
PRACTICAL										
7	PC	22DPC2003	Structural Design Lab-I	0	0	4	2	40	60	100
8	PC	22DPC2004	Advanced Concrete Lab	0	0	4	2	40	60	100
Total							18	320	420	740

M. Tech – II Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PC	22DPC2005	FEM in Structural Engineering	3	0	0	3	40	60	100
2	PC	22DPC2006	Structural Dynamics	3	0	0	3	40	60	100
3	PE		**Program Elective III**	3	0	0	3	40	60	100
		22DPE2007	1. Design of Advanced Concrete Structures							
		22DPE2008	2. Advanced Steel Design							
		22DPE2009	3. Design of High Rise Structures							
4	PE		**Program Elective IV**	3	0	0	3	40	60	100
		22DPE2010	1.Design of Pre-stressed Concrete Structures							
		22DPE2011	2. Design of Bridges							
		22DPE2012	3. Advanced Design of Foundations							
5	MC		**Audit course 2**	2	0	0	0	40	-	40
		22DMC9904	1.Constitution of India							
		22DMC5801	2. Pedagogy Studies							
		22DMC9905	3. Stress Management by Yoga							
		22DMC9906	4. Personality Development through Life Enlightenment Skills.							
PRACTICAL										
6	PC	22DPC2007	Structural Design Lab-II	0	0	4	2	40	60	100
7	PC	22DPC2008	FEM Laboratory	0	0	4	2	40	60	100
8	PR	22DPR2001	Technical Seminar	0	0	4	2	100	00	100
Total							18	380	360	740

M. Tech –III Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PE		**Program Elective IV**	3	0	0	3	40	60	100
		22DPE2013	1.Earthquake Resistant Design							
		22DPE2014	2. Structural Health Monitoring							
		22DPE2015	3. Design of Industrial Structures							
2	OE		**Open Elective**	3	0	0	3	40	60	100
		22DOE2001	1. Waste to Energy							
		22DOE2002	2. Project Management							
		22DOE9001	3. Industrial Safety							
		22DOE9002	4. Operations Research							
		22DOE5801	5. Business Analytics							
		22DOE9004	6. Composite Materials							
3	PR	22DPR2002	Dissertation Phase – I	0	0	20	10	100	00	100
4	PR	22DPR2003	Co-curricular Activities	0	0	0	2			
TOTAL							18	180	120	300

M. Tech – IV Semester

S.No	Category	Course Code	Course Title	Hours per week			Credits	Scheme of Examination (Max. Marks)		
				L	T	P		CIE	SEE	Total
THEORY										
1	PR	22DPR2004	Dissertation Phase – II	0	0	32	16	100	100	200
TOTAL							16	100	100	200

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Year: I **Semester : I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2001	Matrix Methods of Structural Analysis	3	0	0	3

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

1. Understand the basic concepts of structural analysis.
2. Apply numerical methods to solve continuum beams.
3. Analysis of two dimensional portal frames using different methods.
4. Understand the basic concepts of transformation of matrices from local to global coordinates.
5. Solve the equations using different solution techniques.

UNIT – I:

Introduction: Indeterminacy-Determination Of Static And Kinematic Indeterminacies Of Two-Dimensional And Three-Dimensional Portal Frames, Pin Jointed Trusses And Hybrid Frames-Coordinate Systems –Structural Idealization. Introduction to Matrix Methods Of Analysis-Flexibility And Stiffness Matrices Force Displacement Relationships For Axial Force, Couple, Torsional Moments – Stiffness Method Of Analysis And Flexibility Method Of Analysis.

UNIT – II:

Analysis of continuous beams - Stiffness Method and Flexibility Method of Analysis – Continuous Beams of Two and Three Spans with Different End Conditions-Internal Hinges.

UNIT – III:

Analysis of two dimensional portal frames – Stiffness And Flexibility Method of Analysis Of 2D Portal Frames With Different End Conditions-Plotting of Bending Moment Diagrams.

UNIT – IV:

Transformation of Co-ordinates - Local and Global Co-Ordinate Systems-Transformation of Matrices from Local to Global Coordinates of Element Stiffness Matrix-Direct Stiffness Method of Analysis-Assemblage of elements –Static Condensation-Sub-Structuring.

UNIT -V:

Equation Solvers-Solution of System of Linear Algebraic Equations-Direct Inversion Method-Gauss Elimination Method-Cholesky Method-Banded Equation Solvers-Frontal Solution Technique.

REFERENCES:

1. Structural Analysis By Pundit & Gupta, Tata MC Graw Hill Book Company.
2. Structural Analysis By C.S.Reddy, Tata MC Graw Hill Book Company
3. Matrix Analysis of Framed Structures, Weaver and Gere.
4. Computer Methods in Structural Analysis, Meek J. L., E and FN, Span Publication.

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2002	Advanced Solid Mechanics	3	0	0	3

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

1. Understanding the basic concepts, Cartesian Tensors and Equations of Elasticity.
2. Apply numerical methods to solve continuum problems.
3. Solve simple problems of elasticity and plasticity understanding the basic concepts.
4. Solve simple problems Two-Dimensional Problems of Elasticity and torsion
5. Understand Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential

UNIT – I:

Introduction to Elasticity: Displacement, Strain and Stress Fields, Constitutive Relations, Cartesian Tensors and Equations of Elasticity.

UNIT – II:

Strain and Stress Field: Elementary Concept of Strain, Stain at a Point, Principal Strains and Principal Axes, Compatibility Conditions, Stress at a Point, Stress Components on an Arbitrary Plane, Differential Equations of Equilibrium, Hydrostatic and Deviatoric Components.

UNIT – III:

Equations of Elasticity: Equations of Equilibrium, Stress- Strain relations, Strain Displacement

And Compatibility Relations, Boundary Value Problems, Co-axiality of the Principal Directions.

UNIT – IV:

Two-Dimensional Problems of Elasticity: Plane Stress and Plane Strain Problems, Airy's stress Function, Two-Dimensional Problems in Polar Coordinates. **Torsion of Prismatic Bars:** Saint Venant's Method, Prandtl's Membrane Analogy, Torsion of Rectangular Bar, Torsion of Thin Tubes.

UNIT -V:

Plastic Deformation: Strain Hardening, Idealized Stress- Strain curve, Yield Criteria, von Mises Yield Criterion, Tresca Yield Criterion, Plastic Stress-Strain Relations, Principle of Normality and Plastic Potential, Isotropic Hardening.

REFERENCES:

1. Theory of Elasticity, Timoshenko S. and GoodierJ. N., McGraw Hill, 1961.
2. Elasticity, SaddM.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.

Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2001	Structural Optimization	3	0	0	3

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

1. To study the different optimization methodologies applied to structural systems.
2. To study the different optimization methodologies applied to structural systems.

UNIT – I:

Introduction :Need and scope of optimization, Historical development, Statement of an optimization problems, Objective function and its surface, design variables, constraints and constraint surface. Classification of optimization problems, various functions (continuous, discontinuous, and discrete) and Function behaviour (Monotonic, Non-Monotonic and Uni-modal)

UNIT – II:

Classical Optimization Techniques: Differential calculus method, Multivariable optimization by method of constrained variation and Lagrange multipliers (generalized problem). Kuhn-Tucker conditions for optimality. Fully stressed design and optimally criterion based algorithms, Introduction, Characteristics of fully stressed design theoretical basis – Examples..

UNIT – III:

Non-linear Programming: Unconstrained minimization – Fibonacci, Golden section, Quadratic and Cubic interpolation methods for a one-dimensional minimization and Univariate Method, Powel's method, Newton's method and Davidon Fletcher Powell's method for multivariable optimization. Constrained minimization – Cutting plane method, Zoutendijk's method and penalty function methods.

UNIT – IV:

Linear programming – Definitions and theorems – Simplex method – Duality in linear programming. Plastic analysis and minimum weight design and rigid frame.

UNIT -V:

Introduction to quadratic programming, Geometric programming and Dynamicprogramming. Design of beams and frame using dynamic programming technique.

REFERENCES:

1. Optimization Theory and Applications by Rao, S.S., Wiley Eastern Ltd., New Delhi, 1978.
2. Optimum Design of Structures by Majid, K.I., Newnes-Butter Worths, London, 1974.

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Year: I **Semester : I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2002	Advanced Concrete Materials and Technology	3	0	0	3

Course Outcomes: After the completion of the course student should be able to

1. Understand various ingredients of concrete and their role.
2. Examine knowledge on the fresh and hardened properties of concrete.
3. Design concrete mixes using various methods.
4. Perceive special concretes for accomplishing performance levels.
5. Understand the durability of concrete and remedial methods.

UNIT – I:

Introduction to concrete – Mineral and chemical admixtures – Structure of hydrated cement paste – Calcium Aluminate Cement – Cement Production quality control - Transition zone in concrete – measurement of workability by quantitative empirical methods – concrete properties: setting and hardening.

UNIT – II:

Durability of concrete and concrete construction: Durability concept, pore structure and transport processes, Permeability of concrete, reinforcement corrosion, fire resistance, frost damage, sulphate attack, Acid attack, alkali silica reaction, delayed ettringite formation, methods of providing durable concrete, short-term tests to assess long-term behavior.

UNIT – III:

Mix design: Review of methods and philosophies of IS, BS and ACI methods, mix design for special purposes, Acceptance criteria for compressive strength of concrete.

Test methods: Analysis of fresh concrete, accelerated testing methods, Tests on hardened concrete, Core cutting and testing, partially destructive testing, Non-destructive testing of concrete structures.

UNIT – IV:

Special concretes: Lightweight concrete, autoclaved aerated concrete, no-fines concrete, lightweight aggregate concrete and foamed concrete, High strength concrete, high density and radiation-shielding concrete, polymer concrete, fibre-reinforced concrete, Ferro Cement.

UNIT – V:

Special concretes: Self Compacting Concrete, underwater concrete, grouts, grouting and grouted concrete, mass concrete, slip form construction, pumped concrete and Geopolymer concrete .

Text Book

1. Properties of Concrete, A.M.Neville, Longman 1995.

2. Concrete Technology Theory and Practice, M.S.Shetty, S.Chand& Company Ltd, New Delhi.

Reference

1. Concrete micro-structure, Properties and Materials, P.K.Mehta, J.M.Monteiro, Printice Hall INC & McGraw Hill, USA.

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2003	Stability of Structures	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Understand the difference between stability and instability of the structures
2. Determine stability of columns
3. Able to determine the buckling loads for columns
4. Able to apply advanced numerical techniques to buckling analysis of structures.
5. Determine stability of beams

UNIT – I:
Beam Columns: Stability, Strength, and Stiffness, Concept of Stability, Differential Equation For Beam Columns –Beam Column With Concentrated Loads Continuous Lateral Load –Couples -Beam Column With Built In Ends – Continuous Beams With Axial Load.
UNIT – II:
Elastic Buckling of bars: Elastic Buckling Of Straight Columns –Effect Of Shear Stress On Buckling-Eccentrically And Laterally Loaded Columns, Buckling Of A Bar With Intermediate Compressive Forces, Effect Of Shear Force On Critical Load –Built Up Columns.
UNIT – III:
Energy Methods: Buckling of a Bar on Elastic Foundation, Distributed Axial Loads – Buckling of Bars with varying Cross Section.
UNIT – IV:
Mathematical Treatment of Stability Problems: Buckling Problem Orthogonality Relation –Ritz Method-Timoshenko Method, Galerkin Method
UNIT -V:
Lateral Buckling Of Simply Supported Beams And Rectangular Plates: Beams Of Rectangular Cross Section Subjected For Pure Bending. Derivation Of Equation Of Rectangular Plate Subjected To Constant Compression In Two Directions And One Direction.

REFERENCES:

1. Theory of elastic stability, Timoshenko and Gere, Tata Mc Graw Hill,1981
2. Principles of Structural Stability Theory, Alexander Chajes, Prentice Hall, New Jersey.
3. Theory of Beam Columns Vol I by Chen & Atsuta Mc.Graw Hill.
4. Strength of Metal Structures, Bleich F. Bucking, Tata McGraw Hill, New York.
5. Stability of Metalic Structure by Bleich, Mc Graw Hill

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2004	Analytical and Numerical Methods for Structural Engineering	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Analyze the concept of Linear equations.
2. Understand the concept of Calculus of Variation.
3. Understand methods of Numerical solutions of O.D.E .
4. Analyze the concept of basic methods of P.D.E .
5. Understand the concepts of Partial Difference Equation to solve engineering problems.

UNIT-I

Solutions of linear equations: Direct method – Elimination method-Gauss – Jordan elimination method– Jacobi – Iteration method. Eigen values and Eigen vectors: Jacobi method for symmetric matrices- Given's method for symmetric matrices.

UNIT-II

Calculus Of Variation – Functionals – Euler's Equation - Solution Of Euler's Equation – Isoperimetric Problems – Several Dependent Variables – Functionals Invoving Higher Order Derivatives – Hamilton's Principle – Lagrange's Equations.

UNIT-III

Numerical Solutions of Ordinary Differential Equations: Euler's Method- R-K Method, Predictor-Corrector Methods:Milne's Method-Adams-Bashforth Method-Soluitions of Simultaneous First Order Differential Equations by using R – K method.

UNIT-IV

Numerical Solution of Partial Differential Equations: Elliptical equations standard five point formula, diagonal five point formula — solution of Laplace equation by Leibmann's iteration method, Poisson's equation.

UNIT-V

Numerical Solution of Partial Differential Equations – Parabolic Equations Bender – Schmidt Method-Bender - Schmidt Recurrence Equation, Crank-Nicholson Difference Method

Text books

1. Higher Engineering Mathematics-Dr.B.S.Grewal, Khanna Publishers,42nd Edition, New Delhi.o
2. S.S.Sastry,Introductory Methods of Numerical Methods",Prentice Hall of India Pvt.Ltd.

3 N.P.Bali and M. Goyal, "Engineering Mathematics",LakshmiPublishers,New Delhi.

Reference Books

1. M.K.Jain-S.R.K.Iyengar – R.K.Jain, Computational methods for partial differential equations, . New Age International (p) Ltd.,Publishers.
2. Numerical Methods For Scientific and Engineering Computations. M.K.Jain-S.R.K.Iyengar – R.K.Jain Willey Eastern Limited. New Age International (p) Ltd.,Publishers.

3. C Language and Numerical methods by C.Xavier – New Age International Publisher.Reprint March 2012 ISBN:978-81-224-1174-4.

4.Computer based numerical analysis by Dr. M.Shanta Kumar, Khanna Book publishers.
5..Dr.T.K.V.Iyengar,Dr.M.V.S.S.N.Prasad ,Dr.B.KrishnaGandhi,S.Ranganatham "Mathematical Methods" S.Chand Publishing.
6. Numerical Methods for Engineering Problems by N. Krishna Raju and K.U. Muthu, M.C.Millan Publishers, New Delhi.

Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2005	ENERGY EFFICIENT BUILDINGS	3	0	0	3

Course Outcomes:

1. This course aims to provide an understanding of the concept of reduction in energy consumption through low energy building design.
2. Highlight strategies to integrate day lighting and low energy heating/cooling in buildings.
3. Understand the concept and theoretical background of low energy building design.
4. Apply simulation tools to achieve energy efficiency in buildings.
5. Understand importance of energy consumption.

UNIT – I

Green Buildings, Energy and Environment: Green Buildings within the Indian Context, Types of Energy, Energy Efficiency and Rebound Effect, Pollution, Better Buildings, Reducing energy consumption, Low energy design.

Renewable Energy sources : Solar energy, Passive Solar Heating, Passive Solar collection, Wind and other renewables. A passive solar strategy: Direct gain - Trombe wall, convective air loop, Photovoltaic's, Climate and Energy, Macro and Microclimate - Indian Examples.

UNIT – II

Heating and Cooling : Building Form Surface area and Fabric Heat Loss, utilizing natural energy, Internal Planning, Grouping of buildings – Robin's Spatial Proportion – Orientation of building –Heat transmission through buildings –Thermal properties of building materials – Thermal Comfort –Psychometric Chart –Heat transfer – Cosine Effect - Insulation - Cooling buildings, passive cooling, and mechanical cooling – Measurement of heating and cooling loads.

Ventilation and Infiltration : Natural ventilation and forced ventilation in commercial buildings, passive cooling, modelling air flow and ventilation – stack effect - ventilation calculation – Mass effect.

UNIT -III

Day lighting and Artificial Lighting : Illumination requirements - Concepts of daylight factors and day lighting, daylight assessment, sky dome - sun path diagram, sky exposure angle, sun protection, shading coefficient, visualising day lighting: Source-Path-Target and apparent size, illuminance calculation, penetration and spread of sky component, artificial lighting, efficacy, Radiant barriers - new light sources – luminaries - light shelves - Supplementary artificial lighting design – light distribution – electric lighting control.

UNIT -IV

Design for Climatic Zones: Energy efficient building strategies for various climatic zones – cold and cloudy – cold and sunny – composite – warm and humid – moderate – hot and dry – case studies.

UNIT -V

Energy Assessment and Compliances Procedures : Energy awareness, monitoring energy consumption, Building Environmental Assessment- environmental criteria – embodied energy of building materials - assessment methods - assessment tools (e.g. GRIHA, LEED) - Ecohomes - Sustainable architecture and urban design – principles of environmental architecture.

REFERENCES:

1. SatyajitGhosh and Abhinav Dhaka (2015), Green Structures: Energy Efficient Buildings, Ane Books.
2. Charles Eley (2016), Design Professional's Guide to Zero Net Energy Buildings, Island Press.
3. Ian M. Shapiro (2016), Energy Audits and Improvements for Commercial Buildings, John Wiley & Sons.
4. MoncefKrarti (2016), Energy Audit of Building Systems: An Engineering Approach, Second Edition.
5. EngHwa Yap., (2017), Energy Efficient Building., Published by InTech.,Crotia.LalJayamaha (2006), Energy-Efficient Building Systems: Green Strategies for Operation and Maintenance, McGraw Hill Professional.

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2006	Theory of Thin Plates and Shells	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Use analytical methods for the solution of thin plates and shells.
2. Use analytical methods for the solution of shells.
3. Apply the numerical techniques and tools for the complex problems in thin plates.
4. Apply the numerical techniques and tools for the complex problems in shells.
5. Application to Pipes and Pressure Vessels.

UNIT – I
Introduction: Space Curves, Surfaces, Shell Co-ordinates, Strain Displacement Relations, Assumptions in Shell Theory, Displacement Field Approximations, Stress Resultants, Equation of Equilibrium using Principle of Virtual Work, Boundary Conditions.

UNIT – II
Static Analysis of Plates: Governing Equation for a Rectangular Plate, Navier Solution for Simply- Supported Rectangular Plate under Various Loadings, Levy solution for Rectangular Plate with other Boundary Conditions.

UNIT – III
Circular Plates: Analysis under Axis- Symmetric Loading, Governing Differential Equation in Polar Co-ordinates. Approximate Methods of Analysis- Rayleigh-Ritz approach for Simple Cases in Rectangular Plates.

UNIT – IV
Static Analysis of Shells: Membrane Theory of Shells - Cylindrical, **Thermal Stresses** in Plate/ Shell

UNIT -V
Shells of Revolution with Bending R**esistance:** Cylindrical Shells, Application to Pipes and Pressure Vessels.

REFERENCES:

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

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22MBA0110	Research Methodology and IPR	2	0	0	2

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

1: To acquaint with basics of research problem formulation

2: Familiar with research related information and ethics.

3: aware about research report writing and presentation.

4: Understand and get knowledge of basic rights for protection of innovatives.

5: Understand different types of IPRs

Unit I

Introduction to Research – Types of Research, 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 to investigation of solutions for research Problem.

Unit II

Review of Literature and Data Collection - Effective literature studies approaches, analysis, Plagiarism and Research ethics.

Data collection, analysis, interpretation, Necessary instrumentations.

Unit III

Report Writing- 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

Intellectual Property Rights: Nature, 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.

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.

References:

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

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9901	English for Research Paper Writing	2	0	0	0

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

1. Understand that how to improve your writing skills and level of readability

2. Learn about what to write in each section

3. Understand the skills needed when writing a Title

4. Develop writing skill

5. Able to quote phrases

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.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 – IV

Skill 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 -V

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

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'sbook .

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

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC2001	Disaster Management	2	0	0	0

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

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

UNIT – I

Introduction: Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts.

UNIT – II

Disaster Prone Areas in IndiaStudy Of Seismic Zones; Areas Prone To Floods and Droughts, Landslides andAvalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Referenceto Tsunami; Post-Disaster Diseases and Epidemics

UNIT – III

Disaster Preparedness and ManagementPreparedness: Monitoring of Phenomena Triggering a Disaster or Hazard;Evaluation of Risk: Application of Remote Sensing, Data from Meteorological andother Agencies, Media Reports: Governmental and Community Preparedness.

UNIT – IV

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 -V

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.

REFERENCES:

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.

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Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9902	Sanskrit for Technical Knowledge	2	0	0	0

Course Outcomes: At the end of the course, students will be able to
1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Understanding basic Sanskrit language
4. Ancient Sanskrit literature about science & technology can be understood
5. Being a logical language will help to develop logic in students

UNIT – I
Alphabets in Sanskrit, Past/Present/Future Tense,

UNIT – II
Simple Sentences

UNIT – III
Order, Introduction of roots

UNIT – IV
Technical information about Sanskrit Literature

UNIT -V
Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

REFERENCES:
1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-VempatiKutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication

3. "India's Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.

PG **AK22 Regulations**
Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9903	Value Education	2	0	0	0

Course Outcomes: At the end of the course, students will be able to
1**.** Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character
4. Learn the importance of Human values
5. Developing the overall personality

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 judgments

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, Universal brotherhood and religious tolerance, True friendship, Order, Introduction of roots

UNIT – IV
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, Equality, Nonviolence, Humility, Role of Women, All religions and same message, Mind your Mind, Self-control. Honesty, studying effectively

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

PG **AK22 Regulations**
Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2003	Structural Design Lab-I	0	0	4	2

Course Outcomes: At the end of the course, students will be able to
1. Design and Detail of simple beams
2. Design and Detail of simple frames and Truss
3. Design and Detail complete all the Structural Components of Frame Buildings.
4. Design and Detail complete Multi-Storey Frame Buildings.
5.Analyze a Tall building for wind force

List of Experiments/Assignments: Design of Structures Using software

1. Analysis of Cantilever, Simply Supported Beam, Fixed Beams, Continuous Beams for Different Loading Conditions.
2. Analysis and design of plane and space frame
3. Analysis and Design of plane and space truss
4. Analysis, design and detailing of a multistoried building and Preparation of detailed drawings of different structural elements
5. Wind analysis on tall structure
6. Analysis and Design of steel transmission line tower

PG **AK22 Regulations**
Year: I **Semester: I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2004	Advanced Concrete Lab	0	0	4	2

Course Outcomes: At the end of the course, students will be able to
1. Conduct tests on Concrete ingredients.
2. Understand the mix design of concrete as per Codal Specification
3. Conduct tests on workability and hardened concrete
4.Develop stress strain curve on concrete
5.Establish the correlation between different strengths of concrete
6. Conduct NDT tests on concrete members.
7. Understand the Mix design of special concretes.
8. Understand concepts of durability
9. Understand the concept of corrosion and its effect on concrete

List of Experiments/Assignments:

1. Fundamental tests on concrete ingredients.
2. Mix design of normal, medium and high strength concretes.
3. Mix design of special concretes
4. Workability and hardened properties of concrete.
5. Study of stress-strain curve of high strength concrete.
6. Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
7. Non-Destructive tests on concrete
8. Durability tests on of concrete

PG **AK22 Regulations**
Year: I **Semester : II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2005	FEM in Structural Engineering	3	0	0	3

Course Outcomes:

1: Analyze finite element method efficiently in order to solve field problems
2: Understand the basic concepts of 1D Dimensional elements
3: Understand the basic concepts of 2D Dimensional elements
4: Analyze 4-Noded And 8-Noded Isoparametric elements
5: Understand the concepts of 3-D Elements

UNIT – I

Introduction-Concepts Of FEM –Steps Involved –Merits &Demerits –Energy Principles – Discretization –Rayleigh –Ritz Method Of Functional Approximation.

Elastic Formulations: Stress Equations-Strain Displacement Relationships in Matrix Form-Plane Stress, Plane Strain AndAxi-Symmetric Bodies Of Revolution With Axi Symmetric Loading

UNIT – II

One Dimensional FEM-Stiffness Matrix For Beam And Bar Elements Shape Functions For ID Elements –Static Condensation Of Global Stiffness Matrix- Solution –Initial Strain And Temperature Effects- Numerical Integration Techniques.

UNIT – III

Two Dimensional FEM-Different Types of Elements For Plane Stress And Plane Strain Analysis –Displacement Models –Generalized Coordinates-Shape Functions-Convergent And Compatibility Requirements –Geometric Invariance – Natural Coordinate System-Area And Volume Coordinates-Generation Of Element Stiffness And Nodal Load Matrices –Static Condensation.

UNIT – IV

Isoparametric Formulation-Concept, Different Isoparametric Elements For 2D Analysis-Formulation Of 4-Noded And 8-Noded Isoparametric Quadrilateral Elements –Lagrangian Elements-Serendipity Elements.

Axi Symmetric Modelling –Strain Displacement Relationship-Formulation OfAxi Symmetric Elements.

UNIT -V

Three Dimensional FEM: Different 3-D Elements, 3D Strain –Displacement Relationship-Formulation of Hexahedral And Isoparametric Solid Element.

REFERENCES:

1. Finite Element Analysis, Seshu P., Prentice-Hall of India, 2005.
1. A First course in Finite element method by Daryl Logan, Third edition, Thomson Asia publishers, 2002.
2. Finite element analysis by S.S.Bhavikatti, Third edition, New Age International Publishers, 2015.
3. Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
4. Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.
5. Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.

PG **AK22 Regulations**
Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2006	Structural Dynamics	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Understand the concept of dynamic loads and vibrations
2. Analyze and study dynamics response of single degree freedom system using fundamentalTheory and equation of motion.
3. Analyze and study dynamics response of Multi degree freedom system using fundamental theory and equation of motion.
4. Use the Approximate Methods for dynamic analysis.
5. Analyze earthquake loads acting on structure.

UNIT-I
Theory Of Vibrations: Introduction –Elements Of A Vibratory System – Degrees Of Freedom-Continuous Systems –Lumped Mass Idealization –Oscillatory Motion –Simple Harmonic Motion –Pictorial Representation Of S.H.M - Free Vibrations Of Single Degree Of Freedom (SDOF) Systems –Undamped And Damped –Critical Damping –Logarithmic Decrement –Forced Vibrations Of SDOF Systems-Harmonic Excitation –Dynamic Magnification Factor- Bandwidth.Fundamental Objective Of Dynamic Analysis-Types Of Prescribed Loading- Methods Of Discretization- Formulation Of The Equations Of Motion.
UNIT-II
Single Degree Of Freedom System: Formulation And Solutions Of The Equation Of Motion - Free Vibration Response –Response To Harmonic, Periodic, Impulsive And General Dynamic Loading –Duhamel Integral
UNIT-III
Multi Degree Of Freedom System: Selection Of The Degree Of Freedom –Evaluation Of Structural Property Matrices-Formulation Of The MDOF Equations Of Motion –Undamped Free Vibrations-Solution Of Eigen Value Problem For Natural Frequencies And Mode Shapes- Analysis Of Dynamic Response –Normal Coordinates –Uncoupled Equations Of Motion –Orthogonal Properties Of Normal Modes-Mode Superposition Procedure
UNIT-IV
Practical Vibration Analysis: Stodola Method- Fundamental Mode Analysis –Analysis of Second and Higher Modes –Holzer's Method –Basic Procedure –Transfer Matrix Procedure
UNIT-V
Introduction To Earthquake Analysis: Introduction –Excitation By Rigid Base Translation –Lumped Mass Approach -SDOF And MDOF System- I.S Code Methods Of Analysis.
Continuous System: Introduction –Flexural Vibrations Of Beams- Elementary Case-Equation Of Motion –Analysis Of Undamped Free Shapes Of Simple Beams With Different End Conditions-Principles Of Application To Continuous Beams.

REFERENCES:

1. Dynamics of Structures, Clough R. W. and Penzien J., Mc Graw 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.

PG **AK22 Regulations**

Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2007	Design of Advanced Concrete Structures	3	0	0	3

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

1. Analyze the deflections of Reinforced Concrete Beams And Slabs by understanding their behaviour.
2. Analyze and Design the Deep Beams by understanding their behaviour.
3. Analyze and Design the Flat Slabs by understanding their behaviour.
4. Analyze and Design the Shear Walls by understanding their behaviour.
5. Analyze and Design the concrete members for Fire Resistance

UNIT I

Deflection Of Reinforced Concrete Beams And Slabs: Limit state design - beams, slabs and columns according to IS Codes -Short-Term Deflection Of Beams And Slabs -Deflection Due To - Imposed Loads - Short- Term Deflection Of Beams Due To Applied Loads- Calculation Of Deflection Of Continuous Beams - Deflection Of Cantilevers - Deflection Of Slabs- Redistribution of Moments in Reinforced Concrete Beams.

UNIT II

Estimation Of CrackWidth In Reinforced Concrete Members: Introduction - Factors Affecting Crack width In Beams - Mechanism Of Flexural Cracking Calculation Of Crack Widths - Simple Empirical Method - Estimation Of Crack width In -Beams - Shrinkage And Thermal Cracking.

Deep Beams: Introduction - Minimum Thickness - Steps Of Designing Deep Beams - Design By IS 456 - Design According To British Practice - ACI Procedure For Design Of Deep Beams - Checking For Local Failures - Detailing Of Deep Beams.

UNIT-III

Design of Flat Slabs:

Introduction - Checking For One-Way (Wide Beam) Shear - Two-Way (Punching) Shear Permissible Punching Shear - Shear Due To Unbalanced Moment (Torsional Moments) Calculation Of J Values - Strengthening Of Column Areas For Moment Transfer By Torsion Which Produces Shear - Shear Reinforcement Design - Effect Of Openings In Flat Slabs - Recent Revisions In ACI 318 - Shear In Two – Way Slabs With Beams.

UNIT-IV

Design of Plain Concrete Walls and Shear Walls:

Introduction - Braced And Unbraced Walls - Slenderness Of Walls- Eccentricities Of Vertical Loads At Right Angles To Wall - Empirical Design Method For Plane Concrete Walls Carrying Axial Load - Design Of Walls For In-Plane Horizontal Forces - Rules For Detailing Of Steel In Concrete Walls

Design of Shear Walls: Introduction - Classification Of Shear Walls - Classification According To Behavior - Loads In Shear Walls - Design Of Rectangular And Flanged Shear Walls - Derivation Of Formula For Moment Of Resistance Of Rectangular Shear Walls

UNIT-V

Design of Elevated Water Tanks.Design of rectangular and circular water tanks both below and above ground level – Design of circular slab.

Reference Books:

1. P.Purushothaman, Reinforced Concrete Structural Elements: Behaviour, Analysis And Design, Tata Mcgraw Hill.
2. C.E. Reynolds And J.C. Steedman, Reinforced Concrete Desigers Hand Bood, A View Point Publication.

PG **AK22 Regulations**

Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2008	Advanced Steel Design	3	0	0	3

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

1. Use Design steel structures/ components by different design processes.
2. Analyze and design beams for stability and strength, and drift.
3. Determine the stability of column and strength
4. Understand the method of design criteria
5. Design welded and bolted connections.

UNIT – I

Design of Steel Structures:

Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift

UNIT – II

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

UNIT – III

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

UNIT – IV

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

UNIT -V

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

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

REFERENCES:

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 ofStructural Steel Detailing, BIS,1987

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2009	Design of High Rise Structures	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading
conditions.
2. Analyse, design and detail the RC Chimney
3. Analyse, design and detail Steel Chimney.
4. Analyse. design and detail the tall buildings subjected to different loading conditions using relevant codes.
5. Analysis and Design by using software application

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 Chimney: Foundation design for varied soil strata
UNIT – III
Analysis and Design of Steel chimney: Foundation design for varied soil strata
UNIT – IV
Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Fire fighting design provisions.
UNIT -V
Application: software in analysis and design.

REFERENCES:

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

AK22 Regulations

Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2010	Design of Pre-stressed Concrete Structures	3	0	0	3

Course Outcomes:

1: Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.

2: Find out losses in the prestressed concrete.

3: Analysis and design of prestressed concrete sections for flexure

4: Analyze and design for shear and anchorage in prestressed concrete.

5: Analysis of Statically Indeterminate Structures

UNIT – I

Introduction to prestressed concrete: Development Of Prestressed Concrete –Advantages And Disadvantages Of PSC Over RCC –General Principles Of Pre-Stressing-Pre Tensioning And Post Tensioning –Materials Used In PSC-High Strength Concrete –High Tension Steel-Different Types /Methods/Systems Of Prestressing.

UNIT – II

Losses Of Prestress: Estimation Of The Loss Of Prestress Due To Various Causes Like Elastic Shortening Of Concrete ,Creep Of Concrete, Shrinkage Of Concrete, Relaxation Of Steel, Slip In Anchorage, Friction Etc.

UNIT – III

Flexure & Deflections: Analysis Of Sections For Flexure In Accordance With Elastic Theory-Allowable Stresses-Design Criteria As Per I.S Code Of Practice –Elastic Design Of Beams (Rectangular, I And T Sections) For Flexure –Introduction To Partial Prestressing.

UNIT – IV

Shear, Bond, Bearing And Anchorage: Shear In PSC Beams –Principal Stresses –Conventional Elastic Design For Shear-Transfer Of Prestress In Pre-tensioned Members-Transmission Length –Bond Stresses-Bearing At Anchorage – Anchorage Zone Stresses In Post-Tensioned Members.

UNIT-V

DESIGN OF TENSION AND COMPRESSION MEMBERS

Design of tension members- application in the design of prestressed pipes and prestressed concrete cylindrical water tanks.

REFERENCES :

1. Prestressed Concrete, Krishnaraju N., Tata McGraw Hill, New Delhi, 1981
2. Prestressed Concrete By S. Ramamrutham, Dhanpati Rai Pubilicartions.
3. Design of Prestressed Concrete Structures, Lin T.Y., Asia Publishing House, 1955

PG **AK22 Regulations**
Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2011	Design of Bridges	3	0	0	3

Course Outcomes:
1: Understand the basic aspects of Bridges
2: Able to design Box Culvert and Slab Deck bridge
3: Able to design T Beam bridge and Longitudinal Girder
4: Able to design Prestressed Concrete Bridges
5: Analysis of Piers and Abutments

UNIT – I
Introduction – Classification, Investigations And Planning, Choice Of Type – Economic Span Length – IRC Specifications For Road Bridges, Standard Live Loads, Other Forces Acting On Bridges, General Design Considerations.
UNIT – II
Design of Box Culverts – General Aspects – Design Loads – Design Moments, Shears And Thrusts – Design Of Critical Section.
Design of Slab Bridges – Effective Width of Analysis – Workings Stress Design And Detailing of Slab Bridges For IRC Loading.
UNIT – III
T-Beam Bridges – Introduction – Wheel Load Analysis – B.M. In Slab – Pigaud's Theory – Analysis of Longitudinal Girders by Courbon's Theory Working Stress Design And Detailing of Reinforced Concrete T-Beam Bridges For IRC Loading.
UNIT – IV
Prestressed Concrete Bridges – General Features – Advantages Of Prestressed Concrete Bridges – Pre-tensioned Prestressed Concrete Bridges – Post Tensioned Prestressed Concrete Bridge Decks. Design of Post Tensioned Prestressed Concrete Slab Bridge Deck. Bridge Bearings – General Features – Types Of Bearings – Forces On Bearings Basis For Selection Of Bearings – Design Principles Of Steel Rocker And Roller Bearings And Its Design – Design Of Elastometric Pad Bearing Detailing Of Elastomeric Pot Bearings.
UNIT-V
Piers and Abutments – General Features – Bed Block – Materials For Piers And Abutments – Types Of Piers – Forces Acting On Piers – Design Of Pier – Stability Analysis Of Piers – General Features Of Abutments – Forces Acting On Abutments – Stability Analysis Of Abutments.

REFERENCES :

1. Essentials Of Bridges Engineering – D.Hohnson Victor Oxford & IBH Publishers Co-Private Ltd.
2. Design Of Concrete Bridges MC Aswanin VN Vazrani, MM Ratwani, Khanna Publishers.
3. Bridge Engineering – S.Ponnuswamy.

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2012	Advanced Design of Foundations	3	0	0	3

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

1. Decide the suitability of soil strata for different projects.

2. Design shallow foundations deciding the bearing capacity of soil.

3. Analyze and design the pile and well foundation.

4. Understand analysis methods for tunnel and open cuts.

5. Understand analysis methods for coffer dams.

UNIT-I

Planning of Soil Exploration for Different Projects, Methods of Subsurface Exploration, 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

Pile 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

REFERENCES:

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.

PG **AK22 Regulations**
Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9904	Constitution of India	2	0	0	0

Course Outcomes: At the end of the course, students will be able to
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.
5. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.

UNIT – I

History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working), Philosophy of the Indian Constitution: Preamble Salient Features

UNIT – II

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 – III

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 – IV

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

UNIT -V

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.

REFERENCES:

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.

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC5801	Pedagogy Studies	2	0	0	0

Course Outcomes: At the end of the course, 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? Perspective.
4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
5. Identify critical evidence gaps to guide the development.

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? 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 – IV

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 -V

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

REFERENCES:

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.

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9905	Stress Management by Yoga	2	0	0	0

Course Outcomes: At the end of the course, students will be able to
1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency
3. To achieve overall health of body and mind
4. To overcome stress
5. Identify critical evidence gaps to guide the development.

UNIT – I
Definitions of Eight parts of yoga (Ashtanga)

UNIT – II
Yam and Niyam. Ahinsa, satya, astheya, bramhacharya and aparigraha

UNIT – III
Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

UNIT – IV
Asan and Pranayam: Various yoga poses and their benefits for mind & body

UNIT -V
Regularization of breathing techniques and its effects-Types of pranayam
REFERENCES:
1. 'Yogic Asanas for Group Tarining-Part-I" :Janardan Swami Yogabhyasi Mandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, AdvaitaAshrama (Publication Department), Kolkata

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DMC9906	Personality Development through Life Enlightenment Skills	2	0	0	0

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

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality andb 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. To become a person with stable mind, pleasing personality and determination
5. To awaken wisdom in students

UNIT – I

Neetisatakam-Holistic development of personality

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

UNIT – II

1. Approach to day to day work and duties.
2. Shrimad Bhagwad Geeta: Chapter 2-Verses 41, 47,48,

UNIT – III

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

UNIT – IV

1. Statements of basic knowledge.
2. Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
3. Chapter 12 -Verses 13, 14, 15, 16,17, 18

UNIT -V

1. Personality of Role model.
2. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
3. Chapter 4-Verses 18, 38,39
4. Chapter18 – Verses 37,38,63

REFERENCES:

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

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2007	Structural Design Lab-II	0	0	4	2

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

1. Design and Detail of Prestressed Concrete members

2. Design and Detail of Water Tanks.

3. Design and Detail of bridge girder and cylindrical shell.

4. Determine the Dynamic of tall building.

5. Design and Detailing of different foundations.

List of Experiments:

1. Dynamic analysis of tall buildings
3. Analysis and design of bridge girder
4. Analysis of Cylindrical shell
5. Analysis and Design of Water Tanks.
6. Design of Raft, Combined, Isolated foundations.
6. Analysis and Design of prestressed concrete continuous slab
7. Analysis and Design of prestressed concrete continuous beam

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Year: I **Semester:II** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPC2008	FEM Laboratory	0	0	4	2

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

1. Identify mathematical model for solution of common engineering problems

2. Understand the concept of meshing for rectangular and circular plates

3. Analyze the bar elements and truss elements using FEM software

4. Analyze the 2D Frame and 3D frame using FEM software

List of Experiments/Assignments:

1. Discretisation of Geometry
2. Meshing a rectangular plate using 4 node elements
3. Meshing the circular plate using 3 node and 4 node elements
4. Analysis of an assembly of bar elements
5. Analysis of a stepped bar
6. Analysis of a plane truss
7. Analysis of a space truss
8. Analysis of a fixed beam
9. Analysis of a 2D-Frame
10. Analysis of a 3D-Frame

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2013	Earthquake Resistant Design	3	0	0	3

Course Outcomes:

1. To study the basic concepts of engineering seismology, strength and capacity design principles of earthquake resistant design.
2. To study the behavior of various types of buildings under static and dynamic forces subjected to earthquakes.
3. Learn the basic concepts of earthquake engineering and principles of earthquake resistant design.
4. Analyze and design the various types of structures under static and dynamic loading conditions.
5. Understand different vibration techniques.

UNIT – I

Seismology and Earthquake : Internal structure of the earth, continental drift and plate tectonics, Faults, Elastic rebound theory, seismic waves and characteristics, earthquake size, strong ground motion, seismic zoning map of India, Seismic hazard assessment.

Principles of Earthquake Resistant Design : Seismic design philosophy - Principles of earthquake resistant design - Response spectrum theory - Application of response spectrum theory to seismic design of structures -Capacity - Design Principles - Design criteria for strength - Stiffness and ductility.

UNIT – II

Seismic Analysis of Moment Resisting Frames: Determination of design lateral forces as per IS: 1893, 2014 – equivalent static force and dynamic analysis procedure. Effect of infill stiffness on analysis of frames – Equivalent diagonal strut.

UNIT – III

Modelling, Analysis and Design of Structures : Seismic analysis and design of RC structures using software - static and dynamic methods – equivalent static, response spectrum and time history methods.

Design of Beam Column Junctions : Elastic and Inelastic deformations of structures – ductility of the composite system - design of axial and flexural members – beam column junctiondetailing – strong column - weak beam effects as per IS: 13920: 2016.

UNIT -IV

Design of Shear Walls: Unreinforced and reinforced masonry shear walls – analysis and design of reinforced concrete shear walls.

UNIT -V

Vibration Control Techniques: Vibration control – energy dissipating devices – principles and application, basic concept of base isolation – various systems - case studies.

REFERENCES:

1. PankajAgarwal and Manish Shrikhande., (2010), Earthquake resistant design of structures, Prentice-Hall India Pvt Ltd., New Delhi.
2. Jack Moehle (2015), Seismic Design of Reinforced Concrete Buildings, McGraw-Hill Education, New Delhi.
3. Pauley andPriestly., (1992), Seismic design of reinforced concrete and masonry buildings, John Wiley and Sons, London.

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2014	Structural Health Monitoring	3	0	0	3

Course Outcomes:

CO1: Select amongst various types of Structural health monitoring techniques
CO2: Perform Static field testing's
CO3: Perform Dynamic field testing's
CO4: Perform Non destructive evaluation
CO5: Select Software and Hardware required for remote health monitoring of Structures

UNIT I

Introduction - Definition of SHM – Classification, Types and Components of SHM – Advantagesand Benefits of SHM.

UNIT II

Sensing Technologies: Strain Measurement – LVDT – Temperature Sensors – Fiber Optic Sensing Technology - DIC.
Methodology : Sensors – Selection of Sensors – Installation and placement – Data acquisition

UNIT III

Communication – Processing and Analysis – Staorage – Dianostics and Prognostics – Retrievalof data.

UNIT IV

Testing: Static Field Testing – Dynamic field testing - Stress history data - Dynamic load allowance tests - Ambient vibration tests - Forced Vibration Method - Dynamic response methods
Data Acquisition: Static data acquisition systems - Dynamic data acquisition systems - Components of Data acquisition system - Hardware for Remote data acquisition systems.

UNIT V

Remote Structural health monitoring: Remote Structural Health Monitoring - Importance and Advantages – Methodology – IoT applications in SHM – Application Machine leaning Techniques in SHM.

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DPE2015	Design of Industrial Structures	3	0	0	3

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

1. Apply the IS code of practice for the design of steel structural elements
2. Design Gantry Girders
3. Design Portal Frames
4. Design Welded plate girders
5. Design Communication Towers

UNIT – I

Plastic Analysis: Introduction, Limit analysis of steel structures, Mechanical properties of structural steel, Plastic hinge, Moment curvature relations, Limit load, Coplanar load, Upper lower bound theorems.

Planning and functional requirements- classification of industries and industrial structures- planning for layout- requirements regarding lighting ventilation and fire safety- protection against noise and vibrations.

UNIT – II

Design of 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 – III

Design of welded plate girders – elements – economical depth – design of main section – connections between web and flange – design of stiffeners - bearing stiffener– intermediate stiffeners – Design of web splice and flange splice

UNIT – IV

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

UNIT -V

Design of Communication Towers: Analysis of Transmission line Towers: Loads on towers, Sag (dip) and Tension in uniformly loaded conductors, Analysis of towers (analysis as coplanar assembly), Design of members in towers, Design of foundation of towers. Design of Steel Chimneys for wind and gravity loads.

Reference Books:

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

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DOE2001	Waste to Energy	3	0	0	3

Course Outcomes: At the end of the course, students will be able to
1. Able to classify types of wastes
2. Understand the method of pyrolysis
3. Understand the use and application of Biomass gasifiers
4. Design biomass combustors
5. Analyze the properties of Biogas

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 & 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.

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DOE2002	Project Management	3	0	0	3

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

1. To understand the importance of project management and organization
2. To apply theoretical and practical aspects of project management planning techniques to achieve project goals.
3. To understand the resources, cost and accounts managements
4. To know about the project implementation, and contract management and procurement management
5. Understand to apply knowledge and skills of quality and safety managements in construction.

Unit I

Introduction to Project management: Characteristics of projects, Definition and objectives of Project Management, Stages of Project Management, Project Planning Process, Establishing Project organization.

UNIT-II

Project Planning: Planning techniques- Bar Chart- Networks: basic terminology, preparation of CPM-computation of float values, critical paths-PERT- Determination of three time estimates- Comparison between CPM and PERT

UNIT-III

Resources Management: Flow chart of Resources Management, Labour's requirement, Factors behind the selection of equipment, Material Management- flow chart and functions.

Cost and Accounts Management: Cost–volume relationship-Basic Cost Control System-Principle of accounting, Account process, Balance sheet.

Unit IV

Project Implementation: Project Monitoring and Control with PERT/Cost,Computers applications in Project Management, Contract Management, Project Procurement Management.

UNIT-V

Quality management

Inspection, quality control and quality assurance in projects- Cost of quality, cost versus quality levels- ISO standards- benefits-ISO 9001-2000 family of standards- Audit- types, ISO 9001-2000 for internal audit.

Safety management

Cause for accident in construction site- -Principle of safety- Role of safety personnel's - General safety conditions

REFERENCES:

1. Kumar Neeraj Jha, Construction Project Management Theory & Practice, Pearson Education Ltd., 2014.
2. Chitkara.K.K., Construction Project Management Planning Scheduling and Controlling, TataMcGraw-Hill, 2014
3. Project Planning And Control With PERT And CPM By Dr.B.C.Punmia, K.K.Khandelwal, Lakshmi Publications New Delhi.

4. Total Project Management, The Indian Context- By : P.K.JOY- Mac Millan Publishers India Limited.

Additional Readings:

1. John M Nicholas, Project Management for Business and Technology: Principles and Practice, Prentice Hall,
India, 2002.
2. N. J. Smith (Ed), Project Management, Blackwell Publishing, 2002.
3. Robert K. Wysocki, Robert Back Jr. and David B. Crane, Effective Project Management, John Wiley, 2002.
4. Jack R Meredith and Samuel J Mantel, Project Management: A Managerial Approach, John Wiley, 2000.

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DOE9001	Industrial Safety	3	0	0	3

Course Outcomes:

CO: 1 Analyze the basics of industrial safety.
CO: 2 Understand the Fundamentals of maintenance engineering
CO: 3 Apply the methods of prevention of corrosion and wear.
CO: 4 Understand the Fault tracing and their applications.
CO: 5 Understand the methods of preventive measures and maintenance

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:

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

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DOE9002	Operations Research	3	0	0	3

Course Outcomes:

CO: 1 Understand the characteristics and phases, types of models, allocation in linear programming

CO: 2 Apply the concept of optimal solution, unbalanced problem, degeneracy and Transportation problem & sequencing.

CO: 3 Understand the concept of replacement of items and related problems, theory of games related problems

CO: 4 Apply the concept of the knowledge of queuing models, inventory management models.

CO: 5 Apply the knowledge of dynamic programming, the concept of the simulation and simulation languages.

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 Flowproblem - CPM/PERT

Unit IV

Scheduling and sequencing - single server and multiple server models - deterministic Inventorymodels - 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

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

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Year: II Semester: I Branch of Study: Power Systems, EEE

Course Code	Course Title	L	T	P	Credits
22DOE5801	**BUSINESS ANALYTICS**	**3**	**0**	**0**	**3**

Unit I

Business Analysis: Overview of Business Analysis, Overview of Requirements, Role of the Business Analyst.

Stakeholders: the project team, management, and the front line, Handling Stakeholder Conflicts.

Unit II

Life Cycles: Systems Development Life Cycles, Project Life Cycles, Product Life Cycles, Requirement Life Cycles.

Forming Requirements: Overview of requirements Attributes of Good Requirements, Types of Requirements, Requirement Sources, Gathering Requirements from Stakeholders, Common Requirements Documents.

Unit III

Transforming Requirements: Stakeholder Needs Analysis, Decomposition Analysis, Additive/Subtractive Analysis, Gap Analysis, Notations (UML & BPMN), Flowcharts, Swim Lane Flowcharts, Entity-Relationship Diagrams, State-Transition Diagrams, Data Flow Diagrams, Use Case Modeling, Business Process Modeling

Unit IV

Finalizing Requirements: Presenting Requirements, Socializing Requirements and Gaining Acceptance, Prioritizing Requirements. Managing Requirements Assets: Change Control, Requirements Tools

Unit V

Recent Trends in: Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data Journalism.

Text Book:1 Business Analysis by James Cadle et al. Project Management:

The Managerial Process by Erik Larson and, Clifford Gray

2. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FT Press.

3. Business Analytics by James Evans, persons Education.

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Year: II **Semester:I** **Branch of Study: CE**

Subject Code	Subject Name	L	T	P	Credits
22DOE9004	Composite Materials	3	0	0	3

Course Outcomes:

CO: 1 Understanding of basic concepts and charactestics of geometric and physical applications
of composites.
CO: 2 Explain different reinforcements and their properties.
CO: 3 Study of micromechanics and properties of composite material.
CO: 4 Study of coordinate transformations of stress and strain laws.
CO: 5 Study of elastic behaviour of unidirectional composites; Joining Methods and Failure Theories

UNIT-I

Introduction: Definitions, Composites, Reinforcements and matrices, Types of reinforcements,Types of matrices, Types of composites, Carbon Fibre composites, Properties of composites in comparison with standard materials,
Reinforcements: Fibres- Glass, Silica, Kevlar, carbon, boron, silicon carbide, and born carbide fibres. Particulate composites, Polymer composites, Thermoplastics, Thermosetts, Metal matrix and ceramic composites.

UNIT-II

Manufacturing methods :
Hand and spray lay - up, injection molding, resin injection, filament winding, pultrusion, centrifugal casting and prepregs. Fibre/Matrix Interface, mechanical.
Measurement of interface strength. Characterization of systems; carbon fibre/epoxy, glass fibre/polyester, etc.

UNIT-III

Micromechanics: Unidirectional composites, constituent materials and properties, elastic properties of a lamina, properties of typical composite materials, laminate characteristics and configurations. Characterization of composite properties.
Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

UNIT-IV

Coordinate transformations: Hooke‟s law for different types of materials, Hooke‟s law for two dimensional unidirectional lamina, Transformation of stress and strain, Numerical examples of stress strain transformation, Graphic interpretation of stress – strain relations. Off - axis, stiffness modulus, off - axis compliance.

UNIT-V

Elastic behavior of unidirectional composites: Elastic constants of lamina, relationship between engineering constants and reduced stiffness and compliances, analysis of laminated composites, constitutive relations
Joining Methods and Failure Theories: Joining –Advantages and disadvantages of adhesive and mechanically fastened joints. Typical bond strengths and test procedures.

Text Books:

1. Chawla, Krishan K, Composite Materials Science and Engineering, Springer, 3rd Edition 2012.
2. R. M. Jones, Mechanics of Composite Materials, Mc Graw Hill Company, New York, 1975.

References:

1. B. D. Agarwal and L. J. Broutman, Analysis and performance of fibre Composites, Wiley-Interscience, New York, 1980.
2. L. R. Calcote, Analysis of Laminated Composite Structures, Van Nostrand Rainfold, New York, 1969.
3. Engineering Mechanics of Composite Materials by Isaac and M.Daniel, Oxford University Press, 1994