GOVT. COLLEGE OF ENGINEERING, AMRAVATI

CURRICULUM

For

M. TECH. (STRUCTURAL ENGINEERING)

2019- 2020

Member Secretary
(S. W. Thakare)

Chairman, BoS
(Dr. M. N. Hedaoo)

Principal
(Prof. A.M.Mahalle)

PROGRAM EDUCATIONAL OBJECTIVES

1. Post graduates will as competent structural engineer by acquiring state of the art knowledge in structural analysis and design of various structural systems.

2. Post graduate will be capable of handling complex structural systems using latest analytical and design techniques and software.

3. Post graduate will have professional and ethical attitude blended with communication skill rendering himself as a team member as well as leader and have capability and spirit of lifelong learning to cope for global trends

PROGRAM OUTCOMES (POs):

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

M. Tech. (Structural Engineering)

SEM I													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PC	CEP131	Advanced Structural Analysis	3	-	-	3	30	10	60	-	-	100	3
PC	CEP132	Advanced Solid Mechanics	3	-	-	3	30	10	60	-	-	100	3
PC	SHP111	Numerical Methods For Structural Engineering	3	-	-	3	30	10	60	-	-	100	3
PE	CEP134	Program Elective I	3	-	-	3	30	10	60	-	-	100	3
PL	CEP135	Lab Practice-I		-	6	6	-	-	-	50	50	100	3
PS	CEP136	Seminar I	-	-	4	4	-	-	-	50	-	50	2
Audit Course I	SHP121	Audit Course I	-	-	-	-	30	20	50	-	-	50	0
	Total		**12**	**-**	**10**	**22**	**150**	**60**	**290**	**100**	**50**	**600**	**17**

LIST OF PROGRAM ELECTIVESLIST OF AUDIT COURSES

PROGRAM ELECTIVE I (CEP134)

A) Theory and Applications of Cement Composites
B) Theory of Structural Stability
C) Computer Methods for Structural Analysis
D) Structural Health Monitoring
E) Structural Optimization
F) Theory of Plates & Shells

AUDIT COURSES (SHP121)	
(A) English for Research Paper Writing	(B) Disaster Management
(C) Sanskrit for Technical Knowledge	(D)Value Education
(E) Pedagogy Studies	(F) Stress Management by Yoga
(G) Personality Development through Life Enlightenment Skills.	
(H) Constitution of India	

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M. Tech. (Structural Engineering)

SEM II													
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**						**Credits**
							Theory			**Practical**		**Total**	
			Theory Hrs /week	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
PC	CEP231	FEM in Structural Engineering	3	-	-	3	30	10	60	-	-	100	3
PC	CEP232	Structural Dynamics	3	-	-	3	30	10	60	-	-	100	3
PC	CEP233	Earthquake Resistant Structures	3	-	-	3	30	10	60	-	-	100	3
PE	CEP234	Program elective II	3	-	-	3	30	10	60	-	-	100	3
MC	SHP221	Research Methodology	-	-	-	-	30	20	-	-	-	50	2
PL	CEP235	Lab Practise-II	-	-	6	6	-	-	-	50	50	100	3
Seminar II	CEP236	Seminar II	-	-	4	4	-	-	-	50	-	50	2
	Total		**12**	**00**	**10**	**22**	**150**	**60**	**240**	**100**	**50**	**600**	**19**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE II (CEP234)	
A) Advanced Steel Design	B) Design of Formwork
C) Design of High Rise Structures	D) Design of Masonry Structures
E) Design of Advanced Structures	F) Advanced Design of Foundations
G) Soil Structure Interaction	H) Design of Industrial Structure

M. Tech. (Structural Engineering)

SEM III*

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PE	CEP331	Program Elective III	3	-	-	3	30	10	60	-	-	100	3
OE	SHP321	Open Elective	3	-	-	3	30	10	60	-	-	100	3
PROJ	CEP332	Dissertation Stage I	-	-	20	20	-	-	-	100	-	100	10
	Total		**06**	**00**	**20**	**26**	**20**	**60**	**120**	**100**	**-**	**300**	**16**

***Students going for Industrial Project/Thesis will complete these courses through MOOCs.**

PROGRAM ELECTIVE III (CEP 331)	**OPEN ELECTIVE**(SHP321)
(A) Design of Prestressed Concrete structures	(A) Business Analytics(ME)
(B) Analysis of Laminated Composite Plates	(B)Industrial Safety (ME)
(C) Fracture Mechanics of Concrete Structures	(C) Operations Research (ME)
(D) Design of Plates and Shells	(D) Cost Management of Engineering Projects (CE)
	(E) Composite Materials (ME)
	(F) Waste to Energy (CE)
	(G) Finance Management (EE)
	(H) Project Management (EE)
	(I) Data Structure & Algorithms (CS)
	(J) Any other course offered by BOS

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SEM IV*

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	TA	MSE	ESE	ICA	ESE		
PROJ	CEP432	Dissertation Stage II	-	-	32	32	-	-	-	200	200	400	16
	Total		**-**	-	**32**	**32**	-	-	-	**200**	**200**	**400**	**16**

Equivalence Scheme

M.Tech (Structural Engineering)

Course in old Scheme				Equivalence course in new scheme		
Sr. No.	Course code with Name of course(old)		Credit	Course code with Name of course (new)		Credit
1.	SHP101	Engineering Mathematics	4	SHP111	Numerical Methods For Structural Engineering	3
2.	CEP101	Theory of Plates & Shells	4	CEP134(F)	Program Elective I -Theory of Plates & Shells	3
3.	CEP102	Computer Methods Of Structural Analysis	4	CEP134 (C)	Program Elective I- Computer Methods of Structural Analysis	3
4.	CEU103	Advanced Structural Analysis	4	CEP131	Advanced Structural Analysis	3
5.	CEP107	Structural Dynamics	4	CEP232	Structural Dynamics	3
6.	CEP105	Lab Practice-I	4	-----	No Equivalence	-----
7.	CEP106	Seminar I	1	CEP136	Seminar I	2
9	CEP201	Finite Element Method	4	CEP231	FEM in Structural Engineering	3
10	CEP202	Advanced design of Steel & RC structures	4	-----	No Equivalence	----
11	CEP208	Theory of Elasticity and Plasticity	4	CEP132	Advanced Solid Mechanics	3
12	CEP204 (A)	Elective-I Prestressed Concrete	4	CEP331 (A)	Program Elective III- Design of Prestressed Concrete Structures	3
13	CEP204 (B)	Elective-I Structural	4	CEP134 (B)	Program Elective I- Theory of	3

		Stability			Structural stability	
14	CEP204 (C)	Elective-I Experimental Stress Analysis	4	-----	No Equivalence	-----
15	CEP205 (A)	Elective-II Earthquake Resistant Structures	4	CEP233	Earthquake Resistant Structures	3
16	CEP205 (B)	Elective II - Design of Environmental Structures	4	-----	No Equivalence	-----
17	CEP205 (C)	Soil Structure Interaction	4	CEP234 (G)	Program Elective II- Soil structure Interaction	3
18	CEP206	Lab Practice-II	4	-----	No Equivalence	-----
19	CEP207	Seminar II	1	CEP236	Seminar II	2
20	CEP301	Dissertation Phase I	10	CEP332	Dissertation Stage I	10
21	CEP401	Dissertation Phase II	30	CEP432	Dissertation Stage II	16
22	---	No Equivalence	---	SHP121	Audit Course I	0
23	---	No Equivalence	----	SHP221	Research Methodology	2
24	---	No Equivalence	---	SHP321	Open Elective	3
25	---	No Equivalence	----	CEP135	Lab Practice-I	3
26	---	No Equivalence	-----	CEP235	Lab Practice -II	3
27	---	No Equivalence	----	CEP134(A)	Program Elective I-Theory and Applications of Cement Composites	3
28	---	No Equivalence	---	CEP134(D)	Program Elective I: Structural Health Monitoring	3
29	---	No Equivalence	---	CEP134(E)	Program Elective I: Structural Optimization	3
30	---	No Equivalence	---	CEP234 (A)	Program Elective II: Advanced Steel Design	3

31	---	No Equivalence	---	CEP234 (B)	Program Elective II: Design of Formwork	3
32	---	No Equivalence	---	CEP234 (C)	Program Elective II: Design of High Rise Structures	3
33	---	No Equivalence	---	CEP234 (D)	Program Elective II: Design of Masonry Structures	3
34	---	No Equivalence	---	CEP234 (E)	Program Elective II: Design of Advanced Structures	3
35	---	No Equivalence	---	CEP234 (F)	Program Elective II: Advanced Design of Foundations	3
36	---	No Equivalence	---	CEP234 (H)	Program Elective II: Design of Industrial Structure	3
37	---	No Equivalence	---	CEP331 (B)	Program Elective III: Analysis of Laminated Composite Plates	3
38	---	No Equivalence	---	CEP331 (C)	Program Elective III: Fracture Mechanics of Concrete Structures	3
39	---	No Equivalence	---	CEP331 (D)	Program Elective III: Design of Plates and Shells	3

CEP131: ADVANCED STRUCTURAL ANALYSIS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study analysis of Virendeel Girder and Plane Frames using Cantilever Moment Distribution
II. To study analysis of beams on elastic foundation, beams curved in plan, and beams subjected to torsion
III. To study analysis of multistory frames by Approximate Methods
IV. To study applications of Energy Theorems and Rayleigh-Ritz Method in structural analysis

Course Contents:

Cantilever moment distribution method: Application to parallel chord Virendeel girder, rigid jointed plane frames by cantilever moment distribution method

Beams on elastic foundation: Governing differential equation, solution for finite and infinite beams, energy methods

Approximate methods of analysis: a) Portal Method, b) Cantilever Method, c) Factored Method.

Analysis of beams curved in plan.

Energy theorems: Energy and complementary energy, total potential energy of structures, minimum potential energy theorem,

Rayleigh-Ritz approach: Application to beams using power series and trigonometric series.

Torsion: Saint Venant torsion theory, membrane analogy, torsion of thin walled open section, pure twist of thin walled tubes of one cell and multiple cells, Shear center of Thin walled beam section

Reference Books:

1. Basic Structural Analysis, Reddy C. S., 2nd edition, Tata McGraw Hill, New Delhi, 2004.
2. Energy Principles of Structural Mechanics, T. R. Taucher, 2nd edition., McGraw- Hill, 1974
3. Advanced Mechanics of Material, R. D. Cook and W. C. Young, 2nd edition., Prentice - Hall Inc., 1999
4. Elementary Structural Analysis, Utku, Norris and Wilbur, 4th edition, McGraw Hill Inc, 1991
5. Structural Analysis, R. C. Hibbler, 4th edition, Prentice Hall of India Pvt., Ltd. Publications,1999
6. https://www.youtube.com/c/drsuchitahirde/videos

Course Outcomes:

On successful completion of this course students will be able to

CEP131.1:analyse Virendeel Girder and Plane Frames using Cantilever Moment Distribution.

CEP131.2:analyse beams on elastic foundation, beams curved in plan, and beams subjected to torsion

CEP131.3: analyzemultistory frames using Portal Method, Cantilever Method and Factor Method

CEP131.4: apply Energy Theorems and Rayleigh-Ritz Method in structural analysis

CEP132: ADVANCED SOLID MECHANICS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To Define and Illustrate Elastic and Plastic behavior of material and associated terms.

II. To Solve 2-D and 3-D state of Stress and strain problems in Elasticity

III. To Choose appropriate coordinate system viz. Cartesian coordinate system or Polar coordinate system and to solveelasticity problems

IV. To identify suitable Yield criteria to represent plastic behaviour

V. To establish plastic stress strain relations

Course Contents:

Elastic behaviour of engineering materials: Stress and strain, Components of stress and strainsin three-dimensional structural model. Generalized Hook's law, Elastic constants

Plane stress and plane strain problems in elasticity: Principal stresses and principal strains, Compatibility of stress and strains, Equilibrium equations and compatibility equations, Boundary conditions, Stress function, End effects, Saint Venant principle, solution of problems by polynomials, Determination of displacements, Solutions of simple problems of flexure of two-dimensional structures. Solutions of problems in Fourier series

General equations in polar coordinates: Stress distribution symmetrical about axis, Strain components in polar coordinates, Stresses in circular disc, Concentrated loads and couples on structures and surfaces.

Differential equations of equilibrium: conditions of compatibility in three dimensional stress field, principles of superposition, strain energy theorems, Castigliano theorem, principle of virtual work. Uniqueness of solutions

Basic experiments: monotonic tension and compression test, loading-unloading reloading types, loading-unloading reverse loading type, their observations, definitions of nominal stress, strain, true stress, natural strain etc. and their relations, Bauschinger's effects, strain hardening, stress-strain curves, their empirical equations.

Stress and strain tensors: Principal stresses and strains, stress and strain invariants, maximum and octahedral shear stresses and strains, stress and strain deviator tensor

Definition of yield criteria: On II-plane, C -curve etc., various yield criteria like Rankines, Saint-Venant's, Trescas and Von mises and their two dimensional representation.

Subsequent yield surfaces: Isometric and kinematic hardening, plastic work, Prandtl-Renss equations, plastic stress-strain relations.

Recommended Books:

1. 1.Theory of Elasticity, Timoshenko and Goodier, 3rd edition, McGraw-Hill International Book Company, 1995
2. Plasticity, Theory and Application, Alexander Mendeson, Macmillan, 1968
3. Applied Elasticity, Chi Teh Wang, McGraw-Hill Book Company, 1953
4. Elasticity in Engineering, Ernest E Sechler, Dover Publications, 1952
5. Engineering Plasticity, R. Calladine, Pergamon Press, 1968
6. Plasticity for Structural Engineers, W.F. Chen and D. J. Han, Springer- Verlag, 1987
7. Theory of Plasticity, J Chakrabarti, 1st Edition, McGraw-Hill Book Company, 1988

Course Outcomes:

On successful completion of this course students will be able to:

CEP132.1: define and Illustrate Elastic and Plastic behavior of material and associated terms.

CEP132.2:solve 2-D and 3-D state of Stress and strain problems in Elasticity

CEP132.3: choose appropriate coordinate system viz. Cartesian coordinate system or Polar coordinate system and to solve elasticity problems

CEP132.4: identify suitable Yield criteria to represent plastic behaviour

CEP132.5: establish plastic stress strain relations

SHP111: NUMERICAL METHODS FORSTRUCTURAL ENGINEERING

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To understand the numerical techniques to solve simultaneous equations, ordinary differential equation and definite integrals.

II. To analyze the industrial problems with the help of optimization techniques.

III. To understand the numerical techniques to solve partial differential equation.

IV. To impart the knowledge of numerical techniques to linear algebra.

Course Contents:

Fundamentals of Numerical Methods:

Error analysis: absolute, relative and percentage error.

Solution of algebraic and transcendental equations: Newton Raphson method, Regula-falsi method , simultaneous nonlinear equations using Newton Raphsonmethod;Solution of linear system of equations by Gauss elimination method, Gauss Siedal method, Gauss Jordan method.

Numerical differentiation and integration: Numerical differentiationby Newton's forward difference formula, Newton's divided difference formula, Numerical integration byTrapezoidal rule, Simpson'sone-thirdandthreeighthrule,Weddle'srule.

Numerical solution of ordinary differential equation: Taylor's series method,Euler's method, Euler's modified method,numerical solution of 1^{st} ,2^{nd} order & two simultaneous 1^{st} order differential equations by RungeKutta method of 4^{th} order.

Elements of matrix algebra: Standard & general Eigen value problem, Power iteration method, Jacobi method

Numerical solution of partial differential equations:

Solution of boundary value problems

i) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=0$ and ii) $\frac{\partial^2 u}{\partial x^2}+\frac{\partial^2 u}{\partial y^2}=-f(x,y)$ using Liebmann's process.

Solution of boundary value problems

iii) $\frac{\partial^2 u}{\partial t^2}=c^2\frac{\partial^2 u}{\partial x^2}$ iv) $\frac{\partial u}{\partial t}=c^2\frac{\partial^2 u}{\partial x^2}$ using Benders iteration process.

Reference Books:

1. Theory and Problems in Numerical Methods, T.Veerarajan and T.Ramchandran, Tata McGraw-Hill,2004
2. An Introduction to numerical Analysis by Atkinson K.E.,J.Wiley and sons,1989
3. Theory and problems of Numerical Analysis by Scheid F.,McGraw Hill book company(Shaum series)1988.
4. Introductory methods of Numerical Analysis by S.S.Sastry,Prentice Hall of India,1989
5. Higher Engineering Mathematics, B.S.Grewal, 6th edition, Khanna Publication, , NewDelhi, 1976.

Course Outcomes:

On successful completion of this course students will be able to

CEP133.1 apply the numerical techniques to solve simultaneous equations, ordinary differential equation and definite integrals.

CEP133.2 analyze the industrial problems with the help of optimization techniques.

CEP133.3 apply the numerical techniques to solve partial differential equation.

CEP133.4 apply the knowledge of numerical techniques to linear algebra.

PROGRAM ELECTIVES I

CEP134 (A)THEORY AND APPLICATIONS OF CEMENT COMPOSITE

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To study various composite materials, their mechanical behavior and theories applicable to such materials.

II. To study micro and macro mechanical behavior of cement composites used in practice.

III. To study the applications of cement composites in modern construction industry.

IV. To analyze and design structural elements made of cement composites.

Course Contents:

Introduction: Classification and Characteristics of Composite Materials- Basic Terminology, Advantages. Stress-Strain Relations- Orthotropic and Anisotropic Materials, Engineering Constants for Orthotropic Materials, Restrictions on Elastic Constants, Plane Stress Problem, Biaxial Strength, Theories for an Orthotropic Lamina.

Mechanical Behaviour: Mechanics of Materials Approach to Stiffness- Determination of Relations between Elastic Constants, Elasticity Approach to Stiffness- Bounding Techniques of Elasticity, Exact Solutions - Elasticity Solutions with Continuity, Halpin, Tsai Equations, Comparison of approaches to Stiffness.

Cement Composites: Types of Cement Composites, Terminology, Constituent Materials and their Properties, Construction Techniques for Fibre Reinforced Concrete - Ferrocement,SIFCON, Polymer Concretes, Preparation of Reinforcement, Casting and Curing.

Mechanical Properties of Cement Composites:Behaviorof Ferro cement, Fiber ReinforcedConcrete in Tension, Compression, Flexure, Shear, Fatigue and Impact, Durability and Corrosion.

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

Analysis and Design of Cement Composite Structural Elements –Ferrocement, SIFCONandFibre Reinforced Concrete.

Reference Books:

1. Mechanics of Composite Materials, Jones R. M,, 2nd Ed., Taylor and Francis,BSP Books, 1998.
2. Ferro cement – Theory and Applications, Pama R. P., IFIC, 1980.
3. New Concrete Materials, Swamy R.N., 1stEd., Blackie, Academic and Professional, Chapman & Hall, 1983.

Course Outcomes

On successful completion of this course students will be able to

CEP134(A).1: understand the characteristics of composites and classify them according to orthotropic and anisotropic behavior.

CEP134(A).2:understand micro and macro- mechanical behavior of cement composites.

CEP134(A).3: learn the various applications of cement composites in modern construction industry.

CEP134(A).4: apply design procedures to structural elements made up of cement composites.

CEP134 (B) THEORY OF STRUCTURAL STABILITY

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To determine stability of columns and frames

II. To determine stability of beams and plates

III. To use stability criteria and concepts for analyzing discrete and continuous systems.

Course Contents:

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

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

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

Stability of Beams: lateral torsion buckling.

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

Introduction to Inelastic Buckling and Dynamic Stability

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

CEP134(B).1: Determine stability of columns and frames

CEP134(B).2: Determine stability of beams and plates

CEP134(B).3: Use stability criteria and concepts for analyzing discrete and continuous systems.

CEP134 (C) COMPUTER METHODS OF STRUCTURAL ANALYSIS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study analysis of the skeleton structures using flexibility method.

II. To study use of direct stiffness method in analysis of the skeleton structures and understanding its limitations. To study analysis of the skeleton structures using member approach of stiffness method.

III. To understand application of finite difference method to beam bending problems.

Course Contents:

Flexibility method (Structure approach): Flexibility coefficients, physical Meaning, basic determinate or released structure, choice of redundant, Geometrical compatibility conditions, Matrix formulations, Hand Solution of simple problems on truss. Beams, plane rigid jointed frames without axial deformation

Stiffness methods (structure approach): Stiffness co-efficient, restrained structure, Unknown displacements, Joint equilibrium conditions, Hand solution of simple problems on beam, plane rigid jointed frames without axial deformation.

Stiffness methods (member approach): General strategy,stiffness matrix assembly process, structure stiffness matrices, hand solution of simple problems on beam, plane rigid jointed frames without axial deformation.

Stiffness Method applied to Large Frames: Local Coordinates and Global Coordinates, Forces and displacement referred to member and structure axes, Memory problems in large structural systems: In core and out core Techniques, half band storage and solution, SK line storage and solution. Tri-diagonalisation, partial and full block elimination, Tape operations, frontal technique, Sub-structure method

Finite Difference Method: Application of finite difference method to beam bending problems

Computer Programs: (FORTRAN/C Language)

Flow chart and computer programs for member based stiffness method – Data preparations, Various alternative, Displacement code, half band width, calculation of forces.

Recommended Books:

1. Matrix Methods of Structural Analysis, Dr A.S. Meghre and S. K. Deshmukh, Charotar Publishing House, Anand, India, 2003.

2. Structural Analysis, A Matrix Approach: G. S. Pandit and S. P. Gupta, Tata McGrow Hill Publishing Company Limited, New Delhi, 1986.
3. Analysis of framed structures: James M. Gere and William Weaver Jr., D Van Nostrand Company Inc., Affiliated East West Press Pvt. Ltd., 1965.
4. Matrix, Finite Element, Computer and Structural Analysis: M. Mukhopadhyay, Third Edition, Oxford &IBH publishing Co. Pvt. Ltd. 1993.
5. https://www.youtube.com/c/drsuchitahirde/videos

Course Outcomes:

On successful completion of this course students will be able to

CEP134(C).1:analyze the skeleton structures using flexibility method.

CEP134(C).2:analyze the skeleton structures using structure approach and member approach of stiffness method.

CEP134(C):3:determine deflection in beams using finite difference method.

CEP134 (D) STRUCTURAL HEALTH MONITORING

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min

Course Objectives:

I. To diagnosis the distress in the structure understanding the causes and factors.

II. To assess the health of structure using static field methods.

III. To assess the health of structure using dynamic field tests.

IV. To suggest repairs and rehabilitation measures of the structure

Course Contents:

Structural Health: Factors affecting Health of Structures, Causes of Distress, Regular Maintenance.

Structural Health Monitoring: Concepts, Various Measures, Structural Safety in Alteration.

Structural Audit: Assessment ofHealth ofStructure, Collapse andInvestigation, InvestigationManagement, SHM Procedures.

Static Field Testing: Types ofStatic Tests, Simulation and Loading Methods, sensor systems andhardware requirements,Static Response Measurement.

Dynamic Field Testing: Types ofDynamic Field Test, Stress History Data, Dynamic ResponseMethods, Hardware for Remote Data Acquisition Systems, Remote Structural Health Monitoring.

Introduction to Repairs andRehabilitations ofStructures: Case Studies (Site Visits), piezo–electric materials and other smart materials, electro–mechanical impedance (EMI) technique,adaptations of EMI technique.

Reference Books:

1. Structural Health Monitoring, Daniel Balageas, Claus_PeterFritzen, Alfredo Güemes, John Wiley and Sons, 2006.
2. Health Monitoring of Structural Materials and Components Methods with Applications, Douglas E Adams, John Wiley and Sons, 2007.
3. Structural Health Monitoring and Intelligent Infrastructure, Vol1, J. P. Ou, H. Li and Z. D. Duan, Taylor and Francis Group, London, UK, 2006.
4. Structural Health Monitoring with Wafer Active Sensors, Victor Giurglutiu, Academic Press Inc, 2007.

Course Outcomes:

On successful completion of this course students will be able to

CEP134(D).1: Diagnosis the distress in the structure understanding the causes and factors.

CEP134(D).2: Assess the health of structure using static field methods.

CEP134(D).3: Assess the health of structure using dynamic field tests.

CEP134(D).4: Suggest repairs and rehabilitation measures of the structure

CEP134 (E) STRUCTURAL OPTIMIZATION

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To learn basic concept of optimization and use variational principle for optimization in structural engineering.

II. To study various optimization methods.

III. To apply suitable optimization method to the problems of trusses and frames.

Course Contents:

Introduction: Simultaneous Failure Mode andDesign, ClassicalExternalProblems.

Calculus ofVariation: Variational Principles withConstraints,

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

Geometric ProgrammingandStochastic Programming.

Applications: Structural Steel andConcrete Members, Trusses andFrames.

Design: Frequency Constraint, Design ofLayouts.

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

CEP134(E).1: understand the use of variational principle for optimization in structural engine

CEP134(E).2: comprehend various optimization methods.

CEP134(E).3: apply linear programming and geometric programming methods for optimization of trusses and frames.

CEP134 (F) THEORY OF THIN PLATES AND SHELLS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs.30 mion.

Course Objectives:

I. To use analytical methods for the solution of thin plates and shells.

II. To use analytical methods for the solution of shells.

III. To apply the numerical techniques and tools for the complex problems in thin plates.

IV. To apply the numerical techniques and tools for the complex problems in shells.

Course Contents:

Plates: Classification-Thin and thick plates, small and large deflections, Assumptions in theory of thin plates with small deflection, Governing Differential equation in Cartesian coordinates, moment curvature relations, stress resultants.

Rectangular plates: Navier solution for plates with all edges simply supported, Distributed loads, Point loads, rectangular patch load, Green function.

Rectangular plates: Levy's method, Distributed load, line load

Energy method: Minimum potential theorem, Rayleigh-Ritz approach for simple cases.

Circular Plates: Governing differential equation in Polar coordinates, Axi-symmetric situation, moment curvature relations, simply supported and fixed edge, distributed load, line load, linearly varying load.

Shells: Introduction to thin shell theory, classification on shell geometry, equation to shell surfaces, stress resultants, stress-displacement relations, compatibility Conditions, equilibrium equations.

Circular cylindrical shells: Membrane theory

Bending theory for circular-cylindrical shell: Design procedure

Shell of revolution: Membrane theory, spherical and conical shells with axisymmetric loading.

Simple methods: Analysis and design for conical and hyperbolic paraboloid shells

Reference Books

1. Theory of Plates and Shells, S. P. Timoshenko and W. Kriger, 2nd edition, TMH,
1. 1987.
2. Elementary Theory of Plates, L. G. Jaeger, Macmillan, 1964.
3. Analysis of Plates, Szilard Rudolp, PHI, 1974
4. Design and Construction of Concrete Shell Roofs, G. S. Ramaswamy, CBS, 1986.

Course Outcomes:

On successful completion of this course students will be able to

CEP134(F).1: Use analytical methods for the solution of thin plates and shells.

CEP134(F).2: Use analytical methods for the solution of shells.

CEP134(F).3: Apply the numerical techniques and tools for the complex problems in thin plates.

CEP134(F).4: Apply the numerical techniques and tools for the complex problems in shells.

CEP135 - LAB PRACTICE- I

Teaching Scheme: 06 P **Total = 06** **Credit : 03**

Evaluation Scheme: Internal-50 **External = 50** **Total Marks: 100**

LAB PRACTICE- I

Course Objectives:

I. To design high grade concrete and study the parameters affecting its performance.

II. To conduct Non Destructive Tests on existing concrete structures.

III. To apply engineering principles to understand behavior of structural/ elements.

List of Experiments/Assignments:

1. Study of stress-strain curve of high strength concrete, Correlation between cube strength, cylinder strength, split tensile strength and modulus of rupture.
2. Effect of cyclic loading on steel.
3. Non-Destructive testing of existing concrete members.
4. Behavior of Beams under flexure, Shear and Torsion.

Course Outcomes:

On successful completion of this course students will be able to:

CEP135.1: Design high grade concrete and study the parameters affecting its performance.

CEP135.2: Conduct Non Destructive Tests on existing concrete structures.

CEP135.3: Apply engineering principles to understand behavior of structural/ elements.

Online sources

1. https://www.nde-ed.org
2. https://www.youtube.com/watch?v=JGQnbwxPiFA

CEP136 –SEMINAR-I

Teaching Scheme: 04 P Total 04 **Credit: 02**

Evaluation Scheme: Internal -50 **Total Marks: 50**

Course Objectives:

I. To review the literature(research papers, relevant books and internet) to identify topic from structural engineering.
II. To develop technical report writing skills.
III. To improve the presentation skills on technical matters.
IV. To enhance critical thinkingabilities.

Individual students are required to choose a topic of their interest from related topics to the stream of specialization, preferably from outside the M. Tech. curriculum. The students are required to review literature on the topic and deliver seminar. A committee consisting of at least three faculty members (preferably specialized in the respective stream headed by HOD wherein guide should be one of the members) shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two copies of a report of seminar. The seminar report shall not have any plagiarized content (all sources shall be properly cited or acknowledged). One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other shall be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation. It is encouraged to do simulations/ experimentation related to the chosen topic and present the results at the end of the semester.

Course Outcomes:

On successful completion of this course students will be able to

CEP136.1:review the literature(research papers, relevant books and internet) to identify topic from structural engineering.

CEP136.2: develop technical report writing skills.

CEP136.3: improve the technical presentation skills.

CEP136.4: enhance critical thinkingabilities.

SHP121 AUDIT COURSES

SHP121(A) ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

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

II. Learn about what to write in each section

III. Understand the skills needed when writing a Title

IV. Ensure the good quality of paper at very first-time submission

Course Contents:

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

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

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,

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

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

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

SHP121(B) DISASTER MANAGEMENT

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

IV. 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:

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

DisasterPreparednessAndManagement:

Preparedness: monitoringof phenomenaTriggeringADisasterOrHazard, EvaluationOfRisk:Applicationof Remote Sensing,DataFromMeteorologicalAnd OtherAgencies,Media Reports: GovernmentalAndCommunity preparedness

Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging, Trends In Mitigation. Structural Mitigation and Non-StructuralMitigation, Programs of Disaster Mitigation in India

Reference Books:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, PardeepEt.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.

SHP121(C) SANSKRIT FOR TECHNICAL KNOWLEDGE

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

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

Course Contents:

Alphabets in Sanskrit,Past/Present/Future Tense,Simple Sentences

Order, Introduction of roots, Technical information about Sanskrit Literature

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

References books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(C).1:Understand basic Sanskrit language

SHP121(C):2 Ancient Sanskrit literatures about science & technology can be understood

SHP121(C):3Being a logical language will help to develop logic in students

SHP121(D)VALUE EDUCATION

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

I. Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

Course Contents:

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

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

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

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

Reference Books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(D).1:Knowledge of self-development

SHP121(D).2: Learn the importance of Human values

SHP121(D).3: Developing the overall personality

SHP121 (E) PEDAGOGY STUDIES

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

I. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

II. Identify critical evidence gaps to guide the development.

Course Contents:

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.

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

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.

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

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

References books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal ofCurriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher educationResearch project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning ofBasic maths and reading in Africa: Does teacher preparation count? International JournalEducational 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.

Course Outcomes:

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

SHP121(E).1 What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

SHP121(E).2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

SHP121(E).3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

SHP121(F) STRESS MANAGEMENT BY YOGA

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives

I. To achieve overall health of body and mind
II. To overcome stress

Course Contents:

Definitions of Eight parts of yog(Ashtanga)

Yam and Niyam

Do`s and Don'ts's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Reference Books:

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

Course Outcomes:

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

SHP121(F).1:Develop healthy mind in a healthy body thus improving social health also

SHP121(F).2:Improve efficiency

SHP121(G) PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives

I. To learn to achieve the highest goal happily
II. To become a person with stable mind, pleasing personality and determination
III. To awaken wisdom in students

Course Contents:

Neetisatakam-Holistic development of personality

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

Approach to day to day work and duties.

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

Statements of basic knowledge.

ShrimadBhagwadGeeta: Chapter2-Verses 56, 62, 68, Chapter 12 -Verses 13, 14, 15, 16,17, 18

Personality of Role model.ShrimadBhagwadGeeta:Chapter2-Verses 17, Chapter 3-Verses 36,37,42,Chapter 4-Verses 18, 38,39, Chapter18 – Verses 37,38,63

References

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

Course Outcomes:

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

SHP121(G).1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

SHP121(G).2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity

SHP121(G).3: Study of Neetishatakam will help in developing versatile personality of students.

SHP121(H) CONSTITUTION OF INDIA

Teaching Scheme: 00TH + 00 T **Total = 00** **Credit : 0**

Evaluation Scheme: 30 MSE + 20TA **Total Marks: 50**

Course Objectives:

I. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
II. To address the growth of Indian opinion regarding modern Indian intellectualsConstitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
III. To address the role of socialism in India after the commencement of the BolshevikRevolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Contents:

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

Philosophy of the Indian Constitution: Preamble, Salient Features

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.

Organs of Governance: ParliamentComposition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions

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

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

Reference Books:

1. The Constitution of India, 1950 (Bare Act), Government Publication
2. Framing of Indian Constitution, Dr. S. N. Busi, Dr. B. R. Ambedkar, 1st Edition, 2015

3. Indian Constitution Law, M. P. Jain, 7thEdn., Lexis Nexis, 2014
4. Introduction to the Constitution of India, D.D. Basu, Lexis Nexis, 2015

Course Outcomes:

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

SHP121(H).1: Discuss the growth of the demand for civil rights in India for the bulk of Indians before thearrival of Gandhi in Indian politics.

SHP121(H).2: Discuss the intellectual origins of the framework of argument that informed the conceptualizationof social reforms leading to revolution in India.

SHP121(H).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 directelections through adult suffrage in the Indian Constitution.

SHP121(H).4: Discuss the passage of the Hindu Code Bill of 1956.

CEP231 :FINITE ELEMENT METHOD IN STRUCTURAL ENGINEERING

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To provide fundamental concepts of finite element method.

II. To learn the theory and characteristics of finite elements that represents engineering structures.

III. To apply finite element solution to structural engineering problem.

IV. To use Finite element analysis program/ software.

Course Contents:

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

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

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

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

Application to Solid Mechanics: Plane Stress, CST Element, Plane Strain Rectangular Element, Isoparametric Formulation of the Plane Quadrilateral Element, Axi- Symmetric Stress Analysis, Strain and Stress Computations.

Computer Implementation of FEM procedure, Pre-Processing, Solution, Post-Processing, Use of Commercial FEA Software

Reference Books:

1. Finite Element Analysis, Seshu P., Prentice-Hall of India,2005.
2. Concepts and Applications of Finite Element Analysis, Cook R. D., Wiley J., New York, 1995.
3. Fundamentals of Finite Element Analysis, Hutton David, Mc-Graw Hill, 2004.
4. Finite Element Analysis, Buchanan G.R., McGraw Hill Publications, New York, 1995.
5. Finite Element Method, ZienkiewiczO.C.& Taylor R.L. Vol. I, II & III, Elsevie

Course Outcomes:

On successful completion of this course students will be able to

CEP231.1: understand the concept behind the formulation method in FEM.

CEP231.2: identify the application and characteristics of finite elements such as beam, bar, plane and isoparametric elements.

CEP231.3: derive constitutive relations and solve structural engineering problem.

CEP231.4: execute the finite element analysis program/ software.

CEP232 : STRUCTURAL DYNAMICS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To define and understand Single Degree of Freedom (SDoF) System, Multi Degree of Freedom (MDoF) System and associated terms.
II. Analyse and find response of Damped and Un-damped Single Degree of Freedom system using numerical and classical methods.
III. To demonstrate behaviour of Damped and Un-damped Multi Degree Freedom System and derive its response in frequency and time domain.
IV. To derive response of continuum system

.COURSE CONTENTS:

Single degree freedom system: Free vibrations, damped free vibrations, critical damping, and response, periodic loading expressed in harmonics, dynamic load factor

Single degree freedom system: Response to impulsive loading, rectangular, triangular pulses, Duhamel Integral, Response to general dynamic loading, Numerical schemes such as Wilson-Theta, Newmark-Beta, constant linear acceleration, time domain and frequency domain analysis.

Multi-degree freedom system: stiffness and flexibility approaches, Lumped-mass matrix, free vibrations fundamental Frequencies and mode shapes, orthogonality of modes, numerical schemes to find mode shapes and frequencies.

Multi degree freedom systems: response to dynamic loading, Formulations of equations of motion, normal coordinates mode superposition method, modal matrix, numerical scheme of Wilson and Newmark.

Distributed systems: free vibrations of uniform beams, differential equation and Solution, boundary conditions, finite difference solution, finite element, Ritz approach, free vibrations of simply supported plate. (Transverse vibrations)

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

CEP232.1:define and understand Single Degree of Freedom (SDoF) System, Multi Degree of Freedom (MDoF) System and associated terms.

CEP232.2: analyse and find response of Damped and Un-damped Single Degree of Freedom system using numerical and classical methods.

CEP232.3:demonstrate behaviour of Damped and Un-damped Multi Degree Freedom System and derive its response in frequency and time domain.

CEP232.4:derive response of continuum system

CEP233 : EARTHQUAKE RESISTANT STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 Credits: 03

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand seismology and seismic codes.

II. To conceptualize earthquake resistant design of structure.

III. To study analysis, design and detailing of earthquake resistant reinforced concrete buildings.

Course Contents:

Seismology: Causes of Earthquake, the Earth and its interior, Circulations, plate tectonics, faults, seismic waves, Strong ground motions, characteristics of strong ground motions. Measurement of Earthquake: Magnitude, Intensity, Richter scale measurement of earthquake, accelerograph, accelerogram, wave measuring instruments, other modern methods of earthquake measurement. Recording and analysis of earthquake records, Numerical Problems

Indian Seismic Codes:

Seismic zones in India, Seismic design philosophy for buildings, I.S. – 1893: 2016 (Part I), Structural response to earthquake, Seismic analysis of multistoried building frames by equivalent static analysis, response spectrum analysis and elastic time history analysis. Numerical Problems

Study of I.S. – 1893: 2016 (Part II): Introduction to Seismic Analysis of Water Tanks.

Earthquake Resistant Design of Structures: Concept, Earthquake Resistant Planning of structures: Guidelines for achieving efficient earthquake resistant building, I.S. selection of sites, importance of architectural features in earthquake resistant building, twisting of building, geotechnical design considerations.

Reinforced Concrete Buildings: Seismic effects, resistance and ductile detailing in RC building elements: Beams, Columns, Beam-Column joints, Footing, Shear Walls. (No mathematical treatment), Seismic design considerations for open ground storey, Short column effect. Special aspects in multistoried buildings, Structural response to earthquake (No mathematical treatment). Ductile detailing using IS-13920: 2015, Design strategy, strength, ductility of reinforced concrete members. (No mathematical treatment). Elasto-Plastic analysis of structures, Introduction toNONLIN software

Reference Books:

1. IS 1893:2016, Criteria for Earthquake Resistant Design of Structures, Part I, Bureau of Indian Standards, New Delhi, 2016.
2. IS 13920: 2015, Ductile Detailing of Reinforced Concrete Structures subjected to Seismic forces

- Code of practice, Bureau of Indian Standards, New Delhi, 1993.

3. Earthquake Design Practice for buildings, Davide Key, Thomas Telford Ltd., London, First edition, 1988.
4. Seismic Design of Reinforced Concrete and Masonry Buildings, Paulay, T., M.J.N. Priestley, John Willey and Son's Publications, First edition ,1992
5. Handbook of seismic analysis and design of structure, FarzadNaiem
6. National Information Centre for earthquake engineering, Indian Institute of Technology Kanpur, www.nicee.org
7. Earthquake resistant Design of Structures, S. K. Duggal, Oxford University Press Publications, First edition, 2007
8. Earthquake resistant design of structures, PankajAgrawal and Manish Shrikhande, Prentice Hall of India Pvt, Ltd. Publications, 2006.
9. https://www.youtube.com/c/drsuchitahirde/videos

Course Outcomes:

On successful completion of this course students will be able to:

CEP233.1: understand seismology and seismic codes.

CEP233.2: conceptualize earthquake resistant design of structure.

CEP233.3:analyze, design and detailing of earthquake resistant reinforced concrete buildings.

PROGRAM ELECTIVE II

CEP234 (A) ADVANCED STEEL DESIGN

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To design steel structures/ components by different design processes.

II. Toanalyze and design beams and columns for stability and strength, and drift.

III. To design welded and bolted connections.

Course Contents:

Properties of Steel: Mechanical Properties, Hysteresis, Ductility.

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

Design of Steel Structures: Inelastic Bending Curvature, Plastic Moments, Design Criteria Stability, Strength, Drift.

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

Stability of Columns: Slenderness Ratio, Local Buckling ofFlangesandWeb, Bracing of Column about Weak Axis.

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

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

Drift Criteria: P Effect, Deformation Based Design;

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

Reference Books:

1. Design of Steel Structures - Vol. II, Ramchandra. Standard Book House, Delhi.
2. Design of Steel Structures, Hirde S. K , Hedaoo M. N., Narosa Publishing House, 2023
3. Design of Steel Structures - Arya A. S., Ajmani J. L., Nemchand and Bros., Roorkee.
4. The Steel Skeleton- Vol. II, Plastic Behaviour and Design - Baker J. F., Horne M. R., Heyman J., ELBS.
5. Plastic Methods of Structural Analysis, Neal B. G., Chapman and Hall London.
6. IS 800: 2007 – General Construction in Steel - Code of Practice, BIS, 2007.
7. SP – 6 - Handbook ofStructural Steel Detailing, BIS,1987

Online Sources

https://nptel.ac.in/courses/105/106/105106113/

https://www.youtube.com/watch?v=CNE4hk_SGTo&list=PLry0oTiKPxdWSdla5MeAGae69h6KMK1a3

https://www.youtube.com/c/drsuchitahirde/videos

Course Outcomes:

On successful completion of this course students will be able to

CEP234(A).1: Design steel structures/ components by different design processes.

CEP234(A).2:Analyze and design beams and columns for stability and strength, and drift.

CEP234(A).3:Design welded and bolted connections.

CEP 234(B) DESIGN OF FORMWORK

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To identify suitable formwork material such as timber, steel etc. to be used in specific situation.

II. To study and select the appropriate structural design concept for formwork used to support structural members such as beam, slab etc.

III. To design formwork for special structures and to study various types of flying formworks.

IV. To access the stability and safety of different temporary works.

Course Contents:

Introduction: Requirements andSelection of Formwork.

Formwork Materials: Timber, Plywood, Steel, Aluminum, Plastic, and Accessories, Horizontal and Vertical Formwork Supports.

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

Formwork Design for Special Structures: Shells, Domes, Folded Plates, Overhead WaterTanks, Natural Draft Cooling Tower, Bridges.

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

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

Reference Books:

1. Formwork for Concrete Structures, Peurify, McGraw Hill India, 2015.
2. Formwork for Concrete Structures, Kumar NeerajJha, Tata McGraw Hill Education, 2012.
3. IS 14687: 1999, Falseworkfor Concrete Structures - Guidelines, BIS.

Course Outcomes:

On successful completion of this course students will be able to:

CEP234(B).1: select proper formwork and accessories for formwork.

CEP234(B).2: design the formwork for beam, slab, column, wall and foundation

CEP234(B).3: design formwork for special structures.

CEP234(B).4: judge the stability and safety of formwork erected in different situations.

CEP234 (C) DESIGN OF HIGH RISE STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To analyse, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.

II. To analyse, design and detail the RC and Steel Chimney.

III. To analyse design and detail the tall buildings subjected to different loading conditions using relevant codes.

Course Contents:

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

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

Tall Buildings: Structural Concept, Configurations, various systems, Wind and Seismic loads, Dynamic approach, structural design considerations and IS code provisions. Firefighting design provisions

Applicationof software in analysis and design

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to:

CEP234(C).1: Analyze, design and detail Transmission/ TV tower, Mast and Trestles with different loading conditions.

CEP234(C).2: Analyze, design and detail the RC and Steel Chimney.

CEP234(C).3: Analyze, design and detail the tall buildings subjected to different loading conditions using relevant codes

CEP234 (D) DESIGN OF MASONRY STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To study properties of masonry units, their strengths and factors affecting strength.

II. To analyse reinforced masonry members for various types of loadings.

III. To provide knowledge of elastic and inelastic methods of analysis applicable to masonry structures.

Course Contents:

Introduction: Historical Perspective, Masonry Materials, MasonryDesign Approaches, Overview of Load Conditions, Compression Behavior of Masonry, Masonry Wall Configurations, Distribution ofLateral Forces.

Flexural Strengthof Reinforced Masonry Members: In planeand Out-of-plane Loading.

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

Shear Strengthand Ductility of Reinforced Masonry Members.

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

Elastic andInelastic Analysis, Modeling Techniques, Static PushOver Analysis and use of Capacity Design Spectra.

Reference Books:

1. Design of Reinforced Masonry Structures, NarendraTaly, ICC, 2nd Edn,
2. Masonry Structures: Behavior and Design, Hamid Ahmad A. and Drysdale Robert G., 1994.
3. Mechanics of Masonry Structures, Editor: Maurizio Angelillo, 2014.

Course Outcomes

On successful completion of this course students will be able to

CEP234(D).1: understand the properties of different masonry units, their strength and factors affecting strength.

CEP234(D).2: analyze, design and detail various types of reinforced masonry members, subjected to different loading systems.

CEP234(D).3: perform elastic and inelastic analysis for masonry walls.

CEP 234(E) DESIGN OF ADVANCED STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To analyse the special structures by understanding their behaviour.

II. To design and prepare detail structural drawings for execution citing relevant IS codes.

Course Contents:

Design philosophy, Modeling of Loads, Material Characteristics.

Reinforced Concrete - P-M, M-phi Relationships, Strut-and- Tie Method, Design of Deep Beam and Corbel, Design of Shear Walls, Compression Field Theory for Shear Design, Design against Torsion; IS, ACI and Eurocode.

Steel Structures -- Stability Design, Torsional Buckling - Pure, Flexural and Lateral, Design of Beam-Columns, Fatigue Resistant Design, IS code, AISC Standards and Eurocode.

Reference Books:

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

Online Sources

https://www.youtube.com/watch?v=undsd92MM8w&list=PLbQO4xhI7wEDIYv90NoF7veaJIohpuf0Q

Course Outcomes:

On successful completion of this course students will be able to:

CEP234(E).1:Analyze the special structures by understanding their behavior.

CEP 234(E).2: Design and prepare detail structural drawings for execution citing relevant IS codes.

CEP234 (F) ADVANCED DESIGN OF FOUNDATIONS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To decide the suitability of soil strata for different projects.

II. To design shallow foundations deciding the bearing capacity of soil.

III. To analyze and design the pile foundation.

IV. Tounderstand analysis methods for well foundation

Course Contents:

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

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

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.

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

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

Reference Books:

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

Online Sources

https://nptel.ac.in/courses/105/108/105108069/

https://www.youtube.com/watch?v=FVvmL2hUjH4&list=PLbMVogVj5nJQtuLxDm2M3KdUTuB4ZOdXT

Course Outcomes:

On successful completion of this course students will be able to

CEP 234(F).1: Decide the suitability of soil strata for different projects.

CEP 234(F).2: Design shallow foundations deciding the bearing capacity of soil.

CEP 234(F).3:Analyze and design the pile foundation.

CEP 234(F).4: Understand analysis methods for well foundation.

CEP234 (G) SOIL STRUCTURE INTERACTION

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand soil structure interaction concept and complexities involved.

II. To evaluate soil structure interaction for different types of structure

III. To prepare comprehensive design oriented computer programs for interaction problems

IV. To analyze different types of frame structure founded on natural deposits with linear and non-linear characteristics.

Course Contents:

Critical Study of Conventional Methods of Foundation Design, Nature and Complexities of Soil Structure Interaction

Application of Advanced Techniques of Analysis such as FEM and Finite Difference Method

Relaxation and Interaction for the Evaluation of Soil Structure Interaction for Different Types of Structure under various Conditions of Loading and Subsoil Characteristics

Preparation of Comprehensive Design Oriented Computer Programs for Specific Problems,

Interaction Problems based on Theory of Sub Grade Reaction Such as Beams, Footings, Rafts, etc.

Analysis of Different Types of Frame Structures Founded on Stratified Natural Deposits withLinear and Non-Linear Stress-Strain Characteristics

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

CEP234(G).1:understand soil structure interaction concept and complexities involved.

CEP234(G).2: evaluate soil structure interaction for different types of structure

CEP234(G).3: prepare comprehensive design oriented computer programs for interaction problems

CEP234(G).4: analyze different types of frame structure founded on natural deposits with linear and non-linear characteristics.

CEP234 (H) DESIGN OF INDUSTRIAL STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 3 hrs. 00 min.

Course Objectives:

I. To design Steel Gantry Girders.

II. To design Steel Portal, Gable Frames.

III. To design Steel Bunkers and Silos.

IV. To design Chimneys and Water Tanks.

Course Contents:

Steel Gantry Girders – Introduction, loads acting on gantry girder, permissible stress, types of gantry girders and crane rails, crane data, maximum moments and shears, construction detail, design procedure.

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

Steel Bunkers and Silos – Design of square bunker – Jansen's andAiry's theories – IS Code provisions – Design of side plates – Stiffeners – Hooper – Longitudinal beams Design of cylindrical silo – Side plates – Ring girder – stiffeners.

Chimneys – Introduction, dimensions of steel stacks, chimney lining, breech openings and access ladder, loading and load combinations, design considerations, stability consideration, design of base plate, design of foundation bolts, design of foundation.

Water Tanks – Design of rectangular riveted steel water tank – Tee covers – Plates – Stays – Longitudinal and transverse beams –Design of staging – Base plates – Foundation and anchor bolts –

Design of pressed steel water tank – Design of stays – Joints – Design of hemispherical bottom water tank – side plates – Bottom plates – joints – Ring girder –Design of staging and foundation.

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.

Online Sources

https://www.youtube.com/watch?v=lheoBL2QaqU

https://nptel.ac.in/courses/105/106/105106113/

Course Outcomes:

On successful completion of this course students will be able to:

CEP234(H).1: Design Steel Gantry Girders.

CEP234(H).2: Design Steel Portal, Gable Frames.

CEP234(H).3: Design Steel Bunkers and Silos.

CEP234(H).4: Design Chimneys and Water Tanks.

SHP221 RESEARCH METHODOLOGY

Teaching Scheme : 00 L + 00 T Total= 00 **Credits: 02**

Evaluation Scheme: 30 MSE+ 20 TA **Total Marks: 50**

Course Contents:

Meaning of research problem, Sources of research problem, Criteria Characteristics of agood 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

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

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

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

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology, Patentinformation 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

Reference Books:

1. Stuart Melville and Wayne Goddard, “Research methodology: an introduction for science & amp; 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 NewTechnological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008.

Course Outcomes:

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

SHP221.1: Understand research problem formulation.

SHP221.2: Analyze research related information

SHP22.1.3:Follow research ethics

SHP22.1.4:Understandthattoday'sworldiscontrolledbyComputer,InformationTechnology,buttomorrow world will be ruled by ideas, concept, and creativity

SHP22.1.5:Understanding that when IPR would take such important place in growth of individuals nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular

SHP22.1.6:UnderstandthatIPRprotectionprovidesanincentivetoinventorsforfurther research workandinvestmentinR&D,whichleadstocreationofnewandbetterproducts,andinturn bringsabout,economicgrowthandsocialbenefit

CEP235 :LAB PRACTICE- II

Teaching Scheme: 06 P **Total = 06** **Credit : 03**

Evaluation Scheme: Internal = 50 **; External = 50** **Total Marks: 100**

Course Objectives:

I. To Prepare and /or choose proper experimental models.
II. To Conduct model testing for static loading
III. To Conduct model testing for free and forced vibrations
IV. To Design and Detail G+3 Multi-Storied Frame Buildings

Course Contents:

Response of structures and its elements against extreme loading events.

Model Testing: Static - testing of plates, shells, and frames models.

Model Testing: Free and forced vibrations, Evaluation of dynamic modulus.

Beam vibrations, Vibration isolation, Shear wall building model, Time and frequency-domain study, Vibration Characteristics of RC Beams using Piezoelectric Sensors etc.

Design and detailed drawing of complete G+ 3 structures by individual student using latest relevant IS codes.

Course Outcomes:

On successful completion of this course students will be able to

CEP235.1:prepare and/or choose proper experimental models.

CEP235.2: conduct model testing for static loading

CEP235.3:conduct model testing for free and forced vibrations

CEP235.4: design and Detail G+3 Multi-Storied Frame Buildings

CEP236 SEMINAR-II

Teaching Scheme: 04 P Total 02 **Credit : 02**

Evaluation Scheme: Internal = 50 **Total Marks :50**

Course Objectives:

I. To review the literature (research papers, relevant books and internet) to identify expected potential dissertation topic from structural engineering.
II. To develop technical report writing skills.
III. To improve the technical presentation skills.
IV. To enhance critical thinking abilities.

Individual students are required to choose a topic of their interest. They will acquire state-of-the art knowledge in that area and to define the gray area related to topic (gap analysis) so as to carry dissertation in that area. The students are required to review literature on the topic and deliver seminar. A committee consisting of at least three faculty members (preferably specialized in the respective stream headed by HOD wherein guide should be one of the members) shall assess the presentation of the seminar and award marks to the students based on merits of topic of presentation. Each student shall submit two copies of a report of seminar. The seminar report shall not have any plagiarized content (all sources shall be properly cited or acknowledged). One copy shall be returned to the student after duly certifying it by the chairman of the assessing committee and the other shall be kept in the departmental library. Internal continuous assessment marks are awarded based on the relevance of the topic, presentation skill, quality of the report and participation. It is encouraged to do simulations/ experimentation related to the chosen topic and present the results at the end of the semester.

Course Outcomes:

On successful completion of this course students will be able to

CEP236.1:review the literature (research papers, relevant books and internet) to identify expected potential dissertation topic from structural engineering.

CEP236.2:develop technical report writing skills.

CEP236.3: improve the technical presentation skills.

CEP236.4: enhance critical thinking abilities.

PROGRAM ELECTIVES III

CEP331(A) DESIGN OF PRESTRESSED CONCRETE STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 3 hrs.00 MIN.

Course Objectives:

I. To find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.

II. To analyst prestressed concrete deck slab and beam/ girders.

III. To design prestressed concrete deck slab and beam/ girders.

IV. To design of end blocks for prestressed members.

Course Contents:

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, ultimate strength in flexure, code provisions.

Statically determinate PSC beams: design for ultimate and serviceability limit states for flexure, analysis and design for shear and torsion, code provisions.

Transmission of prestress in pretensioned members; Anchorage zone stresses for posttensioned members.

Statically indeterminate structures - Analysis and design - continuous beams and frames, choice of cable profile, linear transformation and concordancy.

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

Analysis and design of prestressed concrete pipes, columns with moments.

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

CEP331(A).1: Find out losses in the prestressed concrete. Understand the basic aspects of prestressed concrete fundamentals, including pre and post-tensioning processes.

CEP331(A).2: Analyse prestressed concrete deck slab and beam/ girders.

CEP331(A).3: Design prestressed concrete deck slab and beam/ girders.

CEP331(A).4: Design of end blocks for prestressed members.

CEP331 (B) ANALYTICAL AND FINITE ELEMENT ANALYSIS OF LAMINATED COMPOSITE PLATES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs.30 MIN.

Course Objectives:

I. To analyse the rectangular composite plates using the analytical methods.

II. To analyse the composite plates using advanced finite element method.

III. To develop the computer programs for the analysis of composite plates.

Course Contents:

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

Governing Equations, Navier Solutions of Cross-Ply and Angle-Ply Laminated Simply-Supported Plates, Determination of Stresses. Levy Solutions for Plates with Other Boundary Conditions, Analytical Solutions for Bending of Rectangular Laminated Plates Using FSDT.

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

Introduction to Finite Element Method, Rectangular Elements, Formation of Stiffness Matrix, Formation of Load Vector, Numerical Integration, Post Computation of Stresses

Reference Books:

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

Online Courses

https://www.youtube.com/watch?v=WZN8SDXOX5Q

Course Outcomes:

On successful completion of this course students will be able to

CEP331(B).1:Analyse the rectangular composite plates using the analytical methods.

CEP331(B).2:Analyse the composite plates using advanced finite element method.

CEP331(B).3.Develop the computer programs for the analysis of composite plates.

CEP331 (C) FRACTURE MECHANICS OF CONCRETE STRUCTURES

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives

I. To impart basic knowledge of fracture mechanics and influence of material behavior on fracture mechanics.

II. To explain linear and nonlinear fracture mechanics and their applications to structural design.

Course Contents:

Introduction: Basic Fracture Mechanics, Crack in a Structure, Mechanisms ofFracture and Crack Growth, Cleavage Fracture, Ductile Fracture, Fatigue Cracking, Environment assisted Cracking, Service Failure Analysis.

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

Material Models: General Concepts, Crack Models, Band Models, Models based on Continuum Damage Mechanics, Applications to High Strength Concrete, Fibre Reinforced Concrete, Crack Concepts and Numerical Modeling.

Reference Books:

1. Fracture Mechanics, Suri C. T. and Jin Z.H., 1st Edition, Elsevier Academic Press, 2012.
2. Elementary Engineering Fracture Mechanics, Broek David, 3rd Rev. Ed. Springer, 1982.
3. Fracture Mechanics of Concrete Structures – Theory and Applications, Elfgreen L., RILEMReport, Chapman and Hall, 1989.
4. Fracture Mechanics – Applications to Concrete, Victor, Li C., Bazant Z. P., ACISP 118, ACIDetroit, 1989.

Course Outcomes:

On successful completion of this course students will be able to:

CEP331.1: identify various fracture mechanism and explain the influence of material behavior on fracture mechanics, characterization of crack growth etc.

CEP331.2: explain the concepts of fracture mechanics of both linear and nonlinear regimes.

CEP331 (D) DESIGN OF PLATES AND SHELLS

Teaching Scheme : 03 L + 00 T Total= 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To analyse and design prismatic folded plate systems.
II. To analyse and design shells using approximate solutions
III. To analyse and design cylindrical shells
IV. To design doubly curved shells using approximate Solutions.

Course Contents:

Prismatic folded Plate Systems

Shell Equations

Approximate Solutions

Analysis and Design of Cylindrical Shells

Approximate Design methods for Doubly Curved Shells

Reference Books:

1. Theory of Plates and Shells, Timoshenko and Woinowsky-Krieger S., Tata McGraw Hill Edition, 2010.
2. Design and Construction of Concrete Shell Roofs, Ramaswamy G. S., 1st Edition, 2005.
3. Design of Reinforced Concrete Shells & Folded Plate, Varghese P. C., 1st Edition, PHI.
4. Design of Plate and Shell Structures, Jawad Maan H., Springer Science.

Course Outcomes:

On successful completion of this course students will be able to

CEP331D.1:Analyse and design prismatic folded plate systems

CEP331D.2:Analyse and design shells using approximate solutions

CEP331D.3:Analyse and design cylindrical shells

CEP331D.4:Design doubly curved shells using approximate Solutions.

OPEN ELECTIVES

SHP321(A)BUSINESS ANALYTICS

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Understand the role of business analytics within an organization.

II. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.

III. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.

IV. To become familiar with processes needed to develop, report, and analyze business data.

V. Use decision-making tools/Operations research techniques.

VI. Mange business process using analytical and management tools.

VII. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Contents:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

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

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

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

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.

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

Recent Trendsin : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

SHP321(A).1: demonstrate knowledge of data analytics.

SHP321(A).2:demonstrate the ability of think critically in making decisions based on data and deep analytics.

SHP321(A).3:demonstrate the ability to use technical skills in predicative and prescriptive modelling to support business decision-making.

SHP321(A).4:demonstrate the ability to translate data into clear, actionable insights.

SHP321(B) INDUSTRIAL SAFETY

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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 fire fighting, equipment and methods.

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

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.

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.

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

Reference Books:

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

SHP321(C) OPERATIONS RESEARCH

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. 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

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

SHP321(C).1:apply the dynamic programming to solve problems of discreet and continuous variables.

SHP321(C).2:apply the concept of non-linear programming

SHP321(C).3:carry out sensitivity analysis

SHP321(C).4: model the real world problem and simulate it.

SHP321(D) COST MANAGEMENT OF ENGINEERING PROJECTS

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Overview of the Strategic Cost Management Process

Cost concepts in decision-making: Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making

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

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

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

SHP321(E) COMPOSITE MATERIALS

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

References:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WDCallister, Jr., Adapted by R. Balasubramaniam, John Wiley & 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.

SHP321(F)WASTE TO ENERGY

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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.

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.

SHP321(F) FINANCE MANAGEMENT

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

Financial Management: objectives and goals, Fixed Capital, Floating Capital, Fund flow analysis and Fund flow statements. Ratio analysis: Classification, structural group, standards for comparison and limitations

Profit planning and Break-even analysis, margin of safety. Financial Budgets, control measures, Authorized capital, working capital, reserve, capital Management, floating of shares, share capitals & fund raising –methods and their appraisal.

Control measures: Payback approach, Standard costing, Actual costing, Operating ratio, techniques of cost control, Marginal cost.

Elements of Costs: Material, Labor, Expenses, Overheads, Direct and Indirect Cost, Fixed and Variable Cost, other classifications. Allocation of overheads Methods for Depreciation calculation, Budgetary control and Variance analysis, Activity based costing (ABC). Biases in cash flow estimation.

Appraisal criteria: Net Present Value, benefit cost ratio, internal rate of returns urgency, payback period, accounting rate of returns, investment appraisal in practice

Analysis of Risk: Types and measure of risk , simple estimation of risk, sensitivity analysis, scenario analysis, Special decision situations: Choice between mutually exclusive projects of unequal life, optimal timing decision, determination of economic life, inter-relationships between investment and financing aspects, inflation and capital budgeting. Analysis of firm and market risk:

Portfolio theory and capital budgeting, Capital Asset Pricing Model.

Reference Books :

1. J Pandey I M., Financial Management, Vikas Publication,10th Edition 2013
2. Henry M. Stenier, “Engineering economics Principles”, McGraw Hill Publication.
3. C. B. Gupta, “Fundamentals of Business”, Sultan Chand & Company.
4. S. K. Basu, K.C. Sahu and Rajiv B, “Industrial Organisation and Management”, PHI New Delhi, Nov 2012.

SHP321(G) PROJECT MANAGEMENT

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Human Factors and Systems, Information Input and Processing, Visual Displays of Dynamic Information, Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Hand Tools and Devices.

Definition of Ergonomics and its significance in designing workplace layout and detailed motion plan of work, Man-Machine Symbiosis, Human Factors in design & manufacturing, Viz. pressure of the environment, temperature, humidity etc., Principles of motion economy, anthropometric condition, stability criterion etc. Biodynamic analysis for design of products & its concept of learning by man and machine;

Measurement of Learning Index and training for each job and each man, Product design – various aspects including ergonomic design and reliability based design.

Dynamic consideration in design of product using vibration stability in biomechanisms, Safety in manufacturing, Considerations of human stress, Allowable limit of stress, stress adjustment.

Estimation of human error and human reliability, combining various forms of human error by random number simulation, Human Error, Accidents and safety, Human Factors and the Automobile, Human Factors in Systems Design.

Dynamic consideration in project operations, leadership, requirement, communication process, motivating a diverse workflow, facilitating team decisions, resolving interpersonal conflicts, managing different people, strengthening team accountability

Reference Books :

1. Sanders, M.M. &McCormick, E.J., Human Factors in Engineering & Design, McGraw-Hill, 7th ed. (1993)
2. S. K. Basu, K.C. Sahu and Rajiv B, Industrial Organisation and Management –, PHI New Delhi, Nov 2012.

(H) DATA STRUCTURE AND ALGORITHMS

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Outcomes:

I. Write neat code by selecting appropriate data structure and demonstrate a working solution for a given Problem.

II. Think of all possible inputs to an application and handle all possible errors properly.

III. Analyze "Clearly different possible solutions to a program and select the most efficient one.

IV. Write an application requiring an effort to fat least l000 lines of code to demonstrate a good working solution.

V. Demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking

Course Contents:

Introduction: Data, Data types. Object, data structure and abstract data types (ADT). Characteristics of an algorithm' Analyzing progams Frequency count Time and space complexity, Big 'O' and Ω notation. Best, average and worst cases. Dangling pointers and garbage memory

Arrays, Files and Searching: Searching: linear and binary search algorithm. Hashing: hashing functions, chaining, overflow handling with and without chaining, open addressing: linear. Quadratic Teaching Scheme: Examination Scheme: probing. Files handling: text and binary files, use of various libraries for handling files.

Stacks and Queues: Stack and queue. as ADT. Operations on stack and queue, Implementations using arrays and dynamic memory allocation, Application of stack for expression evaluation, expression conversion, Recursion and stacks, Problems like maze and knight's tour.

Lists: List as ADT. Concept of linked organization of data against linked list. Singly linked list, doubly linked list, circular linked list. Representation & manipulations of polynomials/ sets using linked lists. Dynamic memory management, Representation of sparse matrix, Addition and transpose of sparse matrix

Trees and Graphs: Basic terminology. Binary trees and its representation, Binary tree traversals (recursive and non-recusive) and various operations, Insertion and deletion of nodes in binary search tree, Representation of graphs using adjacency matrix, adjacency list, Implementation of

algorithms for traversals; implementing Kruskal's. Prim's algorithms, Single source shortest paths using Djkstra's algorithm, Applications of graphs and trees

Time Complexity Analysis, Algorithm Design: Verification of programs, invariants, assertions, proof of termination. Best, Average and Worst case analysis of binary search, quick sort, merge sort, insertion sort, hashing techniques, sparse matrix algorithms. Designing data structures for specific applications

Reference Books:

1. E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", Second Edition,University Press, ISBN 978-81-7371-605-8
2. B. Kernighan, D. futchie, "The C Programming Language", Prentice Hall of India, Second Edition,ISBN 8 1 -203-0596-5
3. Y. Langsam, M. Augenstin and A. Tarmenbaum, "Data Structues using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1
4. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928
5. Jean-Paul Tremblay, Paul. G. Soresan, "An inhoduction to data structures with Applications",TataMc-Graw Hill Intemational Editions, 2nd edition 1984, ISBN-O07-462471-7

CEP332 DISSERTATIONPHASE I

Teaching Scheme : 20 P **Total -20** **Credit : 10**

Evaluation Scheme: ICA-100 **Total Marks: 100**

Course Objectives:

I. To identify and define the problem with objectives.

II. To perform the literature review of past work related to the problem and identify the research gap.

III. To demonstrate the problem with respect to society.

IV. To demonstrate understanding, application of relevant methodology, techniques and analysis with 40% of work completion.

Project Stage I: Student has to select a topic for Project/dissertation, carry out literature review, find the literature gap, carry out 25% or more work on Project/dissertation topic and submit the report and deliver the seminar based on it. It is to be evaluated internally by three members panel of examiners headed by HOD wherein guide should be one of the members of the panel.

Course Outcomes:

On successful completion of this course students will be able to

CEP332.1: define the problem with objectives with bridging the research gap.

CEP332.2:demonstrate the problem in-depth knowledge and thoughtful application in stating an in-depth analysis of key theories supporting the study.

CEP332.3:apply the relevant methodology and technique to solve the problem.

CEP332.4:complete 40% study on defined problem through mathematical application or experimentation.

CEP432 DISSERTATIONPHASE II

Teaching Scheme : 32 P Total= 32 Credit : 16

Evaluation Scheme: ICA - 200; ESE - 200 Total Marks: 400

Course Objectives:

I. To complete the study with respect to objectives defined in phase I.
II. To record the findings of the study.
III. To prepare the report on complete study with clear interpretation, discussion of the results and conclusions.
IV. To identify the future scope of the study.

Project Stage II: Student has to carry out remaining project/dissertation work on the selected Project/dissertation topic and submit the report. It is to be evaluated internally by three members panel of examiners headed by HOD wherein guide should be one of the members of the panel.

Course Outcomes:

On successful completion of this course students will be able to

CEP432.1:complete the study with respect to objectives defined in phase I.

CEP432.2:record and analyze the results of the findings of study.

CEP432.3: prepare the report on complete study with clear interpretation, discussion of the results and conclusions.

CEP432.4: define future scope of study.

GOVT. COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF CIVIL ENGINEERING

CURRICULUM

For

M. TECH. (Geotechnical Engineering)

2019- 2020

Member Secretary
(S. W. Thakare)

Chairman, BoS
(Dr. M. N. Hedaoo)

Principal
(Prof. A.M.Mahalle)

PROGRAM OBJECTIVES

1. To make students learn the principles of soil and rock mechanics. Understand different problems associated with geotechnical engineering. Explain how to select design soil/rock parameters for design purpose based on the subsurface exploration. Develop Analysis and Design procedure for various geotechnical structures.
2. Students should gain competency in the design of shallow/deep foundations, earth retaining structures, embankment and earthen dams, underground structures. Can assess stability of slopes and apply preventive measures for stability.

PROGRAM OUTCOMES (POs):

1. Students will learn soil and rock behaviour. Students will be able to perform various laboratory and in-situ tests on soil/rock to find out design parameters.
2. Students can design shallow/deep foundations, earth retaining structures, embankment and earthen dams, tunnel support systems for given site conditions.
3. Student can compute factor of safety to assess stability of slopes and apply preventive measures for stability.
4. Student can develop numerical models to estimate response of various geotechnical structures under different loadings.

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M. Tech. (Geotechnical Engineering)

Sem -I													
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**						**Credits**
							Theory			**Practical**		**Total**	
			Theory Hrs /week	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**MSE**	**TA**	**ESE**	**ICA**	**ESE**		
PC	CEP151	Advanced Soil Mechanics	3	-	-	3	30	10	60	-	-	100	3
PC	CEP152	Advanced Foundation Engineering	3	-	-	3	30	10	60	-	-	100	3
PE	CEP154	Program Elective – I	3	-	-	3	30	10	60	-	-	100	3
PC	CEP153	Ground Improvement Technology	3	-	-	3	30	10	60	-	-	100	3
PL	CEP155	Geotechnical Engineering Lab I	-	-	6	6	-	-	-	50	50	100	3
PS	CEP156	Seminar I	-	-	4	4	-	-	-	50	-	50	2
HSMC	SHP121	Audit Course I	-	-	-	-	30	20	-	-	-	50	0
	Total		**12**	**-**	**10**	**22**	**150**	**60**	**240**	**100**	**50**	**600**	**17**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE I –CEP154	
(A) Earth dam analysis & Design	(B) Computational Geomechanics
(C) Design of Underground structures	

LIST OF AUDIT COURSES

AUDIT COURSES -SHP121	
(A)English for Research Paper Writing	(B) Disaster Management
(C)Sanskrit for Technical Knowledge	(D)Value Education
(E)Pedagogy Studies	(F) Stress Management by Yoga
(G)Personality Development through Life Enlightenment Skills. (H) Constitution of India	

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SEM- II													
Cate-gory	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PC	CEP251	Dynamics of Soil and Foundations	3	-	-	3	30	10	60	-	-	100	3
PC	CEP252	Geotechnical Investigations & Construction practices	3	-	-	3	30	10	60	-	-	100	3
PC	CEP253	Pavement Analysis & Design	3	-	-	3	30	10	60	-	-	100	3
PE	CEP254	Program elective II	3	-	-	3	30	10	60	-	-	100	3
MC	SHP221	Research Methodology	-	-	-	-	30	20	-	-	-	50	2
PL	CEP255	Geotechnical Engineering Lab II	-	-	6	6	-	-	-	50	50	100	3
PS	CEP256	Seminar II	-	-	4	4	-	-	-	50	-	50	2
			12	**00**	**10**	**22**	**150**	**60**	**340**	**100**	**50**	**600**	**19**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE II- CEP 254

(A) Geotechnical Earthquake Engineering (B) Environmental Geo-technology (C) Foundation on weak soil

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Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PE	CEP351	Program Elective III	3	-	-	3	30	10	60	-	-	100	3
OE	SHP321	Open Elective	3	-	-	3	30	10	60	-	-	100	3
PROJ	CEP352	Dissertation Stage I	-	-	20	20	-	-	-	100	-	100	10
	Total		**06**	00	20	**26**	**60**	**20**	**120**	**100**	**-**	**300**	**16**

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LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE III – CEP 351	OPEN ELECTIVE- SHP321
(A) Finite Element Method in Geomechanics (B) Engineering Rock Mechanics (C) Earth Retaining Structures	(A) Business Analytics (ME) (B) Industrial Safety (ME) (C) Operations Research (ME) (D) Cost Management of Engineering Projects (CE) (E) Composite Materials (ME) (F) Waste to Energy (CE) (G) Finance Management (EE) (H) Project Management (EE) (I) Data Structure and Algorithms (CS) (J) Any other courses approved by BOS Note:- ME:- Offered by Mechanical Engineering Department CE:- Offered by Civil Engineering Department EE:- Offered by Electrical Engineering Department CS:- Offered by Computer Science and Engineering Department

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SEM -IV													
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**						**Credits**
							Theory		**Practical**		**Total**		
			Theory Hrs /week	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**MSE**	**ESE**	**ICA**	**ESE**			
PROJ	CEP451	Dissertation Stage II	-	-	32	32	-	-	200	200	400	16	
	Total		**-**	**-**	32	**32**	**-**	**-**	**200**	**200**	**400**	**16**	

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COMPARISON OF SEMESTER-WISE CREDIT DISTRIBUTION IN OLD AND PROPOSED STRUCTURE

SEMESTER	CREDITS IN OLD CURRICULUM	CREDITS IN PROPOSED CURRICULUM
I	25	17
II	25	19
III	10	16
IV	30	16
Total	90	68

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Department of Civil engineering

Equivalence Scheme

Programme Name:-M. Tech. Geotechnical Engineering

Sr. No.	Course code with Name of course(old)		Credit	Course code with Name of course (new)		Credit
1.	CEP121	Computer Programming & Numerical Methods	04	-	-	-
2.	CEP122	Advanced Soil Mechanics	04	CEP151	Advanced Soil Mechanics	03
3.	CEP123	Advanced Foundation Engineering	04	CEP152	Advanced Foundation Engineering	03
4.	CEP124	Ground Improvement Techniques	04	CEP153	Ground Improvement Technology	03
5.	CEP125	Earth Dam Analysis and Design	04	CEP154 (A)	Earth dam analysis & Design	03
6.	CEP126	Geotechnical Engineering Laboratory-I	04	CEP156	Geotechnical Engineering Laboratory-I	03
7.	CEP127	Seminar-I	01	CEP156	Seminar I	02
8.	CEP221	Soil Dynamics and Machine Foundation	04	CEP251	Dynamics of Soil and Foundations	03
9.	CEP222	Finite Element Methods in Geotechnical Engineering	04	-	-	-
10.	CEP223	Geosynthetics	04	-	-	-
11.	CEP224	Elective-I, (C) Construction Methods in Geotechnical Engineering	04	CEP252	Geotechnical Investigations and Construction Practices	03
12.	CEP225	Elective-II, (C) Pavement Analysis and Design	04	CEP253	Pavement Analysis and Design	03
13.	CEP226	Geotechnical Engineering Laboratory-II	04	CEP255	Geotechnical Engineering Laboratory-II	03
14.	CEP227	Seminar-II	01	CEP256	Seminar - II	02
15.	CEP321	Dissertation (Phase-I)	10	CEP352	Dissertation Stage I	10
16.	CEP421	Dissertation (Phase-II)	30	CEP451	Dissertation Stage II	16

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CEP151 ADVANCED SOIL MECHANICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**

Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To impart the knowledge of consolidation theory for determination of consolidation settlement and time required.

II. To enhance the knowledge of strength theories for determination of shear strength of soil for different field conditions.

III. To provide the knowledge of stress path and Critical state soil mechanics and Elastic and plastic deformations to develop mathematical models for solving different problems in soil mechanics for different field conditions.

Course Contents:

Compressibility of soils: Introduction, factors affecting consolidation, measurement of various consolidation characteristic, one way two way drainage, degree of consolidation, Terzaghi's one-dimensional consolidation equation, consolidation theory (one, two, and three dimensional consolidation theories), determination of pre-consolidation pressure, determination of coefficient of consolidation, field consolidation time for NC and OC clays, secondary consolidation, swell-pressure consolidation in layered soil,

Strength behavior of soils; Basic concept, Mohr-Coulomb Theory; measurement of shear strength, drainage conditions along with field problems, UU, CU, CD tests, drained and undrained behavior of sand and clay, factors affecting shear strength of cohesive and cohesionless soil, Skempton's pore pressure parameters, Hvorslev's shear strength parameters, significance of pore pressure parameters, determination of shear strength of soil; Interpretation of triaxial test results.

Stress path; Drained and undrained stress path; Stress path with respect to different initial state of the soil; Stress path for different practical situations.

Critical state soil mechanics; Critical state parameters; Critical state for normally consolidated and over consolidated soil; Significance of Roscoe and Hvorslev state boundary surface; drained and undrained plane. Critical void ratio; effect of dilation in sands; different dilation models

Elastic and plastic deformations: elastic wall; introduction to yielding and hardening; yield curve and yield surface, associated and non-associated flow rule

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Reference Books:

1. Atkinson, J.H. and Bransby, P.L, The Mechanics of Soils: An introduction to Critical soil mechanics, McGraw Hill, 1978.
2. Atkinson J.H, An introduction to the Mechanics of soils and Foundation, McGraw- Hill Co., 1993.
3. Das, B.M., Advanced Soil Mechanics, Taylor and Francis, 2nd Edition, 1997.
4. Wood, D.M., Soil Behavior and Critical State Soil Mechanics, Cambridge University Press, 1990.
5. Craig, R.F., Soil Mechanics, Van Nostrand Reinhold Co. Ltd., 1987.
6. Terzaghi, K., and Peck, R.B., Soil Mechanics in Engineering Practice, John Wiley & Sons, 1967.
7. Lambe, T.W. and Whitman, R.V., Soil Mechanics, John Wiley & Sons, 1979.

Course Outcomes:

After Completion of course students will able to

CEP151.1 Explain one dimensional and three-dimensional consolidation characteristics and secondary consolidation in clays and determine the consolidation settlement and time from the given data.

CEP151.2 Describe Stress-strain characteristics of soils, failure mechanism, various factors affecting the shear strength of soil, effective stress phenomenon and determine shear strength parameters of soil for different types of soil and field conditions.

CEP151.3 Describe different test procedures to determine the shear strength of soil.

CEP151.4 Summerize stress path and Critical state parameters and yield curve and yield surface for different practical situations.

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CEP152 ADVANCED FOUNDATION ENGINEERING

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Provide knowledge of various methods of soil explorations, their suitability and preparation of investigation reports.
II. Impart knowledge of design procedure for various shallow and deep foundations as per relevant IS codesand based on various criteria and different field situations.
III. Determination of Foundation settlements.

Course Contents:

Planning of soil exploration for different projects, methods of subsurface exploration, methods of borings along with various penetration tests

Shallow foundations: Requirements for satisfactory performance of foundations, Terzaghi's, Meyerhoff, Hansens bearing capacity theories, Types of shear failures, Effect of water table on bearing capacity, layered soils, eccentric and inclined loads, Bearing capacity on slopes, Annular Footings, Rigid and flexible foundations, Plate load test, Design of Individual, Combined and Raft Foundations for axial and bending loads (Uniaxial and biaxial)

Foundation settlements, settlements of footings and rafts, proportioning of foundations using field test data, IS codes.

Pile foundations

Introduction, classification, Load transfer mechanism, Static and dynamic formulas for pile capacity in various soil types, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, lateral and uplift capacity of piles, Analysis and design of pile and pile cap

Drilled Piers and Caissons

Introduction, types, Construction of drilled piers, advantages and disadvantages, Design considerations, bearing capacity equations, Settlements, Types of caissons, stability analysis, advantages and disadvantages of caissons

Well foundation

Different shapes of well, grip length, forces acting on well foundation, Trezaghi's analysis, components of well, sinking of wells, measurement and rectification of tilts and shifts, IS and IRC codal provisions,

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Foundations on problematic soils: Foundations for collapsible and expansive soil

Reference Books:

1. N.P. Kurien, Design of Foundation Sytems, Principles & Practices, Narosa,
2. E.S. Melerski, Design Analysis of Beams, Circular Plates and Cylindrical Tanks on Elastic Foundation, Taylor and Francis,
3. L.C. Reese, Single piles and pile groups under lateral loading, Taylor & Francis,
4. V.N.S. Murthy, Advanced Foundation Engineering, CBS Publishers & Distributors,
5. P. C. Varghese, Foundation Design, PHI Learning Pvt. Ltd Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.
6. Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.
7. Tomlinson M.J., Pile design and construction Practice, Chapman and Hall Publication, 1994.
8. Poulos, H. G. and Davis, F. H., "Pile Foundation Analysis and Design", Wiley and Sons 1980, John Wiley & Sons, 1979.

Course Outcomes:

After Completion of course students will able to

CEP152.1 Describe various methods of soil explorations and select appropriate method for different projects and prepare soil investigation reports.

CEP152.2 Discuss different types of foundations and their suitability based on various criteria and different field situations.

CEP152.3 Select and design appropriate shallow and deep foundation based on subsurface investigation data and structural details.

CEP152.4 Determine foundation settlements based on soil properties and foundation details.

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CEP153 GROUND IMPROVEMENT TECHNOLOGY

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Explain different issues related to problematic soils and their associated solutions.
II. Describe various methods of ground improvement, their principles and field applications.
III. Explain design techniques for ground improvement methods for different projects.

Course Contents:

Introduction: Major soil deposits in India, Necessity of Ground Improvement, Various mechanisms of Ground Improvement, Classification, Applications, Economic consideration and suitability

Mechanical modification: Dynamic compaction, impact loading, compaction by blasting, vibro-compaction; pre-compression, Hydraulic modification: dewatering systems, preloading and vertical drains, electro-kinetic dewatering

Stone columns: Introduction, layout, function and application, advantages, vibrofloatation and rammed technique of stone column installation, Analysis of stone column treated soft soil, unit cell concept, load transfer mechanism, load carrying capacity and settlement analysis, different methods to improve the effectiveness of stone column, strengthening by micro piles

Chemical modification; Modification by admixtures, Methods of stabilization, mechanical stabilization, stabilization of soil using cement, lime, bitumen, chemical and fly ash stabilization, and stabilisation using industrial wastes,

Grouting – Applications, Types of grouts and their suitability, Desirable characteristics of grouts, Groutability, Grouting methods – Permeation grouting, soil facture grouting, Compaction grouting, Jet grouting, their applications, Grouting Technology- single stage grouting, Descending and Ascending stage grouting, Sleeved Pipe Grouting, Grout plant and equipment, Grouting procedure- Pre-grouting site investigation, Grout hole pattern, Grouting arrangement, Grout injection measurements and monitoring

stabilisation/improvement of ground using Geotextiles, Geogrid, Geomembrane, geocells, genets, and soil nails.

Application of soil reinforcement: Shallow foundations on reinforced earth, design of reinforced earth retaining walls, reinforced earth embankments structures, wall with reinforced backfill, analysis and design of shallow foundations on reinforced earth, road designs with Geosynthetics

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Reference Books:

1. Geotechnical Engineering, S K Gulhati& M Datta, Tat McGraw Hill Publishing Company Ltd. 2005
2. Ground Improvement Techniques, P Purushothams Raj, University Science Press, 2011.
3. Foundation Engineering Handbook, HSAI – YANG FANG, CHAPMAN & HILL, New York, 1991
4. Hausmann, M.R., Engineering Principles of Ground Modification, McGraw-Hill International Editions, 1990.
5. Yonekura, R., Terashi, M. and Shibazaki, M. (Eds.), Grouting and Deep Mixing, A.A. Balkema, 1966.
6. Moseley, M.P., Ground Improvement, Blackie Academic & Professional, 1993.
7. Xanthakos, P.P., Abramson, L.W. and Bruce, D.A., Ground Control and Improvement, John Wiley & Sons, 1994.
8. Koerner, R. M., Designing with Geosynthetics, Prentice Hall Inc. 1998.
9. Shukla, S.K., Yin, Jian-Hua, "Fundamentals of Geosynthetic Engineering", Taylor & Francis.

Course Outcomes:

After Completion of course students will able to:

CEP153.1 Discuss different issues related to problematic soils and their associated solutions.

CEP153.2 Explain various methods of ground improvement, their principles, and applications in the field.

CEP153.3 Propose and design suitable ground improvement technique for different projects.

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CEP154 PROGRAM ELECTIVE I
CEP154(A) EARTH DAM ANALYSIS & DESIGN

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Impart knowledge of design criteria, typical cross sections of earthen dams, design requirements of various components as per IS Code a to suit different field situations.
II. Preliminary design of earthen dams for the given data.
III. Carry out stability analysis of earthen dams

Course Contents:

Preliminary section: Requirements of good dam, Types of earthen dams and their suitability, Components of earthen dam and their functions, Causes of failure, Design criteria, Typical cross sections as per and design requirements of various components as per IS Code, General guidelines for embankment section as per IS codes, Typical cross sections of earthen dams to suit different field conditions, suitability of different soils as per IS code

Stability analysis: Infinite and finite slopes with or without water pressures; concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method; Method of slices, Bishop's method,

Stability analysis in the presence of seepage: Two dimensional flow – Laplace equation and it's solution, graphical method, determination of phreatic line, flow nets in homogeneous and zoned earth dams under steady seepage and draw-down conditions, seepage control in earth dams, influence of seepage on slope stability, stability analysis of dam body during steady seepage,

Design of filters and upstream impermeable blanket

Stability analysis during earthquake: Stability analysis considering earthquake forces, Design considerations for earth dam in Seismic region.

Stability of foundation

Reference Books:

1. Engineering for Embankment Dams, Bharat Singh and R. S. Varshney, Oxford &IBH.
2. Irrigation Engineering, K. R. Arora, Standard Publishers Distributers.
3. Irrigation Engineering, R. K. Sharma and T. K. Sharma, S. Chnad& co., New Delhi, 2007

4. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
5. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press,1997.
6. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
7. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E &FN Spon, 1995.
8. Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
9. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.
10. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and
11. Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.

Course Outcomes:

After Completion of course students will able to

CEP154(A).1: Discuss the design criteria and design requirements of various components of earth dams as per revenant IS codes and draw typical cross sections of earthen dams to suit different field conditions.

CEP154 (A).2: Check the stability of earthen dams under different conditions.

CEP154 (A).3: Design the various components of earthen dam as per IS Codes of practice.

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CEP154(B) COMPUTATIONAL GEOMECHANICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Provide knowledge of different numerical and statistical tools for analysing various geotechnical engineering problems and their suitability for different field situations.

II. Apply probabilistic approach for selection of design parameters and compute their impact on risk assessment.

Course Contents:

Solution of Non-linear Equations: Bisection, False Position, Newton-Raphson, Successive approximation method, Iterative methods.

Solution of Linear Equations: Jacobi's method, Gauss Seidal method, Successive over relaxation method.

Finite Difference Method: Two point Boundary value problems – Disichlet conditions, Neumann conditions; ordinary and partial differential equations.

Finite Element Method: Fundamentals, Constitutive finite element models for soils.

Correlation and Regression Analysis: Correlation - Scatter diagram, Karl Pearson coefficient of correlation, Limits of correlation coefficient; Regression –Lines of regression, Regression curves, Regression coefficient, Differences between correlation and regression analysis.

One-dimensional Consolidation - Theory of consolidation, Analytical procedures, Finite difference solution procedure for multilayered systems, Finite element formulation.

Flow Through Porous Media - Geotechnical aspects, Numerical methods, Applications and Design analysis, Flow in jointed media.

Risk assessment in Geotechnical Engg. - Probabilistic site characterization and design of foundations.

Reference Books:

1. S. Chandrakant., Desai and John T. Christian, "Numerical Methods in Geotechnical Engineering", Mc. Graw Hill Book Company, 1977.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, "Numerical Methods for Scientific and Engineering computations", Third edition, New Age International (P) Ltd. Publishers, New Delhi.

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3. D.J. Naylor and G.N. Pande, “Finite Elements in Geotechnical Engineering”, Pineridge Press Ltd., UK.
4. Sam Helwany, “Applied soil mechanics”, John Wiley & sons, Inc.

Course Outcomes:

After Completion of course students will able to:

CEP154(B).1: Describe different numerical and statistical tools for analysing various geotechnical engineering problems.

CEP154(B).2: **A**pply probabilistic approach for selection of design parameters and compute their impact on risk assessment

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CEP154(C) DESIGN OF UNDERGROUND STRUCTURES

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Provide knowledge of planning and exploration for various underground construction projects, theirprinciples and its application in underground excavation design.
II. Provide basic concepts of elastic& plastic analysis,and rock mass classification systems in the design of underground support system.
III. Inculcate the importance of field tests generally conducted during and after construction of under structures.

Course Contents:

Introduction, planning and exploration for various underground construction projects, stereographic projection method, principle and its application in underground excavation design.

Elastic stress distribution around tunnels, stress distribution for different shapes and under different in-situ stress conditions, Greenspan method, design principles, multiple openings, openings in laminated rocks, elasto-plastic analysis of tunnels, Daemen's theory.

Application of rock mass classification systems, ground conditions in tunnelling, analysis of underground openings in squeezing and swelling ground, empirical methods, estimation of elastic modulus and modulus of deformation of rocks; uniaxial jacking / plate jacking tests, radial jacking and Goodman jacking tests, long term behaviour of tunnels and caverns, New Austrian Tunnelling Method (NATM), Norwegian Tunnelling Method (NTM), Construction dewatering.

Rock mass-tunnel support interaction analysis, ground response and support reaction curves, Ladanyi' selasto-plastic analysis of tunnels, design of various support systems including concrete and shotcrete linings, steel sets, rock bolting and rock anchoring, combined support systems, estimation of load carrying capacity of rock bolts.

In-situ stress, flat jack, hydraulic fracturing and over coring techniques and USBM type drill hole deformation gauge, single and multi-point bore hole extensometers, load cells, pressure cells, etc. Instrumentation and monitoring of underground excavations, during and after construction, various case studies

Reference Books:

1. Hoek, E and and Brown, E. T.," Underground Excavations in Rocks", Institute of Mining Engineering.

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2. Obert, L. and Duvall, W.I., “Rock Mechanics and Design of Structures in Rocks”, John Wiley.
3. Singh, B. and Goel, R.K.,”Rock Mass Classification- A Practical Engineering Approach”, Elsevier.
4. Singh, B. and Goel, R.K., “Tunnelling in Weak Rocks”, Elsevier.

Course Outcomes:

After Completion of course students will able to:

CEP154(C).1 Carry out planning and exploration for various underground construction projects, their principles and its application in underground excavation design.

CEP154(C).2 Discuss elastic and plastic analysis and rock mass classification systemsin the design of underground support system.

CEP154(C).3 Explain field tests generally conducted during and after construction of under structures.

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CEP155 GEOTECHNICAL ENGINEERING LAB I

Teaching Scheme: 06 P Total = 06 Credit : 03
Evaluation Scheme: ICA = 50 ; ESE= 50 Total Marks: 100

Course Objectives:

I. Develop skills for conducting various laboratory tests as per relevant IS Codes to determine the various properties of soil.
II. Impart skills for conducting various field tests as per relevant IS Codes to determine the various insitu properties of soil.
III. Use Geo5 software for solving problems in Geotechnical Engineering.

Course Contents:

A. List of Laboratory Practical:

1. Collection of Undisturbed / Disturbed Sample for laboratory testing.
2. Determination of In-situ density and Specific gravity of soil.
3. Grain Size Distribution Analysis and Hydrometer Analysis.
4. Atterberg Limits (Liquid Limit, Plastic limit, Shrinkage limit).
5. Visual Classification Tests.
6. Vibration test for relative density of sand.
7. Standard and modified proctor compaction test.
8. Falling head permeability test and Constant head permeability test.
9. Unconfined compression test.
10. Direct shear test.
11. Laboratory vane shear test.
12. Swelling Pressure Test.
13. Tri-axial compression test (Quick Test).
14. C. B. R. Test.
15. Consolidation test.

B. List of Field Practical's:

1. Field Vane shear test.
2. Standard penetration test.
3. Dynamic cone penetration test.
4. Static cone penetration test.

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5. Plate load test.
6. Geophysical exploration tests.

C. Use of Geo5 Software for:

1. Determination of Earth pressure.
2. Determination of stability of retaining wall.
3. Determination of stability of slopes by various methods.
4. Design of shallow footing.
5. Design of pile foundation.
6. Determination of settlement of footing.

A Report based on above experiments shall be submitted by each student.

Course Outcomes:

After Completion of course students will able to:

CEP155.1 Perform various laboratory tests as per relevant IS Codes to determine the various physical, Index and engineering properties of soil.

CEP155.2 Perform various field tests as per relevant IS Codes to determine the various insitu properties of soil.

CEP155.3 Use Geo5 software for solving problems in Geotechnical Engineering.

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CEP156 SEMINAR I

Teaching Scheme: 04 P Total = 04 Credit : 02
Evaluation Scheme: ICA = 50 ; Total Marks: 50

Course Objectives:

I. Guide students to select a topic for seminar based on latest technological advancements and carry out literature review.

II. Guide students to prepare seminar report and power point presentation.

Seminar I: Student has to select a topic for Seminar based on literature review on advanced topics / recent developments in the field of Geotechnical Engineering and submit the report and deliver the seminar based on it. It is to be evaluated internally by panel of examiners headed by HOD (if possible) wherein guide should be one of the members of the panel.

Course Outcomes:

After Completion of course students will able to:

CEP156.1 Select a topic for seminar based on latest technological advancements and collect related literature.

CEP156.2 Prepare seminar report and power point presentation based on information collected related to the selected topic.

CEP156.3 Deliver seminar.

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SHP121 AUDIT COURSES
SHP121(A) ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

II. Learn about what to write in each section

III. Understand the skills needed when writing a Title

IV. Ensure the good quality of paper at very first-time submission

Course Contents:

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

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

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,

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

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

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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SHP121(B) DISASTER MANAGEMENT

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0

Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

IV. 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:

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

Disaster Preparedness And Management:

Preparedness: monitoring of phenomena Triggering A Disaster Or Hazard, Evaluation Of Risk: Application of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community preparedness

Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging, Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India

Reference Books:

1. R. Nishith, Singh 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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SHP121(C) SANSKRIT FOR TECHNICAL KNOWLEDGE

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0

Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

Course Contents:

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Order, Introduction of roots, Technical information about Sanskrit Literature

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

References books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(C).1: Understand basic Sanskrit language

SHP121(C):2 Ancient Sanskrit literatures about science & technology can be understood

SHP121(C):3 Being a logical language will help to develop logic in students

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SHP121(D) VALUE EDUCATION

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

Course Contents:

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

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

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

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

Reference Books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(D).1:Knowledge of self-development

SHP121(D).2: Learn the importance of Human values

SHP121(D).3: Developing the overall personality

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SHP121 (E) PEDAGOGY STUDIES

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

II. Identify critical evidence gaps to guide the development.

Course Contents:

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.

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

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.

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

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

References books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education Research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of Basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell.

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6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.
7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

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

SHP121(E).1 What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

SHP121(E).2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

SHP121(E).3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

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SHP121(F) STRESS MANAGEMENT BY YOGA

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0

Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives

I. To achieve overall health of body and mind
II. To overcome stress

Course Contents:

Definitions of Eight parts of yog (Ashtanga)

Yam and Niyam

Do`s and Don'ts's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Reference Books:

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

Course Outcomes:

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

SHP121(F).1: Develop healthy mind in a healthy body thus improving social health also

SHP121(F).2: Improve efficiency

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SHP121(G) PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives

I. To learn to achieve the highest goal happily
II. To become a person with stable mind, pleasing personality and determination
III. To awaken wisdom in students

Course Contents:

Neetisatakam-Holistic development of personality

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

Approach to day to day work and duties.

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

Statements of basic knowledge.

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

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

References

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

Course Outcomes:

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

SHP121(G).1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

SHP121(G).2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity

SHP121(G).3: Study of Neetishatakam will help in developing versatile personality of students.

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SHP121(H) CONSTITUTION OF INDIA

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

Course Contents:

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

Philosophy of the Indian Constitution: Preamble, Salient Features

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.

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

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

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

Reference Books:

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

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Course Outcomes:

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

SHP121(H).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.

SHP121(H).2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

SHP121(H).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.

SHP121(H).4: Discuss the passage of the Hindu Code Bill of 1956.

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CEP251 DYNAMICS OF SOIL & FOUNDATIONS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Impart knowledge to identify principles of soil dynamics, theory of vibration, propagation of body waves and surface waves through soil.

II. Give insight in to different laboratory and field tests to determine dynamic soil properties required for design purpose.

III. Discussliquefaction mechanism and evaluation of liquefaction potentialstudies of various tests.

IV. Summaries general requirements of machine foundation, and criteria for its design.

V. Learn procedure of analysis & Design of different types of Machine foundation.

COURSE CONTENTS:

Introduction to dynamic loading:

Earthquake loading, machine vibrations, blast loading, background and lessons learnt from damages in past earthquakes due to soil and ground failure, effect of soil properties on seismic response of structures, seismic waves and their characteristics

Soil Dynamics and its applications

Fundamentals of vibrations: single, two and multiple degree of freedom systems, vibration isolation, vibration absorbers, vibration measuring instruments

Wave propagation: elastic continuum medium, semi-infinite elastic continuum medium, soil behaviour under dynamic loading.

Dynamic elastic constants of soil: Static and dynamic characteristics of soils, stress-strain behaviour of cyclically loaded soils, effect of strain level on the dynamic soil properties, measurement of seismic response of soil at low and high strain, using laboratory tests, cyclic triaxial, cyclic direct simple shear, resonant column, shaking table, centrifuge and using field tests - block vibration test, cross bore hole, their suitability and limitations, Interpretation of results, IS Codes

Liquefaction of soils: liquefaction mechanism, factors affecting liquefaction, liquefaction of cohesionless soils and sensitive clays, liquefaction susceptibility, evaluation of liquefaction potentialstudies by dynamic tri-axial testing, oscillatory shear box, shake table and blast tests.

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MACHINE FOUNDATION

Introduction: Types of machines**,** Types of machine foundations, Modes of vibrations, General requirements of machine foundation, General criteria for design, Permissible amplitude

Analysis & Design of Machine foundation: Elastic homogeneous half space and lumped parameter solutions, analysis and design of foundations for reciprocating and impact type machines, turbines, effect of machine foundation on adjoining structures.

Vibration isolation& control: Force isolation & motion isolation, Methods of isolation in machine foundations Isolating materials and their properties

Bearing capacity of foundations: Introduction to bearing capacity of dynamically loaded foundations

Reference Books:

1. Das, B.M., "Fundamentals of Soil Dynamics", Elsevier, 1983.
2. Steven Kramer, "Geotechnical Earthquake Engineering", Pearson, 2008.
3. Prakash, S., Soil Dynamics, McGraw Hill, 1981.
4. Kameswara Rao, N.S.V., Vibration analysis and foundation dynamics, Wheeler Publication Ltd., 1998.
5. Richart, F.E. Hall J.R and Woods R.D., Vibrations of Soils and Foundations, Prentice hall Inc., 1970.
6. Prakash, S. and Puri, V.K., Foundation for machines: Analysis and Design, John Wiley & Sons, 1998
7. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.
8. Das B.M., Shallow Foundations: Bearing capacity and settlement, CRC Press, 1999.
9. Tomlinson M.J., Pile design and construction Practice, Chapman and Hall Publication, 1994.
10. Poulos, H. G. and Davis, F. H., "Pile Foundation Analysis and Design", Wiley and Sons 1980, John Wiley & Sons, 1979.

Course Outcomes:

After Completion of course students will able to:

CEP251.1 Explain basics of soil dynamics, theory of vibration, propagation of body waves and surface waves through soil.

CEP251.2 Discuss different laboratory and field tests to determine dynamic soil properties required for design purpose.

CEP251.3 Describe liquefaction mechanism and evaluation of liquefaction potential studies by various tests.

CEP251.4 Explain general requirements of machine foundation, and criteria for its design.

CEP251.5 Analysis & Design of different types of Machine foundation required in the field.

CEP252 GEOTECHNICAL INVESTIGATIONS & CONSTRUCTION PRACTICES

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 10 TA +30 MSE + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Provide knowledge of various methods of subsurface investigation and their suitability and preparation of reports.
II. Make students familiar with IS code provisions for subsurface investigations for civil engineering project.
III. Impart knowledge of construction methods, procedures and practices for stabilised rods, embankments, foundations and underground structures

COURSE CONTENTS:

GEOTECHNICAL INVESTIGATIONS

Introduction: Planning of sub-surface programs, Stages in sub-surface exploration, Reconnaissance, Lateral extent and depth of exploration, Methods of exploration – trial pits, open excavation, boring etc.,

Types of boring and drilling: Auger, wash, rotary, percussion, core etc., Methods for stabilization of borehole, Types of soil samples, Sample disturbance, storage, labelling and transportation of samples, Types of soil samplers: Split spoon sampler, Scraper bucket sampler, Shelby tube and thin wall samplers, piston sampler, Denison sampler, hand carved samples etc.

Field Tests: Standard Penetration Test, Cone Penetration Test, Vane Shear Test, Plate Load Test, Pressure Meter Test, Geophysical methods, Seismic methods, Electrical resistivity methods. Determination of ground water table

Soil investigation report: Bore log, soil profile and contents of report, Field records Site investigation in the view of ground improvement

GEOTECHNICAL CONSTRUCTION

Embankment construction: Earth moving equipment, Compaction equipment, types of rollers and their suitability, Methods of quality control, Compaction specifications

Construction of Rock fill dams

Deep Foundation Construction: Piling- Pile driving methods, Pile driving equipment, Construction of Driven Precast concrete piles, Driven cast in situ concrete piles, Bored cast-in-situ concrete piles, under reamed piles, micro piles, Patented methods of pile construction

Excavation, Underground construction: Underground construction Methodology, Vertical & Horizontal Construction, Management of ground water, Excavate-support Sequence, Temporary & permanent Soil Support, Spoil removal, stabilisation of nearby foundations Soil Support

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Methods
Dewatering Methods: Methods of Dewatering systems-open sumps and ditches, Well point systems, Deep-well drainage, Horizontal wells, Vacuum dewatering Systems, Dewatering by Electro-osmosis

Cofferdams

Caissons & Wells: Construction of open caisson, Pneumatic Caisson, Construction of well foundation- Components and their functions, Different shapes, Sinking of Wells, Measures for rectification of tilt and shift, Constructional of machine foundations: Reinforcement and construction details

Tunnel: Cut and Cover tunnels, Bored tunnels: Shield Tunnels, Types of Shield tunnel machines, Tunnel lining and supports in Bored Tunneling, Jacked Tunnels: Box Jacking, Micro tunnels, Horizontal Directional Drilling, Tunnel Boring machines (TBM) – Types of TBMs, Components of full face TBM, Choice between Full face and Partial face machines, Mucking

Construction of stabilised Roads- Construction of cement stabilised roads- different methods, Construction of Lime stabilised roads and bituminous stabilised roads, Field control of stabilization

Reference Books:

1. Geotechnical Engineering: S. K. Gulhati& M. Datta, Tata McGraw-Hill, New Delhi (2005)
2. Soil Mechanics and Foundation Engineering: K.R. Arora, Standard Publisher and Distributor
3. Soil Mechanics in Theory and Practice: Alam Singh, Asia Publisher and Distributor, (1975)
4. Basic and Applied soil mechanics: Gopal Ranjan & A.S. Rao, New Edge Int. ltd., (2004)
5. Advanced Foundation Engineering: Murthy VNS, CBS publishing, (2007)

Course Outcomes:

After Completion of course students will able to:

CEP252.1: Discuss various methods of subsurface investigation and their suitability.

CEP252.2: **S**uggest and plan suitable methods of soil exploration based on the requirement of civil engineering project and site condition and prepare soil exploration report.

CEP252.3: Describe construction methods, procedures and practices for stabilised rods, embankments, foundations and underground structures.

CEP253 PAVEMENT ANALYSIS & DESIGN

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Describe Subsoil drainage and compaction of pavements.
II. Choose adequate Design parameters and Material Characteristics for pavement analysis and design.
III. Perform analysis and Design of flexible pavements by various methods.
IV. Discuss analysis and Design of Rigid pavements by various methods.

COURSE CONTENTS:

General: Structural action of flexible and rigid pavements. Characteristics of highway and airfield pavements

Subsoil drainage in Highway: Design of filters, perforated pipe drainage, Methods of sub soil drainage for roads, permeable blankets, longitudinal and transverse under drains, horizontal drains, stabilizing trenches. Sub soil drainage in highways, runways and railways.

Compaction: Mechanics of compaction, Field-compaction equipment; their suitability and choice, Compaction quality control and measurement.

Design parameters: Standard Axial load and wheel assemblies for road vehicles under carriage system for aircraft, Tire and contact pressure, contact area imprints, Computations of ESWL for flexible and rigid pavements. Load repetitions and distributions of traffic for highway and airfield pavement, airport traffic areas.

Material Characteristics: AASHO sub-grade soil classification. Group index, CBR, North Dakota cone bearing value, plate load test for "K", Marshal's method of bituminous mix design, Modulus of rupture and elasticity, poison's ratio &coefficient of thermal expansion of concrete, Layer equivalency concepts

Analysis of Flexible and Rigid Pavements: Stress, Strain deformation analysis for single, two, three and multi-layered flexible pavement systems. Stress and deflections for rigid pavements due to load and temperature, influence Charts, ultimate load analysis, joints in pavements.

Design of Flexible Pavement: Selection of pavement design input parameters – traffic loading and volume, failure criteria, Different methods -North Dakota cone, Group index, CBR, IRC-37, Brumister, Triaxial (Kansas), AASHO method of design, comparison of different pavement design approaches

Flexible Pavement Design for Airfields: U. S. Crops of Engineering, CBR, FAA, Mcload (Canadian)

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Reference Books:

1. Principles of Pavement Design, Yoder &Witzace; Prentice Hall,2000
2. Pavement Analysis and Design, H. H. Yang, Pearson Prentice Hall, 2004
3. Airport Planning & Design, Goyal & Praveen Kumar; Galgotia Publication, 2002
4. Design and Performance of Road Pavements, Croney & Croney, McGraw Hill, 2002
5. Airport Planning and Design, S K Khanna, M. G. Arora, S S Jain, 6th edition, Nemchand & Bros, Roorkee, 1999
6. Highway Engineering; K. Khanna, and Justo, C.E.G., Khanna Publication, Roorkee, 2001Yang and H. Huang, Pavement Analysis and Design, Pearson Prentice Hall, 2004.
7. Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.
8. Sharma and Sharma, Principles and Practice of Highway Engg., Asia Publishing House, 1980.
9. Teng, Functional Designing of Pavements, McGraw- Hill, 1980.)

Course Outcomes:

After Completion of course students will able to:

CEP253.1 Describe Subsoil drainage and compaction of pavements.

CEP253.2 Apply Design parameters and Material Characteristics for pavement analysis and design.

CEP253.3 Carry out analysis and Design of flexible pavements by various methods.

CEP253.4 Discuss analysis and Design of rigid pavements by various methods.

CEP254 PROGRAM ELECTIVE II

CEP254 (A) GEOTECHNICAL EARTHQUAKE ENGINEERING Teaching Scheme :

03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Discuss causes and quantification of earthquake.
II. Study effect of earthquake and the design criterions to be followed for the design of different geotechnical structures.
III. Impart knowledge of Seismic design of foundations and Seismic slope stability analysis.

COURSE CONTENTS:

Earthquake seismology – Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.

Earthquake ground motion – Seismograph, Characteristics of ground motion, Effect of local site conditions on ground motions, Design earthquake, Design spectra, Development of site specification and code-based design.

Ground response analysis – One-dimensional ground response analysis: Linear approaches, Equivalent linear approximation of non-linear approaches, Computer code "SHAKE".

Liquefaction: Liquefaction and lateral spreading - Liquefaction related phenomena, Liquefaction susceptibility: Historical, Geological, Compositional and State criteria. Evaluation of liquefaction by cyclic stress and cyclic strain approaches, Lateral deformation and spreading, Criteria for mapping liquefaction hazard zones.

Seismic design of foundations

Seismic slope stability analysis: Internal stability and weakening instability and Seismic design of retaining walls

Reference Books:

1. Steven Kramer, "Geotechnical Earthquake Engineering", Pearson,2008.
2. Seco e Pinto, P., Seismic behaviour of ground and Geotechnical structure, A. A.
3. Naeim, F., The Seismic Design Handbook, Kluwer Academic Publication, 2nd Edition, 2001.
4. Ferrito, J.M, Seismic design criteria for soil liquefaction, Tech. Report of Naval Facilities service centre, Port Hueneme, 1997 Highway Engineering;
5. K. Khanna, and Justo, C.E.G., Khanna Publication, Roorkee, 2001Yang and H. Huang,

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Pavement Analysis and Design, Pearson Prentice Hall, 2004.

6. Yoder and Witzech, Pavement Design, McGraw-Hill, 1982.
7. Sharma and Sharma, Principles and Practice of Highway Engg., Asia Publishing House, 1980.
8. Teng, Functional Designing of Pavements, McGraw- Hill, 1980.)

Course Outcomes:

After Completion of course students will able to:

CEP254(A).1 Describe the causes and quantification of earthquake.

CEP254(A).2 Discuss effect of earthquake and the design criterions to be followed for the design of different geotechnical structures.

CEP254(A).3 Describe Seismic design of foundations and Seismic slope stability analysis.

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CEP254(B) ENVIRONMENTAL GEOTECHNOLOGY

03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Recognize and describe sources and effects of subsurface contamination, characteristics of waste, and Soil-waste interaction,
II. Provide foundation for carrying out Planning, designing and construction of landfills for MSW, and pond-ash.
III. Summarize remediation and control of toxic and hazardous waste sites.
IV. Develop an understanding about Geotechnical re-use of waste materials.

COURSE CONTENTS:

Contamination: Surface & subsurface contamination, Sources and effects of subsurface contamination, Physical, Chemical and biological characteristics of solid waste, Identification, Characterization and regulatory requirements for disposal of hazardous, non-hazardous and domestic waste, Soil-waste interaction, Effect of pollutants on soil properties

Waste management: Recycling, Composting, Insiration, and various disposal methods, Site selection, Leachate collection and detection system

Contaminants of solid waste in landfills: Characteristics of solid wastes, Disposal of solid waste, Waste containment, Solid waste Landfills and its components, Shape and size of landfills, Types of landfills, Site selection Impervious barriers for liners and Covers, Liner systems and cover systems, , Landfill construction and operation, Leachate generation, Closure and post-closure care, Sustainable waste management, Ground water contamination associated with leachate transfer

Containment systems using Geomembrane: Advantages of using composite barrier for Liners and Covers, Single composite liner system for MSW landfill, Double composite liner system for HW landfill, Stability of landfills

Contaminants of slurry wastes: Slurry transported waste, Slurry Ponds and their operation, Embankment construction methods for ponds, Design aspects, Environmental impact and control,

Vertical barriers for containment: Contaminated sites, Types of vertical barriers, - Soil-bentonite slurry trench walls, and Cement-Bentonite slurry trench walls -construction and design aspects

Geotechnical reuse of Waste material: Waste reduction, Use of waste in Geotechnical construction, Waste characteristics for soil replacement, Transportation consideration, engineering properties of waste, Waste material in embankment and fills, Reclamation of contaminated site, various methods

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Reference Books:

1. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
2. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press, 1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
5. Rowe, R.K, Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
6. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering - Principles and Applications, Marcel Dekker Inc, 2000.
7. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and
8. Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.

Course Outcomes:

After Completion of course students will able to:

CEP254(B).1 Perceive and describe sources and effects of subsurface contamination, characteristics of waste, and Soil-waste interaction.

CEP254(B).2 Discuss Planning, designing and construction of landfills for MSW, and pond-ash.

CEP254(B).3 Explain remediation and control of toxic and hazardous waste sites.

CEP254(B).4 Relate knowledge of Environmental Geotechnology for Geotechnical re-use of waste materials.

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CEP254(C) FOUNDATIONS ON WEAK SOIL

03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Relate the knowledge of Engineering properties of weak rocks, different rock mass classification systems, Failure criteria for weak rocks and modes of failure of foundations on rocks/ rock masses.

II. Give deep insight in to bearing capacity and Pressure-settlement characteristics of foundations on rocks and rock masses.

III. Outline and describe design procedure for different types of foundations placed over rock mass.

COURSE CONTENTS:

Engineering properties of weak rocks, different rock mass classification systems, relative merits and demerits

Failure criteria for weak rocks, bi-linear Mohr-Coulomb failure criterion, Hoek and Brown criterion and modified Hoek and Brown failure criterion etc.

Effect of structural planes on rock foundations, possible modes of failure of foundations on rocks/ rock masses, determination of in-situ shear strength of rocks and rock masses

Requirements for satisfactory performance of foundations, bearing capacity of foundations on rocks and rock masses, allowable bearing pressure of rock foundations using a nonlinear failure criterion, monotonic and cyclic plate load tests

Pressure-settlement characteristics, effect of layering, anisotropy, heterogeneity and inelasticity

Shallow foundations, shallow foundations on sloping ground, raft foundations, stilt foundations, foundations for suspension bridges, transmission line towers, framed buildings etc, treatment of foundations - open joints, solution cavities, weak seams

Piles in weak rocks, bearing capacity and settlement of piles, piles in stratified rock masses, field load tests on piles in weak rocks, behaviour of bored / driven piles in soft / weathered rocks

Reference Books:

1. Wyllie Duncan C.," Foundations on Rock: Engineering Practice", E&FNSpon, Taylor and Francis.
2. Hudson J.A. and J.P. Harrison. Engineering Rock Mechanics: an Introduction to the Principles, 1997. Elsevier, Oxford
3. Singh, B. and Goel, R.K., " Rock Mass Classification- A Practical Engineering Approach", Elsevier .
4. Ramamurthy, T., "Engineering in Rocks", PHI Learning Pvt. Ltd.
5. Hoek, E., "Practical Rock Engineering", Rock science.

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Course Outcomes:

After Completion of course students will able to:

CEP254(C).1: Discuss Engineering properties of weak rocks, different rock mass classification systems, Failure criteria for weak rocks and modes of failure of foundations on rocks/ rock masses.

CEP254(C).2: Apply design procedure for different types of foundations placed over rock mass.

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SHP221 RESEARCH METHODOLOGY

Teaching Scheme : 02 L + 00 T Total = 02 **Credits: 02**
Evaluation Scheme: 30 MSE + 20 TA **Total 50 marks**

Course Objectives:

I. Understand research problem formulation.
II. Analyze research related information
III. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
IV. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

COURSE CONTENTS:

Introduction to Research: Definition of research, Characteristics of research, Types of research- Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical, Steps of research methodology

Research Problem Formulation and Methods: Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution. Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models. Developing a research plan: Exploration, Description, Diagnosis and Experimentation

Data collection: Sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.

Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

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Research Ethics, IPR and Publishing: Ethics: Ethical issues.
IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights,

Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.
3. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
4. S.D. Sharma , "Operational Research", Kedar Nath Ram Nath & Co.,1972
5. B.L. Wadehra, "Law Relating to Patents, Trademarks, Copyright Designs and Geographical Indications", Universal Law Publishing, 2014.

COURSE OUTCOMES:

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

SHP221.1 Understand research problem formulation. **SHP221.2** Analyze research related information.

SHP221.3 Follow research ethics

SHP221.4 Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

SHP221.5 Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

CEP255 GEOTECHNICAL ENGINEERING LAB II

Teaching Scheme: 06 P **Total = 06** **Credit : 03**

Evaluation Scheme: ICA = 50; ESE = 50 **Total Marks: 100**

Course Objectives:

I. Develop skill for conducting laboratory tests to determine properties of stabilised / reinforced soil
II. Develop skill fordetermining the properties of Geosynthetics
III. Use Geo5 software for solving problems in Geotechnical Engineering

COURSE CONTENTS:

Part A-List of Practical's:

1. UCS and C. B. R. test on cement and lime stabilized soil
2. Model plate load test on reinforced soil foundation bed
3. Tests on Geotextile and Geogrid to determine physical, Mechanical & survivability characteristics
4. Design earth dam and carry out its analysis

Part B: Designs

Design of earthen dam and its Seepage analysis and slope stability analysis, Design of filters

Part C: Geo5 Software

Use of Geo5 Software for Slope stability Analysis of Earthen dam for different conditions

Part D: Field Visits

Field visit should be arranged to soil investigation site, earth dam construction site, ground improvement site, stabilised road construction site or any other such site important from geotechnical engineering aspect.

A Report based on above experiments, Design and field visit reports shall be submitted by each student.

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COURSE OUTCOMES:

After Completion of course students will able to:

CEP255.1: Execute the experiments to determine properties of stabilised / reinforced soil by conducting laboratory and field tests as per relevant IS Codes.

CEP255.2: Determine the various properties of Geosynthetics by conducting various lab tests as per relevant Codes.

CEP255.3: Use software for solving problems in Geotechnical Engineering.

CEP255.4: Design earth dam and carry out its analysis.

CEP255.5: Prepare visit report based on field visit.

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CEP256 SEMINAR II

Teaching Scheme : 04 P **Total =04** **Credit : 02 Evaluation Scheme: ICA = 50** **Total Marks: 50**

Course Objectives:

I. Guide students to select a topic for seminar based on latest technological advancements and carry out literature review, with a focus on selecting a topic for dissertation.

II. Guide students to prepare seminar report and power point presentation.

Seminar II: Student has to select a topic for Seminar based on literature review on advanced topics / recent developments in the field of Geotechnical Engineering and submit the report and deliver the seminar based on it. The topic for seminar should be related to the literature survey based on Dissertation topic. It is to be evaluated internally by panel of examiners headed by HOD (if possible) wherein guide should be one of the members of the panel.

Course Outcomes:

After Completion of course students will able to:

CEP256.1 Select a topic for seminar based on latest technological advancements and collect related literature.

CEP256.2 Prepare seminar report and power point presentation based on information collected related to the selected topic.

CEP256.3 Deliver seminar.

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CEP351 PROGRAM ELECTIVE
CEP351(A) FINITE ELEMENT METHOD IN GEOMECHANICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Develop theoretical background of finite element theory.
II. Impart knowledge of Finite Element Method for solution to different field problems such as settlement analysis, seepage analysis etc.

COURSE CONTENTS:

Stress-deformation analysis: One dimensional, Two dimensional and Three-dimensional formulations.

Discretization of a Continuum, Elements, Strains, Stresses, Constitutive, Relations, Hooke's Law, Formulation of Stiffness Matrix, Boundary Conditions, Solution Algorithms.

Principles of discretization, element stiffness and mass formulation based on direct, variational and weighted residual techniques and displacements approach, Shape functions and numerical integrations, convergence.

Displacement formulation: Rectangular, triangular and isoparametric elements for two dimensional and axisymmetric stress analysis.

Settlement Analysis: 2-D elastic solutions for homogeneous, isotropic medium,

Steady Seepage Analysis: Finite element solutions of Laplace's equation, Consolidation Analysis: Terzaghi consolidation problem, Choice of Soil Properties for Finite Element Analysis

Reference Books:

1. O.C. Zienkiewicz and R.L. Taylor, Finite element methods Vol I &Vol II, McGraw Hill, 1989,1992.
2. K.J. Bathe, Finite element procedures, PHI Ltd., 1996.
3. David M Potts and LidijaZdravkovic, "Finite Element Analysis in Geotechnical
4. Engineering Theory and Application", Thomas Telford. 1999.

Course Outcomes:

After Completion of course students will able to:

CEP351(A).1 Discuss fundamental theory of the FEA method and concepts behind variation methods and weighted residual methods in FEM.

CEP351(A).2 Develop element characteristic equation procedure and generation of global stiffness equation and apply suitable boundary conditions to a global structural equation, and reduce it to a solvable form.

CEP351(A).3 Perform engineering analysis for the given problem using FEM.

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CEP351(B) ENGINEERING ROCK MECHANICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Demonstrate and execute various laboratory tests on rock and classify rock mass.
II. Acquire knowledge of Strength Behavior and Strength/ Failure Criterion for rock masses.
III. Application of rock mechanics in Civil Engineering.

COURSE CONTENTS:

Rock: Formation of rocks, Physical properties, Classification of rocks and rock masses, Elastic constants of rock; Insitu stresses in rock

Rock Testing: Laboratory and Field tests

Rock Mass Classification Systems: Rock load classification according to Terzaghi, RQD index as a qualitative description of the rock mass, limitations and advantages, Lauffer-Pacher classification, Rock structure rating (RSR), Geomechanics Classification: General Comments on Application of Rock Mass Classification Schemes, Comparison of Rock Mass Classification Schemes

Discontinuities in Rock Masses: Discontinuity orientation, Effect of discontinuities on strength of rock

Strength Behaviour: Compression, Tension and Shear, Stress-Strain relationships, Rheological behavior

Strength/ Failure Criterion: Mohr-Coulomb, Griffith theory, Hoek and Brown, strength and other strength criteria. Stresses in rock near underground openings;

Application of rock mechanics in Civil Engineering: Rock tunneling, rock slope stability, bolting, blasting, grouting and rock foundation design. Modern modeling techniques & analyses in rocks

Reference Books:

1. Hudson J.A. and J.P. Harrison. Engineering Rock Mechanics: an Introduction to the Principles, 1997. Elsevier, Oxford
2. Goodman, R.E. Introduction to Rock Mechanics, John Wiley & Sons.
3. Ramamurthy, T., “Engineering in Rocks”, PHI Learning Pvt. Ltd.
4. Jaeger, J.C. and Cook, N.G.W, Fundamentals of Rock Mechanics, Chapman and Hall,

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Course Outcomes:

After Completion of course students will able to:

CEP351(B).1 Describe various laboratory tests on rock and rock mass classification.

CEP351(B).2 Discuss Strength Behaviour and Strength/ Failure Criterion for rock masses and predict strength of rock mass with respect to various Civil Engineering applications.

CEP351(B).3 Apply principles of rock mechanics in Civil Engineering.

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CEP351(C) EARTH RETAINING STRUCTURES

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Stability analysis of different types of earth retaining structure
II. Design of different types of earth retaining structure

Course Contents:

Earth Pressure: Rankin and Coulomb theories, active, passive and pressure at rest; concentrated surcharge above the back fill, earth pressure due to uniform surcharge, earth pressure of stratified backfills, saturated and partially saturated backfill.

Retaining walls: Proportioning of retaining walls, stability of retaining walls, mechanically stabilized retaining walls/reinforced earth retaining walls.

Sheet Pile wall: Free earth system, fixed earth system.

Bulkheads: Bulkheads with free and fixed earth supports, equivalent beam method, Anchorage of bulkheads and resistance of anchor walls, spacing between bulkheads and anchor walls, resistance of anchor plates.

Tunnel and Conduit: Stress distribution around tunnels, Types of conduits, Load on projecting conduits; Arching and Open Cuts: Arching in soils.

Braced excavations: Earth pressure against bracings in cuts, Heave of the bottom of cut in soft clays

Reference Books:

1. Das, Braja M., "Principles of Foundation Engineering", PWS Publishing. 1998
2. Bowles. J.E., Foundation Analysis and Design, Tata McGraw-Hill International Edition, 5th Edn, 1997.

Course Outcomes:

After Completion of course students will able to:

CEP351(C).1 Determine the earth pressure on retaining structures for different field situations.

CEP351(C).2 Design of different types of earth retaining Structures.

CEP351(C).3 Carry out stability analysis of retaining structures.

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OPEN ELECTIVES

SHP321(A)BUSINESS ANALYTICS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE+ 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Understand the role of business analytics within an organization.

II. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.

III. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.

IV. To become familiar with processes needed to develop, report, and analyze business data.

V. Use decision-making tools/Operations research techniques.

VI. Mange business process using analytical and management tools.

VII. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Contents:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

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

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

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

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.

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Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

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

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

SHP321(A).1: demonstrate knowledge of data analytics.

SHP321(A).2: demonstrate the ability of think critically in making decisions based on data and deep analytics.

SHP321(A).3: demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

SHP321(A).4: demonstrate the ability to translate data into clear, actionable insights.

SHP321(B) INDUSTRIAL SAFETY

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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 fire fighting, equipment and methods.

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.

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.

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.

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

Reference Books:

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

SHP321 (C) OPERATIONS RESEARCH

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. 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

Course Outcomes:

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

SHP321(C).1: apply the dynamic programming to solve problems of discreet and continuous variables.

SHP321(C).2: apply the concept of non-linear programming

SHP321(C).3: carry out sensitivity analysis

SHP321(C).4: model the real world problem and simulate it.

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SHP321 (D) COST MANAGEMENT OF ENGINEERING PROJECTS

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Overview of the Strategic Cost Management Process

Cost concepts in decision-making: Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making

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

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

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

SHP321 (E) COMPOSITE MATERIALS

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

References:

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

SHP321 (F) WASTE TO ENERGY

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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.

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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SHP321 (G) FINANCE MANAGEMENT

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Financial Management: objectives and goals, Fixed Capital, Floating Capital, Fund flow analysis and Fund flow statements. Ratio analysis: Classification, structural group, standards for comparison and limitations

Profit planning and Break-even analysis, margin of safety. Financial Budgets, control measures, Authorized capital, working capital, reserve, capital Management, floating of shares, share capitals & fund raising –methods and their appraisal.

Control measures: Payback approach, Standard costing, Actual costing, Operating ratio, techniques of cost control, Marginal cost.

Elements of Costs: Material, Labor, Expenses, Overheads, Direct and Indirect Cost, Fixed and Variable Cost, other classifications. Allocation of overheads Methods for Depreciation calculation, Budgetary control and Variance analysis, Activity based costing (ABC). Biases in cash flow estimation.

Appraisal criteria: Net Present Value, benefit cost ratio, internal rate of returns urgency, payback period, accounting rate of returns, investment appraisal in practice

Analysis of Risk: Types and measure of risk , simple estimation of risk, sensitivity analysis, scenario analysis, Special decision situations: Choice between mutually exclusive projects of unequal life, optimal timing decision, determination of economic life, inter-relationships between investment and financing aspects, inflation and capital budgeting. Analysis of firm and market risk:

Portfolio theory and capital budgeting, Capital Asset Pricing Model.

Reference Books :

1. J Pandey I M., Financial Management, Vikas Publication,10th Edition 2013
2. Henry M. Stenier, “Engineering economics Principles”, Mc Graw Hill Publication.
3. C. B. Gupta, “Fundamentals of Business”, Sultan Chand & Company.
4. S. K. Basu, K.C. Sahu and Rajiv B, “Industrial Organisation and Management”, PHI New Delhi, Nov 2012.

SHP321 (H) PROJECT MANAGEMENT

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Human Factors and Systems, Information Input and Processing, Visual Displays of Dynamic Information, Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Hand Tools and Devices.

Definition of Ergonomics and its significance in designing workplace layout and detailed motion plan of work, Man-Machine Symbiosis, Human Factors in design & manufacturing, Viz. pressure of the environment, temperature, humidity etc., Principles of motion economy, anthropometric condition, stability criterion etc. Biodynamic analysis for design of products & its concept of learning by man and machine;

Measurement of Learning Index and training for each job and each man, Product design – various aspects including ergonomic design and reliability based design.

Dynamic consideration in design of product using vibration stability in biomechanisms, Safety in manufacturing, Considerations of human stress, Allowable limit of stress, stress adjustment.

Estimation of human error and human reliability, combining various forms of human error by random number simulation, Human Error, Accidents and safety, Human Factors and the Automobile, Human Factors in Systems Design.

Dynamic consideration in project operations, leadership, requirement, communication process, motivating a diverse workflow, facilitating team decisions, resolving interpersonal conflicts, managing different people, strengthening team accountability

Reference Books :

1. Sanders, M.M. & Mc Cormick, E.J., Human Factors in Engineering & Design, McGraw-Hill, 7th ed. (1993)
2. S. K. Basu, K.C. Sahu and Rajiv B, Industrial Organisation and Management –, PHI New Delhi, Nov 2012.

SHP321 (I) DATA STRUCTURE AND ALGORITHMS

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Outcomes:

I. Write neat code by selecting appropriate data structure and demonstrate a working solution for a given Problem.

II. Think of all possible inputs to an application and handle all possible errors properly.

III. Analyze "Clearly different possible solutions to a program and select the most efficient one.

IV. Write an application requiring an effort to fat least l000 lines of code to demonstrate a good working solution.

V. Demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking

Course Contents:

Introduction: Data, Data types. Object, data structure and abstract data types (ADT). Characteristics of an algorithm' Analyzing progams Frequency count Time and space complexity, Big 'O' and Ω notation. Best, average and worst cases. Dangling pointers and garbage memory

Arrays, Files and Searching: Searching: linear and binary search algorithm. Hashing: hashing functions, chaining, overflow handling with and without chaining, open addressing: linear. Quadratic Teaching Scheme: Examination Scheme: probing. Files handling: text and binary files, use of various libraries for handling files.

Stacks and Queues: Stack and queue. as ADT. Operations on stack and queue, Implementations using arrays and dynamic memory allocation, Application of stack for expression evaluation, expression conversion, Recursion and stacks, Problems like maze and knight's tour.

Lists: List as ADT. Concept of linked organization of data against linked list. Singly linked list, doubly linked list, circular linked list. Representation & manipulations of polynomials/ sets using linked lists. Dynamic memory management, Representation of sparse matrix, Addition and transpose of sparse matrix

Trees and Graphs: Basic terminology. Binary trees and its representation, Binary tree traversals (recursive and non-recusive) and various operations, Insertion and deletion of nodes in binary search tree, Representation of graphs using adjacency matrix, adjacency list, Implementation of algorithms for traversals; implementing Kruskal's. Prim's algorithms, Single source shortest paths using Djkstra's algorithm, Applications of graphs and trees

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Time Complexity Analysis, Algorithm Design: Verification of programs, invariants, assertions, proof of termination. Best, Average and Worst case analysis of binary search, quick sort, merge sort, insertion sort, hashing techniques, sparse matrix algorithms. Designing data structures for specific applications

Reference Books:

1. E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", Second Edition, University Press, ISBN 978-81-7371-605-8
2. B. Kernighan, D. futchie, "The C Programming Language", Prentice Hall of India, Second Edition, ISBN 8 1 -203-0596-5
3. Y. Langsam, M. Augenstin and A. Tarmenbaum, "Data Structues using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1
4. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928
5. Jean-Paul Tremblay, Paul. G. Soresan, "An introduction to data structures with Applications", Tata Mc-Graw Hill Interactional Editions, 2nd edition 1984, ISBN-O07-462471-7

CEP352 DISSERTATION STAGE I

Teaching Scheme : 20 P Total =20 Credit : 10
Evaluation Scheme: ICA = 100 Total Marks: 100

Course Objectives:

I. Guide students to select a topic for dissertation based on latest technological advancements and carry out related literature review.
II. Guide students for development of a system to carry out analysis/experimental investigation for the selected area/problem.

Dissertation Stage I: Student has to select a topic for Project, carry out literature review, find the literature gap, carry out 25% or more work on Project topic and submit the report and deliver the seminar based on it. It is to be evaluated internally by three members panel of examiners headed by HOD (if possible) wherein guide should be one of the members of the panel.

Last date of submission of report shall be two weeks before the end of semester.

M. Tech Students opting for industrial dissertation for whole year will complete third semester courses through NPTEL or online courses as per the guidelines.

Course Outcomes:

After Completion of course students will able to:

CEP352.1 Select a topic for dissertation and carry out literature review for the selected topic.

CEP352.2 Develop a system to carry out analysis/experimental investigation for the selected area/problem.

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CEP451 DISSERTATION STAGE II

Teaching Scheme : 32 P Total= 32 Credit : 16
Evaluation Scheme: ICA = 200; ESE = 200 Total Marks: 400

Course Objectives:

I. Guide students to carry out analysis/experimental investigation for the selected area/problemand derive conclusions based on results of investigations carried out.
II. Guide students to write dissertation report.
III. Prepare and deliver presentation.

Dissertation Stage II: Student has to carry out remaining project work on the selected Project topic and submit the report. It is to be evaluated internally by three members panel of examiners headed by HOD (if possible) wherein guide should be one of the members of the panel.

Course Outcomes:

After Completion of course students will able to:

CEP452.1 Carry out analysis/experimental investigation for the selected area/problemand derive conclusions based on results of investigations carried out.

CEP452.2 Write dissertation report.

CEP452.3 Prepare and deliver presentation.

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GOVT. COLLEGE OF ENGINEERING, AMRAVATI

DEPARTMENT OF CIVIL ENGINEERING

CURRICULUM

For

M. TECH. (ENVIRONMENTAL ENGINEERING)

2019- 2020

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Chairman, BoS (Dr. M. N. Hedaoo)

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M. TECH. ENVIRONMENTAL ENGINEERING

PROGRAM OBJECTIVES

Post Graduate Environmental Engineering Student should

1. Visualize, formulate, and mitigate Environmental related issues.
2. Develop and adopt sustainable technology for Industrial Development.
3. Understand the importance of professional and ethical responsibilities.
4. Acquire zeal and enthusiasm of lifelong learning to cope up with Global trends.

PROGRAMME OUTCOMES

Post Graduate Environmental Engineering Student will be able to

1. Resolve the Environmental related issues.
2. Adopt sustainable technology for Industrial Development.
3. Shoulder professional and ethical responsibilities.
4. Develop zeal and enthusiasm of lifelong learning to cope up with Global trends.

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M. Tech. (Environmental Engineering)

SEMESTER I

Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits Theory
							Theory			Practical		Total	
			Theory Hrs /week	Tutorial Hrs/week	Practical Hrs/week	Theory Hrs /week	MSE	TA	ESE	ICA	ESE	Theory Hrs /week	Tutorial Hrs/week
PC	CEP141	Environmental Science and Chemistry	3	-	-	3	30	10	60	-	-	100	3
PC	CEP142	Environmental Microbiology and Biological Processes	3	-	-	3	30	10	60	-	-	100	3
PC	CEP143	Advanced Water Treatment	3	-	-	3	30	10	60	-	-	100	3
PE	CEP144	Program Elective I	3	-	-	3	30	10	60	-	-	100	3
PL	CEP145	Environmental Engineering Laboratory I		-	6	6	-	-	-	50	50	100	3
PS	CEP146	Seminar I	-	-	4	4	-	-	-	50	-	50	2
AC	SHP121	Audit Course	-	-	-	-	30	20	-	-	-	50	0
		Total	**12**	**-**	**10**	**22**	**150**	**60**	**240**	**100**	**50**	**600**	**17**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE I (CEP 144)
A. Solid and Biomedical Waste Management
B. Hazardous Waste Management
C. Environmental Geotechnology

LIST OF AUDIT COURSES

AUDIT COURSES (SHP 121)	
(A) English for Research Paper Writing	(B) Disaster Management
(C) Sanskrit for Technical Knowledge	(D)Value Education
(E) Pedagogy Studies	(F) Stress Management by Yoga
(G) Constitution of India	
(H) Personality Development through Life Enlightenment Skills.	

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SEMESTER II													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs/ week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PC	CEP241	Advanced Wastewater Treatment	3	-	-	3	30	10	60	-	-	100	3
PC	CEP242	Industrial Wastewater Treatment	3	-	-	3	30	10	60	-	-	100	3
PC	CEP243	Air Quality Monitoring and Control	3	-	-	3	30	10	60	-	-	100	3
PE	CEP244	Program elective II	3	-	-	3	30	10	60	-	-	100	3
MC	SHP221	Research Methodology	2	-	-	2	30	20	-	-	-	50	2
PL	CEP245	Environmental Engineering Laboratory II	-	-	6	6	-	-	-	50	50	100	3
PS	CEP246	Seminar II	-	-	4	4	-	-	-	50	-	50	2
	Total		**14**	**00**	**10**	**24**	**150**	**60**	**240**	**100**	**50**	**600**	**19**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE II (CEP 244)

A. Environmental Impact Assessments and Management
B. Environmental Management and Auditing
C. Environmental Statistics and Optimization Techniques
D. Bioremediation: Principles and Application

SEMESTER III													
Category	Course Code	Name of the Course	Teaching Scheme				Evaluation Scheme						Credits
							Theory			Practical		Total	
			Theory Hrs/week	Tutorial Hrs/week	Practical Hrs/week	Total	MSE	TA	ESE	ICA	ESE		
PE	CEP341	Program Elective III	3	-	-	3	30	10	60	-	-	100	3
OE	SHP321	Open Elective	3	-	-	3	30	10	60	-	-	100	3
PROJ	CEP342	Dissertation Stage I	-	-	20	20	-	-	-	100	-	100	10
	Total		**06**	**00**	**20**	**26**	**60**	**20**	**120**	**100**	**-**	**300**	**16**

***Students going for Industrial Project/ Thesis / Dissertation will complete these courses through MOOCs.**

LIST OF PROGRAM ELECTIVES

PROGRAM ELECTIVE III (CEP 341)

A. Water Supply and Wastewater Collection Systems
B. Remote Sensing and GIS in Environmental Engineering
C. Environmental Systems Modelling and Statistics
D. Rural Water Supply and Sanitation
E. Soft Computing Techniques.

LIST OF OPEN ELECTIVES

OPEN ELECTIVE (SHP 321)

(A) Business Analytics (ME)
(B) Industrial Safety (ME)
(C) Operations Research (ME)
(D) Cost Management of Engineering Projects (CE)
(E) Composite Materials (ME)
(F) Waste To Energy (CE)
(G) Finance Management (EE)
(H) Project Management (EE)
(I) Data Structure and Algorithms (CS)
(J) Any other course approved by BOS

ME :- Offered by Mechanical Engg. Dept.
CE :- Offered by Civil Engineering Department
EE :- Offered by Electrical Engg. Dept.
CS :- Offered by Computer Science and Engg. Dept.

SEMESTER IV												
Category	**Course Code**	**Name of the Course**	**Teaching Scheme**				**Evaluation Scheme**					**Credits**
							Theory		**Practical**		**Total**	
			Theory Hrs /week	**Tutorial Hrs/week**	**Practical Hrs/week**	**Total**	**MSE**	**ESE**	**ICA**	**ESE**		
PROJ	CEP441	Dissertation Stage II	-	-	32	32	-	-	200	200	400	16
	Total		**-**	**-**	**32**	**32**	**-**	**-**	**200**	**200**	**400**	**16**

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COMPARISON OF SEMESTER-WISE CREDIT DISTRIBUTION IN OLD AND PROPOSED STRUCTURE

SEMESTER	CREDITS IN OLD CURRICULUM	CREDITS IN PROPOSED CURRICULUM
I	25	17
II	25	19
III	10	16
IV	30	16
Total	90	68

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Equivalence Scheme

M. Tech. (Environmental Engineering)

SEMESTER I						
Sr. No.	**Course code with Name of course (old)**		**Credit**	**Course code with Name of course [wef 2019-20]**		**Credit**
1.	CEP111	Environmental Science and Chemistry	4	CEP141	Environmental Science and Chemistry	3
2.	CEP112	Environmental Microbiology and Biological Processes	4	CEP142	Environmental Microbiology and Biological Processes	3
3.	CEP113	Advanced Water Treatment	4	CEP143	Advanced Water Treatment	3
4.	CEP114	Advanced Wastewater Treatment	4	CEP241	Advanced Wastewater Treatment	3
5.	CEP115	Solid and Biomedical Waste Management	4	CEP144(A)	Program Elective I Solid and Biomedical Waste Management	3
6.	CEP116	Environmental Engineering Laboratory I	4	CEP145	Environmental Engineering Laboratory I	3
7.	CEP117	Seminar I	1	CEP146	Seminar I	2
	SEMESTER II					
1.	CEP211	Air Quality Monitoring and Control	4	CEP243	Air Quality Monitoring and Control	3
2.	CEP212	Industrial Wastewater Treatment	4	CEP242	Industrial Wastewater Treatment	3
3.	CEP213	Environmental Impact Assessment & Management	4	CEP244(A)	Program elective II Environmental Impact Assessment & Management	3

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4.	CEP214(A)	Program Elective I Hazardous Waste Management	4	CEP144 (B)	Program Elective I Hazardous Waste Management	3
5	CEP214(B)	Program Elective I Environmental Statistics	4	-	No Equivalence	
6	CEP214(C)	Program Elective I Environmental Geotechnology	4	CEP144(C)	Program Elective I Environmental Geotechnology	
7.	CEP215(A)	Program Elective II Environmental System Modeling	4	CEP341(C)	Program Elective III Environmental System Modeling and statistics	3
8	CEP215(B)	Program Elective II Water And Wastewater Engineering Structures	4	-	No Equivalence	-
9	CEP215(C)	Program Elective II Water Distribution Systems And Optimization	4	-	No Equivalence	-
10	CEP216	Environmental Engineering Laboratory II	4	CEP245	Environmental Engineering Laboratory II	3
11	CEP217	Seminar II	1	CEP246	Seminar II	2
	SEMESTER III					
1	CEP311	Dissertation Phase I	10	CEP342	Dissertation Phase I	10
	SEMESTER III					
1	CEP411	Dissertation Phase II	30	CEP441	Dissertation Phase II	16

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CEP141 ENVIRONMENTAL SCIENCE AND CHEMISTRY

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study the ecosystem
II. To study various pollutants responsible for Global Atmospheric Change
III. To study the Chemistry involved in water and wastewater treatment
IV. To study the composition and characterisation of sewage and sewage sludge
V. To study the fundamental principles and uses of chromatography in Environmental Engineering field

Course Contents:

Ecology: Introduction, Energy flow in Ecosystems, food chain and trophic levels, Nutrient cycles, elements of limnology, Eutrophication.

Global Atmospheric Change: The greenhouse effect and stratosphere ozone depletion, Global temperature, the greenhouse effect, carbon dioxide, chlorofluorocarbon, the greenhouse gases, Regional effects of greenhouse gases, perspective on global atmospheric change.

Introduction to Climate Change: Changing patterns of human habitation due to industrialisation, Changes in the ecosystem due to industrialisation, Changes in the climate due to Industrial activity, Changes in the global rain fall pattern

Earth's Carbon reserve: Carbon Cycle, Carbon flow through life cycle, conversion of carbon into various polluting and non-polluting forms, Global carbon balance, Imbalance in carbon cycle due to human activity

Climatic Changes through the ages: Natural climatic pattern changing through the ages, Response of ecosystem to changing climatic changes, acceleration of climate change due to human activity, Effects of climate change on human life, Rise of temperature and its probable impact on future life

General Chemistry:- Law of mass action, Stoichiometry, Gas Laws

Physical Chemistry:- Types of solution, electrical conductivity and aqueous solution, ionic theory, electrical dissociation, Buffer solutions, Indicators, Solubility products, Common ion effect, Amphoteric hydroxides, chemical equilibria and ways of shifting it.

Organic Chemistry and Biochemistry: Organic compounds of interest to environmental engineers, General preparation of the functional groups of organic compounds, Enzymes, classification, Enzyme carbolysed reactions. Break down and synthesis of carbohydrates, fats, protein under aerobic and anaerobic reactions, CNP cycle under aerobic and anaerobic reactions, Colloidal Chemistry, Dispersion of Colloids, General and electro kinetic properties of colloids, colloidal solutions and mixtures. Concept of BOD, COD, TOC

Environmental Chemistry: -Water structure and anomalous behaviour of water ,Chemistry involved in water treatment processes like coagulation, disinfection, softening, fluoridation defluoridation, Iron and its control Composition and characterisation of sewage, sewage sludge and gas analysis.

Course Outcomes

After successful completion of the course, students will be able to

CEP141.1: Apply the principles of Environmental Science to reduce the pollution of environment

CEP141.2: Apply the knowledge of General and Physical chemistry for water and wastewater treatments

CEP141.3: Design the water and wastewater treatment processes by applying the knowledge of Organic chemistry and Biochemistry

CEP141.4: Apply the knowledge of Colloidal chemistry for water and wastewater treatments

CEP141.5: Design the water and wastewater treatment processes by applying the knowledge of Environmental Chemistry

CEP141.6: Gain a basic understanding of composition and characterisation of sewage and sewage sludge

Reference Books

1. Introduction to Environmental Engineering and Science, M Masters Gillbert, Prentice Hall Publication, New Delhi, 1995
2. Environmental Science & Engineering, Henrry, Prentice Hall College Div ,1989
3. Water and Wastewater Engineering, G M Fair, , J. C Geyer., D. A. Okun, Vol, I & II, John Wiley & Sons, New York, 1966
4. Chemistry for Environmental Engineering, Sawyer & M.C Carty, McGraw-Hill, 1994
5. Global Climate Change, M.Z.A Khan, Rawat Publications
6. Climate change and Agriculture over India, Rao and Prasad, PHI Publications
7. Climate Change and Biodiversity, Dr SS Khinchi, McGRAW HILL.
8. Waste Water Treatment, Disposal and Reuse, Met Calf & Eddy, Tata McGraw

CEP142 ENVIRONMENTAL MICROBIOLOGY AND BIOLOGICAL PROCESSES

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To make students understand about classification of microorganisms their characteristics and importance in the field of environmental engineering.

II. To make students aware of methods those are adopted for enumeration, isolation, straining and differentiation of bacteria.

III. To introduce students about microbiology of food which discuss the role of microbes in food production and food spoilage processes.

IV. To make students understand about classification, sources and formation of enzymes.

V. To learn about fresh water biology including limnology, Lake Eutrophication, pathogens, diseases caused by them and their control.

VI. To study the concept of pure and mixed culture of bacteria and laboratory culturing techniques.

VII. To study different biological treatment technologies, air borne diseases and their control.

Course Contents:

Introduction to Microbiology: Classification of microorganisms, procaryotic cells, eucaryotic cells. Characterization of microorganism, microorganism of importance, Distribution of biological forms, interrelationship application in the field of Environmental Engineering

Bacteria: Distribution, cytology, forms size, morphology and file structure of bacteria, nutritional requirements, metabolism, growth of bacteria, growth patterns, food microorganism relationship, Aerobic, Anaerobic growth, Factor affecting growth, generation time.

Bacteriology of Water: Pathogens and indicator of pollution, method of isolation, enumeration and differentiation. Presumptive, confirmative and completed test for E-coli, most probable number, Membrane filter technique, indicators of pollution, sampling method, frequency, precautions.

Microbiology of Food: Microorganisms associated with milk and food, diseases

transmitted, food poisoning, Enzymes Nature of enzymes, mode of actions, effect of temperature, pH, salts and heavy metal, extra cellular and intracellular enzymes classification, source of enzymes, enzymes formation.

Fresh Water Biology: Flora and fauna in rivers, distribution, limnology, biological cycles, oxygen concentration, nutrient concentration, oxygen depletion, oxygen sag reaeration, Lake eutrophication and its prevention.

Algae, Fungi Protozoa and Viruses: General, introduction to these groups, their role in environmental Engineering and their classification, identification, observation nutrition, reproductions, their control.

Viruses: Occurrence, special features, diseases caused by them, culturing, control of viruses. Bacterial

Bacteria Culture: Isolation of microorganisms, staining procedures, pure and mix cultures, culture characteristics, different medias, selective methods, interference, gram positive and negative bacteria laboratory culturing techniques, equipments used, microscope, autoclave, incubator, test chamber.

Microbiology of Waste Water Treatment: Microorganisms, fundamental theory, theory of operations, oxygen requirements and environmental factors associated with following waste treatment methods.

- Activated sludge process
- Trickling filter
- Oxidation pond
- Sludge digestion
- Cesspools
- Septic tank and Imhoff tank

Air Microbiology: Types of microorganisms, Air borne diseases, sampling of air, microbial content of air, control of airborne diseases. Control of microorganisms Death of bacteria Pattern of death, effect of temp, pH, toxic substances on growth of bacteria, Antagonism, and synergism, Control of microorganisms by physical agents, Control of microorganisms by chemical agents

Reference Books:

1. Microbiology for Environmental Scientist and Engineers, Anthony Gaudy, Elizabeth Gaudy, McGraw Hill Int. Book Co., 1980.
2. Microbiology for Sanitary Engineers, R. E. Mckinney, McGraw Hill Int. Book Co., 1967
3. Microbiology of Water and Sewage, P. L. Gainey., Prentice Hall Inc., 1952
4. Microbiology, M. J Pelczar., E. C. S. Chan, Tata McGraw Hill, 1986 5. Environmental Biology, Mukherjee, Tata McGraw Hill Publishing. Co. Ltd,1996

Course Outcomes:

On successful Completion of the course, students will be able to:

CEP142.1: Study the basic microbial structure and function and study the comparative characteristics of prokaryotes and eukaryotes.

CEP142.2: Demonstrate theory and practical skills in microscopy and their handling techniques and staining procedures, enumeration of bacteria

CEP142.3: Know various Culture media and their applications and also understand various physical and chemical means of sterilization

CEP142.4: Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungi and algae

CEP142.5: Comprehend the different biological treatment technologies adopted for treatment, air borne diseases and their control.

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CEP143 ADVANCED WATER TREATMENT

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand the importance of standards of treated water

II. To learn the various unit operations and processes of water treatment process

III. To study and design various miscellaneous treatment processes such as softening, fluoridation/de- fluoridation.

IV. To design the conventional water treatment plant

Course Contents:

Standards for raw and treated waters, Surface waters, Effects of storage on water quality, Limnology, Water ecology, Thermal stratification, Seasonal Change, lake overturns, Algae, Control measures, quality of underground Waters. Nature and source of impurities, Examination of waters

Requirements of water treatment facilities, Process design and hydraulic design, Unit operations, Gravity systems, pumping systems, Period of design, Fluctuations in demand, Intake structures, Useful concepts from water chemistry and biology

Principles of Sedimentation and Floatation: General equations for settling or discrete particulates, Hindred settling, effect of Temperature, viscosity efficiency of an ideal basin, short-circuiting. Sludge moisture content – specific gravity relationship. Up flow and sludge blanket tanks – mathematical model of the unit processes.

Theories of Chemical Coagulation: Nature of colloids. Zeta potential, Coagulant and their specificity, Design of mechanical Flocculator. Mean velocity gradient "G", "Gt" effect of temperature and other variables. Power consumption, Mathematical Modeling

Theory of Filtration: System Parameter and mathematical modeling size and shape characteristics of granular filtering materials, Preparations of filter sand, Hydraulics of filtration through homogeneous and stratified beds. Performance of slow, rapid, high rate multiplayer and composite filters, Up flow, two way filter, dual media filter.

Pressure Filters: Diatomaceous earth filters. Mico-strainers, Filterability Index

Principles of Disinfections: Factors affecting disinfections. Halogens: Chlorine, Iodine and Bromine.

Principles of Aeration: System parameters and mathematical model. Methods of aeration, Theories of adsorption, Freundlich equation, Removal of taste and odour by adsorption, Removal of colour, Effects of fluorides, Fluoridation, Removal of fluorides

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Industrial water treatment: Boiler feed water, softening of water, Langlier, Ryzner and other indices. Reuse of water and conservation of water in industry

Methods of Iron and Manganese removal: Use of aeration, oxidation, ion-exchange and other methods and their control, Theory of corrosion, and corrosion control, Design of Conventional Water Treatment Plant

Design of Water Treatment Plant

Reference Books

1. Water and Waste water Engineering, Fair Geyer and Okun, John Willy and Sons, 1966
2. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986
3. Water Supply and Sewerage, E.W. Steel and McGhee, Mc Graw Hill Company, 1979
4. Manual on Water Supply & Treatment, CPHEEO, New Delhi. The Central Public Health and Environmental Engineering Organization Publication 3rd edition, May 1999
5. Physico-Chemical Processes for Water Quality Control, Weber, John Wiley & Sons, 1972.

Course Outcomes:

On successful Completion of the course, students will be able to

CEP143.1: Explain the inter-relationship between water quality parameters and plant sizing, hydraulics and layout.

CEP143.2: Illustrate aeration, sedimentation, coagulation, and flocculation and filtration processes.

CEP143.3: Know the importance and removal of trace organics.

CEP143.4: Design Water treatment plant, sizing, hydraulics and layout.

CEP144 PROGRAM ELECTIVE I

CEP144 (A) SOLID AND BIOMEDICAL WASTE MANAGEMENT

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To make students aware about solid waste management system in developing countries along with the problems caused.

II. To give students detail idea about composition and characteristics of municipal solid waste.

III. To make students Study the concept of onsite handling of solid waste including its collection, transportation and proper disposal.

IV. To study aerobic & anaerobic method of composting and biogas generation using solid waste.

V. To learn landfill and incineration method of solid waste disposal along with suitability and associated problems.

VI. To make them aware of Legislation and byelaws associated with solid waste management.

VII. To Study biomedical waste and its management.

Course Content:

Problems and impacts of solid waste in developing countries; Sources, types and composition of Municipal solid waste, quantity estimation and forecast, Management systems and planning.

Characteristics of solid waste – Sampling – physical , chemical and biological analysis. Sources, types and composition of industrial hazardous and toxic wastes, Treatment and disposal methods

Collection of solid waste: On site handling and processing; Collection systems and service; Analysis of collection systems, collection routes; Management issues and concerns.

Transfer and transport, design requirements

Composting: Process microbiology, Aerobic and anaerobic composting, parameters affecting, Design considerations, compost control, engineering design and operations.

Sanitary Landfill: Process mechanism, Classification, types, siting considerations,

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engineering design and operations.

Incineration -Process details, classification, types, siting considerations, Energy recovery, Pyrolysis, engineering design and operations.

Biogas from solid wastes, conversion of solid wastes to protein, Legislation and byelaws in solid waste management, Solid Waste (Management & Handling) Rules, 2001

Biomedical waste categorization; generation, collection, transport, treatment and Disposal

Reference Books

1. Municipal and Rural Sanitation., Ehlens and Steel; Tata McGraw-Hill, 1976.
2. Solid Waste Engineering – Principles and Managements Issues, G. Techbanoglous, H. Theisen and Elliasen, Mc-Graw Hill Inc., 1972
3. Water Supply for Rural Areas and Small Communities, Wagner E. G. and Lanoik J.N; Geneva, WHO Publication, 1989
4. Solid waste Engineering, Principles and management issues, G. Techbanoglous, Elliasen; Mc-Graw Hill Book Co.1985
5. Solid waste Management in developing Countries, Bhide A.D and Sudaresan B.B; INSDOC, New Delhi, 1983.
6. Solid Waste Management, D. Joseph Hagerty, Joseph L. Pavoni & John E. Heer Jr.;Van Norstrand ,Van Nostrand Reinhold, New York 1973.
7. Handbook of solid waste Management, Frank Kreith; 2nd edition, Mc-Graw Hill Inc. 2002
8. Management of Solid Waste in Developing Countries, Frank Flintoff; 2nd Edn, WHO publication, 1984CEP 144

Course Outcomes:

On successful Completion of the course, students will be able to

CEP144(A).1: Illustrate the problems caused by improper solid waste management system in developing countries .

CEP144(A).2: Study the composition and characteristics of municipal solid waste along with collection, transportation and proper disposal of solid waste.

CEP144(A).3: Explain aerobic & anaerobic method of composting and biogas generation using solid waste, biomedical waste and its management.

CEP144(A).4: Know about the landfill and incineration method of solid waste disposal.

CEP144(A).5: Study Legislation and byelaws associated with solid waste management.

CEP144 (B) HAZARDOUS WASTE MANAGEMENT

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To Study the importance of hazardous waste management

II. To learn the various impacts of hazardous waste on environment

III. To study the process techniques and disposal of hazardous waste

IV. To learn the various aspects of the disaster management

Course Contents:

Introduction to Hazardous Waste: Definition, Problems, general awareness, Industry and Government‟s perspective. Risk Assessments, Environmental legislation

Hazardous Waste Characterization and site Treatment. Introduction, study of characterization, Assessment of Hazardous sites, waste minimization and Resource Recovery, chemical, physical and biological treatment to Hazardous waste. Thermal process

Transportation of Hazardous wastes, container for Hazardous waste, bulk transport, Non bulk transport

Hazardous Wastes (Handling, Storage & Management) Rules: 1989 of MoEF. Introduction

Groundwater Contamination: Effect on human health, Historical uses and abuses, hydrology, Detection, Control and Mitigation of groundwater contamination.

Process Techniques and Disposal: Selecting the process, siting the facility, integrated landfill system as Disposal sites, developing a new facility, and operating a landfill.

Basic Disaster Management Aspects: The significance of Disaster, the Disaster threat, National Disaster Management policy, major Requirement for coping with Disaster Management cycle, Disaster and National Development, Disaster legislation, counter disaster resources. International Disaster Organisation, utilisation of Resources.

Long-Term Measures: Prevention, Mitigation. Major factors for occurrence of Disaster impact: - Response to Disaster impact: - Major post impact factors, Disaster management support requirements.

Reference Books

1. Hazardous Waste Management : Charles A. Wentz., McGraw-Hill, New York,1989

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2. Hazardous Waste Minimization, Harry M. Preeman, McGraw-Hill, 1989
3. Hazardous Waste Chemistry, Toxicology and Treatment, Stanly E. Manahan, 1st edition, CRC-Press, 1990)
4. Disaster Management : A Disaster Manager"s Hand Book, W. Nick Carter, ADB Publ., Manila,1991
5. Hazardous Waste Management, Wentz, Charles A., McGraw-Hill, 1989
6. Hazardous Waste Management, LaGrega, Michael D. Buckingham, Philip L. Evans and Jeffrey C., McGraw-Hill, 1989

Course Outcomes:

On successful Completion of the course, students will be able to

CEP144(B).1: Explain the necessity of hazardous waste management

CEP144(B).2: Know the various impacts of hazardous waste on environment

CEP144(B) .3: Design process techniques and disposal methods of hazardous waste

CEP144(B).4: Explain various aspects of the disaster management

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CEP144 (C) ENVIRONMENTAL GEOTECHNOLOGY

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To Study the regulatory requirements for disposal of wastes on land.

II. To Study characteristics and design of landfill sites for handling of solid wastes.

III. To study various design barriers for containment of slurry and solid wastes at landfills.

IV. To Study reuse of waste materials in geotechnical constructions.

Course Contents:

Contamination: Surface & subsurface contamination, Sources and effects of subsurface contamination, Physical, Chemical and biological characteristics of solid waste, Identification, Characterization and regulatory requirements for disposal of hazardous, non-hazardous and domestic waste Soil-waste interaction, Effect of pollutants on soil properties

Contaminants of solid waste in landfills: Characteristics of solid wastes, Disposal of solid waste, Stabilization and solidification of solid waste, Waste containment, Solid waste Landfills and its components, Shape and size of landfills, Types of landfills, Site selection Impervious barriers for liners and Covers, Liner systems and cover systems, , Landfill construction and operation, Leachate generation, Leachate collection and detection system , Closure and post-closure care, Sustainable waste management, Ground water contamination associated with leachate transfer

Containment systems using Geo-membrane: Advantages of using composite barrier for Liners and Covers, Single composite liner system for MSW landfill, Double composite liner system for HW landfill, Stability of landfills.

Contaminants of slurry wastes: Slurry transported waste, Slurry Ponds and their operation, Embankment construction methods for ponds, Design aspects, Environmental impact and control,

Vertical barriers for containment: Contaminated sites, Types of vertical barriers, - Soil-bentonite slurry trench walls, and Cement-Bentonite slurry trench walls -construction and design aspects

Geotechnical reuse of Waste material: Waste reduction, Use of waste in Geotechnical construction, Waste characteristics for soil replacement, Transportation consideration, Engineering properties of waste, Waste material in embankment and fills

Reclamation of contaminated site, various methods

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Course Outcomes:

On successful Completion of the course, students will able to

CEP144(C).1: Use regulatory requirements for disposal of wastes on land.

CEP144(C).2: Determine characteristics and carry out design of landfill sites for handling of solid wastes.

CEP144(C).3: Select design barriers for containment of slurry and solid wastes at landfills.

CEP144(C).4: Reuse waste materials in geotechnical constructions.

Reference Books

1. Mitchell, J.K and Soga, K., Fundamentals of Soil Behavior, John Wiley and Sons Inc., 2005.
2. Fang, H-Y., Introduction to Environmental Geotechnology, CRC Press,1997.
3. Daniel, D.E, Geotechnical Practice for Waste Disposal, Chapman and Hall, 1993.
4. Rowe, R.K., Quigley, R.M. and Booker, J.R., Clay Barrier Systems for Waste Disposal Facilities, E & FN Spon, 1995.
5. Rowe, R.K,, Geotechnicaland Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
6. Reddi, L.N. and Inyang, H.F, Geoenvironmental Engineering-Principles and Applications, Marcel Dekker Inc, 2000.
7. Sharma, H.D. and Lewis, S.P, Waste Containment Systems, Waste Stabilization and
8. Landfills: Design and Evaluation, John Wiley & Sons Inc., 1994.CEP 145 ENVIRONMENTAL ENGINEERING LABORATORY I

CEP145 ENVIRONMENTAL ENGINEERING LABORATORY I

Teaching Scheme : 06 P Total = 06 Credits: 03

Evaluation Scheme: ICA = 50; ESE = 50 Total Marks: 100

Course Objectives:

I. To study various characteristics of wastewater

II. To carry out various tests on wastewater

III. Study of instruments related with Environmental Microbiology practical

IV. To carry the bacteriological examination

Course Contents:

PART I: ENVIRONMENTAL SCIENCE AND CHEMISTRY LAB

A. LABORATORY EXPERIMENTS:

1. Determination of Conductivity, pH, Turbidity of given water sample
2. Determination of Hardness of given water sample (Calcium and total by EDTA method)
3. Determination of Sulphate content in given water sample
4. Determination of Chlorides content in given water sample
5. Determination of Chlorine demand and residual Chlorine in given water sample
6. Determination of Nitrogen content (all types) in given water sample
7. Determination of DO, BOD of given sewage sample
8. Determination of COD, TOC in given sewage sample
9. Determination of Iron and Manganese content in given sample
10. Determination of Acidity and Alkalinity of given sample
11. Determination of Fluorides content in given sample
12. Determination of Solids (Fixed, suspended and Volatile) in given sample

B. FIELD VISITS:

Field visits shall be arranged to Water Treatment plant and Sewage Treatment plant. Report based on Field Visits shall be submitted by students.

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PART II ENVIRONMENTAL MICROBIOLOGY AND BIOLOGICAL PROCESSES LAB

LABORATORY EXPERIMENTS

1. Study of instruments related with Environmental Microbiology practical.
2. Sampling procedure for bacteriological examination.
3. Preparation of differential Nutrient media for bacterial culture.
4. Study of Effect of pH on growth of bacteria.
5. Study of Effect of Temperature on growth of bacteria.
6. Study of Effect of Salt Concentration on growth of bacteria.
7. Study of Isolation of bacteria by various methods: Pour plate method, Spread plate method and streak plate method.
8. Preparation of Bacterial smear,
9. Staining of bacteria,
10. Enumeration of bacteria by various methods, plate count, M.F. technique.
11. Study of Motility of Bacteria; Hanging Drop Method.
12. Control of microorganisms.
13. Preservation of bacteria, Slant culture.
14. Test for Coliform bacteria.

Course Outcomes

After successful completion of the course, students will be able to

CEP145.1: Compare the characteristics of wastewater with standard values

CEP145.2: Identify the pollutional strength of wastewater

CEP145.3: Carry out the bacteriological examination of water and wastewater

CEP145.4: Carry out the enumeration and isolation of bacteria by various methods

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CEP146 SEMINAR I

Teaching Scheme: 04 P Total – 04 **Credit: 02**

Evaluation Scheme: ICA= 50; **Total Marks: 50**

COURSE OBJECTIVES:

I. To know the state of the art in the relevant subjects of Environmental Engineering.

II. To know the experimental procedure to validate theories related to Environmental Engineering.

III. To know how to prepare and present research project.

Student has to select a topic for Seminar in consultation with the allotted guide, carry out literature review, submit the seminar Report and deliver the seminar based on it. It is to be evaluated internally by three member panel of examiners wherein guide should be one of the members of the panel.

Course Outcomes:

On successful Completion of the course, students will be able to

CEP146.1: Illustrate the state of the art in the relevant subjects of Environmental Engineering.

CEP146.2: Apply experimental or mathematical skill to validate theories to relevant subject

CEP146.3: Prepare and present the report with interpretation.

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SHP121 AUDIT COURSES
SHP121(A) ENGLISH FOR RESEARCH PAPER WRITING

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

II. Learn about what to write in each section

III. Understand the skills needed when writing a Title

IV. Ensure the good quality of paper at very first-time submission

Course Contents:

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

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

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,

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

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

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM.
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

SHP121(B) DISASTER MANAGEMENT

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

II. Critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

III. Develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

IV. 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:

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

Disaster Preparedness And Management:

Preparedness: monitoring of phenomena Triggering A Disaster Or Hazard, Evaluation Of Risk: Application of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community preparedness

Risk Assessment: Disaster Risk: Concept and Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment, Strategies for Survival

Disaster Mitigation: Meaning, Concept And Strategies Of Disaster Mitigation, Emerging, Trends In Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India

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Reference Books:

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

SHP121(C) SANSKRIT FOR TECHNICAL KNOWLEDGE

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

Course Contents:

Alphabets in Sanskrit, Past/Present/Future Tense, Simple Sentences

Order, Introduction of roots, Technical information about Sanskrit Literature

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

References books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(C).1: Understand basic Sanskrit language

SHP121(C):2 Ancient Sanskrit literatures about science & technology can be understood

SHP121(C):3 Being a logical language will help to develop logic in students

SHP121(D) VALUE EDUCATION

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Understand value of education and self- development
II. Imbibe good values in students
III. Let the should know about the importance of character

Course Contents:

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

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

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

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

Reference Books:

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

Course Outcomes:

After completion of the course, students will be able to:

SHP121(D).1:Knowledge of self-development

SHP121(D).2: Learn the importance of Human values

SHP121(D).3: Developing the overall personality

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SHP121 (E) PEDAGOGY STUDIES

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

I. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.

II. Identify critical evidence gaps to guide the development.

Course Contents:

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.

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

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.

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

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

References books:

1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education Research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of Basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education Oxford and Boston: Blackwell.

6. Chavan M (2003) Read India: A mass scale, rapid, ‘learning to read’ campaign.

7. www.pratham.org/images/resource%20working%20paper%202.pdf.

Course Outcomes:

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

SHP121(E).1 What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?

SHP121(E).2 What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?

SHP121(E).3 How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

Member Secretary
(S. W. Thakare)

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SHP121(F) STRESS MANAGEMENT BY YOGA

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives

I. To achieve overall health of body and mind
II. To overcome stress

Course Contents:

Definitions of Eight parts of yog (Ashtanga)
Yam and Niyam
Do`s and Don'ts's in life.
i) Ahinsa, satya, astheya, bramhacharya and aparigraha
ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Asan and Pranayam
i) Various yog poses and their benefits for mind & body
ii) Regularization of breathing techniques and its effects-Types of pranayam

Reference Books:

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

Course Outcomes:

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

SHP121(F).1: Develop healthy mind in a healthy body thus improving social health also

SHP121(F).2: Improve efficiency

SHP121(G) PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives

I. To learn to achieve the highest goal happily
II. To become a person with stable mind, pleasing personality and determination
III. To awaken wisdom in students

Course Contents:

Neetisatakam-Holistic development of personality

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

Approach to day to day work and duties.

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

Statements of basic knowledge.

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

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

References

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

Course Outcomes:

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

SHP121(G).1: Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life

SHP121(G).2: The person who has studied Geeta will lead the nation and mankind to peace and prosperity

SHP121(G).3: Study of Neetishatakam will help in developing versatile personality of students.

Member Secretary
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SHP121(H) CONSTITUTION OF INDIA

Teaching Scheme: 00TH + 00 T Total = 00 Credit : 0
Evaluation Scheme: 30 MSE + 20 TA Total Marks: 50

Course Objectives:

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

Course Contents:

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

Philosophy of the Indian Constitution: Preamble, Salient Features

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.

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

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

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

Reference Books:

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

Course Outcomes:

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

SHP121(H).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.

SHP121(H).2: Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.

SHP121(H).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.

SHP121(H).4: Discuss the passage of the Hindu Code Bill of 1956.

Member Secretary
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(Dr. M. N. Hedaoo)

Principal
(Prof. A.M.Mahalle)

CEP241 ADVANCED WASTEWATER TREATMENT

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand the importance of wastewater treatment

II. To learn the process analysis in wastewater treatment

III. To study the principle of biological treatment of wastewater

IV. To learn the various methods of sludge treatment

V. To provide the knowledge of various processes under advanced wastewater treatment.

Course Contents:

Introduction: OBJECTIVES of waste water treatment, Purpose of advanced wastewater treatment, Wastewater quantity and transport and waste water characteristics. Alternative flowcharts function and basic principles involved in different units of conventional wastewater treatment plant.

Process Analysis: Reaction and reaction kinetics, Mass balance, Reactors and their hydraulic characteristics, Practical aspects of reactor design.

Physical and Chemical Treatment: Screening, Grit removal, flow equalizations, and mixing. Flocculation, sedimentation, flotation, Detailed principles and design aspects of Screening, Grit chamber and Sedimentation tank.

Principles of Biological Treatment: Kinetics of biological growth, introduction to suspended and fixed film reactors. Concepts of gas transfer and solids separation, Nitrogen and Phosphorus removal from waste water, Concepts of aerobic and anaerobic treatment of waste water, Design of Activated Sludge system using biological process dynamics, Complete design details of Activated Sludge Process, Modifications of ASP, Process concepts and design aspects of Trickling Filters, Rotating Biological Contactors (RBC), Fluidized bed reactor/treatment.

Sludge Treatment and Disposal: Aerobic and Anaerobic digestion of sludge, sludge stabilization, dewatering, conditioning, and disposal. **Tertiary Treatment**: Principles of tertiary treatment, theory of adsorption and factors affecting adsorption. Concepts and different methods of dissolved solids removal. Basic principles of Reverse Osmosis, Ultra-filtration, Electro dialysis, Desalination

Advanced waste water treatment: Advanced wastewater treatments, Reuse and resource recovery. Recent developments in Wastewater Treatment

Design of Sewage Treatment Plant

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Reference Books

1. Wastewater Engineering: Treatment, Disposal & Reuse, Metcalf & Eddy Inc. 6th edition, McGraw Hill, 2002.
2. Introduction to Environmental Engineering, P. A. Veslind, PWS, Publishing Company, Boston, 1997.
3. Wastewater Treatment and disposal, S.J. Arceivalla, Marcel Dekker, 1981.
4. Wastewater Treatment Plant Planning, Design and Operation, S.R. Quasim, Holt, Rinehart & Winston N.Y, 1985.
5. Activated Sludge Process: Theory and Practices, N.F Grey, Oxford University Press, 1990.
6. Water and Waste water Technology, Mark J. Hammer, John Willy and Sons, 1986

Course Outcomes

On successful Completion of the course, students will be able to

CEP241.1: Explain the necessity of wastewater treatment

CEP241.2: Illustrate the process analysis in wastewater treatment

CEP241 .3: Design the various biological treatment of wastewater

CEP241.4: Design the sludge disposal methods

CEP241.5: Illustrate the various tertiary treatment in wastewater treatment.

CEP242 INDUSTRIAL WASTEWATER TREATMENT

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study the effects of discharge of Industrial Wastewater on the environment

II. To study to minimize the problems of Industrial Wastewater

III. To study the characteristics and treatments of Industrial Wastewaters from different industries.

Course Contents:

Problem of Industrial Waste Water: Variation in quality and quantity of industrial wastewater. Effects of discharge of industrial waste water on streams; land and municipal sewers. Benefits of water pollution control by doing treatment of industrial waste.

Indian Standards for discharge of treated wastewater on land, into municipal sewer and natural water courses.

Sampling Procedure: Industrial waste survey; Stream sanitation, Stream sampling, Types of sampling, Stream survey, Sampling analysis

Approaches to Minimization of problem of industrial waste water, Good housekeeping, equalization, neutralization, precipitation, mixing of different effluent streams, recycle of effluent streams, process modifications in terms of raw materials or chemicals used general approach to planning of industrial waste water treatment and disposal, Cleaner Technologies of production for waste minimization.

Different Aspects and choices of various alternatives such as, Treating different effluent streams separately, Treating different streams jointly after mixing them partly or fully, Including/excluding domestic waste along with the industrial waste.

General Approach for handling and treatment of industrial wastewater with following special characteristics

Shock Loads, presence of colours, toxic metal/ions, refractory substances, e.g. A B S and other detergents, growth inhibiting substances such as insecticides, waste rich in nutrients (N.P.K. etc.), waste rich in oil & grease, high suspended solids, high BOD, high temperature, acidity, alkalinity etc.

Experimental Evaluation of physico-chemical or biological treatment processes for treatment of the waste water.

Process Line Diagrams, characteristics and treatment of industrial waste of: - Pulp and paper, textile, tannery, food, Cannings, sugar mill, distillery, dairy, pharmaceutical,

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electroplating etc. industries. Design of Effluent Treatment Plant

Advanced industrial wastewater treatment: Principles of tertiary treatment, Reuse and resource recovery. recent trends in industrial waste management, Cleaner technologies.

Reference Books

1. Waste Water Treatment, Disposal and Reuse, Mctcalf and Eddy, Tata McGraw Hill Publishing Co. Ltd, 1995
2. Pollution Control in Process Industries, S. P. Mahajan, Tata McGraw-Hill, 1985.
3. Liquid Waste of Industry – Theory, Practices and Treatment, Nemcrow, Addison-Wesley, 1971.
4. Industrial Water Pollution Control, W.W. Eckenfelder, McGraw-Hill, 1989.
5. Natural Systems for Waste Management and Treatment, S.C. Reed, E.J.
6. Middlebrooks and R.W. Crites, McGraw-Hill, 1988.
7. Biological Treatment of Waste Waters: W.W. Eckenfelder, Pergamon Press,1961.

Course Outcomes:

After successful completion of the course, students will be able to

CEP242.1: Identify the effects of discharge of Industrial Wastewater on land and water bodies

CEP242.2: Apply the knowledge to minimize the problems of Industrial Wastewaters

CEP242.3: Apply the knowledge for effective and sustainable treatments of Industrial Wastewaters from different industries

CEP242.4: Design ETP for different industries

CEP243 AIR QUALITY MONITORING AND CONTROL

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To Expose Students to the concepts of various spheres, Air pollution, Sources of pollutants and effects on vegetation, materials and Humans

II. To study about Meteorology, Solar radiation, Heat balance, greenhouse effect, Wind velocity, wind rose, turbulence, wind profile, Atmospheric Stability, Lapse rate, inversion, flume shape and transport of air pollutants

III. To learn and understand Ambient air quality, Air Pollution Monitoring, monitoring equipments, stack monitoring and source monitoring, air pollution control devices, various methods of control of particulate matter in industries .

IV. To study in detail about design of emission control devices and control of gaseous emission.

V. To learn and understand Air Quality Modelling and various air quality mathematical models.

VI. To make students aware about pollution from mobile sources and Other Types of Pollutions, Noise pollution, Radioactive pollution, Thermal pollution.**General Principles**, Biosphere, Air Environment, Air pollution, Primary and Secondary pollutants, Removal processes, sources of pollution, Averaging time air quality.

Course Contents:

Particulate Matter: Natural & manmade, viable & nonviable, effects & removal mechanism, particle size distribution.

Gaseous Pollutants: CO, CO_2, Ozone, SO_2, H_2S, Sources and effects on vegetation materials and Humans, photo-chemical smog, secondary pollutants : NOx, Atmospheric reactions & Scavenging process.

Meteorology: Solar radiation, Heat balance, greenhouse effect, Wind velocity, wind rose, turbulence, wind profile, humidity, temperature.

Atmospheric Stability : Lapse rate, inversion : flume shape, Max mixing depth. Transport of air pollutants

Air Pollution Monitoring: Sampling, monitoring equipments, stack monitoring, quality surveillance, source monitoring, Ambient air quality.

Air Pollution Control: Various methods of control of particulate matter in industries and design of gravity separator, cyclone separator, filters, electrostatic preceptor, absorption devices, scrubbers, combustion devices, control of gaseous emission and process emission

Member Secretary (S. W. Thakare) | Chairman, BoS (Dr. M. N. Hedaoo) | Principal (Prof. A.M.Mahalle)

controls.

Air Quality Modeling: Modeling, Air quality mathematical models, Gaussian Dispersion model, plume rise, application of models.

Pollution from mobile sources, problems, effects, testing and control, preventive measures.

Other Types of Pollutions: Noise pollution, Radioactive pollution, Thermal pollution, Nature, sources, effects and control measures.

Reference Books

1. Air Pollution, Vol. I to IV, A. C. Stern, Academic, New York, 1968.Fundamentals of Air Pollution, Stern, Wohlers, Bouble and Lower, Academic Press, 1984.
2. Air Pollution and Control, P. P. Mowli and N. Venkata Subbayya., Divyajyoti Prakashan, Jodhpur, 1989.
3. Air Pollution, Rao & Rao., Tata McGraw Hill,2006.
4. Air Quality Monitoring- A Course Manual, NEERI, 1981.

Course Outcomes:

On successful Completion of the course, students will able to

CEP243.1: Gain a broad understanding of Air Environment, Air pollution, Gaseous Pollutants, Sources of pollutants and effects on vegetation, materials and Humans

CEP243.2: Study the Ambient air quality, A ir Pollution Monitoring, Monitoring equipments, air pollution control devices.

CEP243.3: Design of emission control devices and control of gaseous emission.

CEP243.4: Comprehend the Air Quality Modeling and Other Types of Pollutions:

CEP244 PROGRAM ELECTIVE-II

CEP244 (A) ENVIRONMENTAL IMPACT ASSESSMENT AND MANAGEMENT

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand the importance Environmental Impact Assessments

II. To study the various EIA methodologies

III. To learn the preparation of EIA reports

IV. To learn the various Environmental management techniques.

Course Contents:

Evolution of EIA; EIA at project; Regional and policy levels; Strategic EIA; EIA process; Screening and scoping criteria

Rapid and comprehensive EIA; Specialized areas like environmental health impact assessment; Environmental risk analysis;

Economic valuation methods; Cost-benefit analysis; Expert system and GIS applications; Uncertainties

Legislative and environmental clearance procedures in India and other countries, Siting criteria; CRZ;

Public participation; Resettlement and rehabilitation, Practical applications of EIA;

EIA methodologies; Baseline data collection; Prediction and assessment of impacts on physical, biological and socio-economic environment; Environmental management plan; **Post project monitoring**

EIA report and EIS; Review process. Case studies on project, regional and sectorial EIA.

Life Cycle Assessment (LCA): Life cycle assessment and its purpose, Evolution of Life Cycle Assessment, Stages in LCA of a Product, A Code of Good Conduct for LCA, Procedures for LCA, Defining the goal and scope, Analyzing the inventory, Assessing environmental impact, Evaluating environmental profiles, Different Applications of LCA, Private sector applications, Governmental application

Environmental Management Techniques: Environmental Monitoring, Environmental Modeling, Forecasting modeling, Growth modeling, Sensitivity Analysis, Application of Remote Sensing and GIS in EM, Environmental Profile, Environmental Technology Assessment, Environmental Risk Assessment, Environmental risk management in

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industries, Ecosystem approach to risk assessment, Rapid Urban Environmental Assessment, Eco-mapping, Environmental Education

Case Study of Environmental Impact Assessment on any project nearby the town

Reference Books

1. Environmental Impact Assessment: Rau and Woofer
2. Environmental Impact Assessment: W.F. Canter, McGraw Hill, 1977.
3. Proceedings of Indo-British Workshop on EIA of Petrochemical Industries and Environmental Audit, Jan. 1994, IAEM, Nagpur.
4. Handbook on Pollution Control Acts, Central Pollution Control Board, New Delhi.
5. The New Environmental Age, R.K. Sapra, S. Bhardwaj, Ashish Pub. House, New Delhi.,1990CEP 244 (B) ENVIRONMENTAL MANAGEMENT AND AUDITING

Course Outcomes

On successful Completion of the course, students will be able to

CEP244(A).1: Explain the necessity of Environmental Impact Assessments

CEP244(A).2: Illustrate the various EIA methodologies

CEP244(A).3: Collect data and prepare EIA reports

CEP244(A).4: Illustrate various Environmental management techniques.

CEP244 (B) ENVIRONMENTAL MANAGEMENT AND AUDITING

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study the Principles of Environment Management

II. To study the Policies and Legal Aspects of EM

III. To study Environmental Auditing

IV. To study Environmental Management System Standards

Course Contents:

Principles of Environment Management: Introducing Environmental Management (EM), Definition and scope, Goals of EM, Need for EM, Need for sustainable development, EM tools, Participants in EM, Existing users, Groups seeking change, Groups with little control, The public, Facilitators, Controllers,

Ethics and the Environment, The philosophy of Aldo Leopold, Factors that necessitate environmental ethics, International Environmental Movement, Environmental Concerns in India

Policy and Legal Aspects of EM : Introduction to Environmental Policies, Economics and environmental policies, Industries and environmental policies, Agriculture and environmental policies, Ecosystem and environmental policies, Environmental policy instruments (EPI), Environmental Policies and Programmes in India, Forest conservation activities, NGO movements for environmental protection in India, Environmental Laws and Legislations, Private and Public law, Principles of international law, Indian Environmental Laws, International institutions, Key international treaties, objectives and principles of legislation, Environmental Legislations in India, Evolution of Indian Legislations, Constitution of India, Union Government initiatives

Environmental Auditing: Introduction to Environmental Auditing (EA), Principles of auditing objectives and scope, Responsibilities, resources and procedures within the audit records from the audit program, monitoring and reviewing the audit program, Types of environmental audits, General Audit Methodology, Basic structure of EA, General steps in EA procedure, Elements of Audit Process, What to audit, Who should audit, Why an audit, How to audit, Waste Audits and Pollution Prevention Assessments, EA in Industrial Projects, Liability Audits and Site Assessment, Auditing of EMS, Audit objectives roles and responsibilities, Scoping and review, Preparing the audit(start, setting objectives scope and audit criteria, determining the feasibility audit, selection of the audit team to establish initial contact with the audited organization, document review,

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preparation of the audit on the spot), Implementation of on-site audit, Preparation, approval and distribution of messages, Resolution of disagreements, corrective and preventive actions, competence and evaluation of auditors, Conducting the audit, Content of audit report

Life Cycle Assessment (LCA): Life cycle assessment and its purpose, Evolution of Life Cycle Assessment, Stages in LCA of a Product, A Code of Good Conduct for LCA, Procedures for LCA, Defining the goal and scope, Analyzing the inventory, Assessing environmental impact, Evaluating environmental profiles, Different Applications of LCA, Private sector applications, Governmental application

Environmental Management System Standards: Environmental Management Systems (EMS), Core elements of EMS, Benefits of EMS, Certification body assessments of EMS, Documentation for EMS, EMS Standards: ISO 14000-Evolution, Principles and structure, ISO 14000 supporting systems, EMS specification standards: ISO 14001, Implementation of EMS Conforming to ISO 14001, Benefits of Implementing ISO 14001: An Indian Scenario, OHSAS 18001 and its comparison with ISO 14001 and ISO 9001, BS 18004:2008

Reference Books

1. Environmental Science and Management, Abhijit Mallick,
2. The ISO 14000 EMS Audit Handbook, Greg Johnson
3. Corporate Environmental Management Systems and Strategies, Richard Welford, Universities Press (I) Ltd., Hyderabad, 1996.

Course Outcomes:

After successful completion of the course, students will be able to:

CEP244 (B) .1 Understand the Principles of Environment Management

CEP244(B) .2: Apply the knowledge of various environmental policies and laws

CEP244 (B).3: Carry out Environmental Auditing

CEP244 (B).4: Prepare the documentation of Environmental Management System

CEP 244 (C) ENVIRONMENTAL STATISTICS AND OPTIMIZATION TECHNIQUES

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand and determine parameters of sampling theory.

II. To understand and determine confidence intervals for parameters of estimation theory.

III. To learn techniques to take statistical decisions using test of hypothesis for a given sample.

IV. To learn techniques to formulate and solve linear as well as nonlinear optimization problems.

Course Contents:

Sampling Theory: Population Parameter, Sample Statistics, Sampling distributions, Sample mean, Sampling distribution of means, the sample variance, the sampling distribution of variance.

Estimation Theory: Point estimate and interval estimates reliability, confidence interval estimates of population parameters, confidence intervals for means, proportions and variance.

Tests of Hypothesis and Significance: Statistical decisions, tests of hypotheses and significance, Type I and Type II errors, level of significance, one tailed and two tailed tests. Tests involving small samples and large samples, fitting theoretical distributions to sample frequency distribution, The chi-square test for goodness of fit.

O. R. Techniques

Linear Programming: Formulation of linear programming problem, Graphical solution-simplex method (including Big M method and two phase method), dual problem- duality theory, dual simplex method, revised simplex method.

Transportation problem: existence of solution-degeneracy- MODI method; Assignment problem- traveling salesman problem

Nonlinear programming problem (NLPP): Constrained NLPP, Lagrange‟s multipliers method – convex NLPP, Kuhn-Tucker conditions

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Reference Books

1. Environmental Statistics and Data Analysis, Wayne R. Ott, CRC Press, 1994
2. Environmental statistics: Methods and Applications, V Barnett, John Wiley & Sons Ltd, 2004
3. Environmental Statistics with S-Plus, Steven P. Millard, Nagaraj K. and Neerchal,CRC Press 2001
4. Probability and Statistics, M.R. Speigel, McGraw Hill,
5. Operation Research, H.A. Taha, Prentice Hall of India Pvt. Ltd.
6. Introduction to Optimisation: Operations Research, J.C. Pant,Jain Brothers, New Delhi. Probability and Statistics for Engineers, Miller and Freund,

Course Outcomes:

On successful Completion of the course, students will able to

CEP244(C).1: Determine parameters of sampling theory.

CEP244(C).2: Determine confidence intervals for parameters of estimation theory.

CEP244(C).3: To take statistical decisions using test of hypothesis for a given sample.

CEP244(C).4: Formulate and solve linear as well as nonlinear optimization problems.

CEP 244 (D) BIOREMEDIATION: PRINCIPLES AND APPLICATION

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03
Evaluation Scheme: 30 MSE +10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand the importance of biotransformation, biodegradation, bioremediation and Bio remedial practices.

II. To learn the various impacts of bio remedial practices, bio stimulation, bio augmentation, bio concentration and bio magnifications.

III. To learn the various aspects of Natural and programmed bioremediation, anaerobic and aerobic bioremediation processes, application of bioinformatics in bioremediation.

IV. To study Genetic Engineering, bioremediation, Concept and types of phytoremediation systems.

V. To study biosensors and their applications in bioremediation.

Course Contents:

Introduction to biotransformation: biodegradation and bioremediation, history of bioremediation, xenobiotics and their structures and persistence in the environment, in situ and ex situ bioremediation technologies and their merits and demerits.

Bio remedial practices: An overview of the current bio remedial practices and its application, factors affecting bioremediation (physical, chemical and biological), bio stimulation and bio augmentation, bio concentration and bio magnifications.

Natural and programmed bioremediation: Inducible and degrading enzymes and their roles, Roles of electron donors and acceptors in bioremediation, anaerobic and aerobic bioremediation processes, application of bioinformatics in bioremediation.

Types of bioremediation: Solid and slurry phase bioremediation (composting, land farming, slurry bioreactors and lagoons), liquid phase bioremediation, bioventing, soil-vapour extraction(SVE) and treatment.

Genetic Engineering and bioremediation

Phytoremediation: Concept of phytoremediation, roles of phytochelatins and chemicals secreted by the plant roots, phytoremediation with trangemic plants, fungal and algal bioremediation, merits and demerits of phytoremediation, Types of phytoremediation systems.

Regulations of GM organisms in India,

Biosensors and their applications in bioremediation.

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Reference Books

I. Baker H. and Herson D.S. Bioremediation, McGraw Hill, 1994

II. Eweis J.B., Ergas S.J., Chang D.P.Y. and Schroeder E.D., Bioremediation Principles, McGraw Hill, 1998.SHP 221

Course Outcomes:

On successful Completion of the course, students will able to

CEP244(D).1: Illustrate importance of biotransformation, biodegradation and bioremediation.

CEP244(D).2: Explain the impacts of bio remedial practices, bio stimulation

CEP244(D).3: Know various aspects of Natural and programmed bioremediation, anaerobicand aerobic bioremediation processes, application of bioinformatics in bioremediation.

CEP244(D).4: Know Genetic Engineering, bioremediation, Concept and types of phytoremediation

CEP244(D).5: Study application of biosensors in bioremediation.

SHP221 RESEARCH METHODOLOGY

Teaching Scheme : 02 L + 00 T Total = 02 **Credits: 02**
Evaluation Scheme: 30 MSE +20 TA **Total 50 marks**

Course Objectives:

I. Understand research problem formulation.
II. Analyze research related information
III. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
IV. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

Course Contents:

Introduction to Research: Definition of research, Characteristics of research, Types of research- Descriptive *vs.* Analytical, Applied *vs.* Fundamental, Quantitative *vs.* Qualitative, Conceptual *vs.* Empirical, Steps of research methodology

Research Problem Formulation and Methods: Literature review, sources of literature, various referencing procedures, maintain literature data using Endnote2, Identifying the research areas from the literature review and research database, Problem Formulation, Identifying variables to be studied, determining the scope, objectives, limitations and or assumptions of the identified research problem, Justify basis for assumption, Formulate time plan for achieving targeted problem solution. Important steps in research methods: Observation and Facts, Laws and Theories, Development of Models. Developing a research plan: Exploration, Description, Diagnosis and Experimentation

Data collection: Sampling methods, methods of data collection, Basic Concepts concerning testing of hypotheses, procedures of hypothesis testing, generalization and interpretation Applied statistics: Regression analysis, Parameter estimation, Multivariate statistics, Principal component analysis Software tools for modeling, Simulation and analysis.

Research reports and Thesis writing: Introduction: Structure and components of scientific reports, types of report, Thesis writing: different steps and software tools in the design and preparation of thesis, layout, structure and language of typical reports, Illustrations and tables, bibliography, referencing and footnotes, Oral presentation: planning, software tools, creating and making effective presentation, use of visual aids, importance of effective communication.

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Research Ethics, IPR and Publishing: Ethics: Ethical issues.
IPR: intellectual property rights and patent law, techniques of writing a Patent, filing procedure, technology transfer, copy right, royalty, trade related aspects of intellectual property rights,

Publishing: design of research paper, citation and acknowledgement, plagiarism tools, reproducibility and accountability.

Reference Books:

1. Ranjit Kumar, "Research Methodology: A Step by Step Guide for Beginners", SAGE Publications Ltd., 2011.
2. Wayne Goddard, Stuart Melville, "Research Methodology: An Introduction" JUTA and Company Ltd, 2004.
3. C.R. Kothari ,"Research Methodology: Methods and Trends", New Age International,2004
4. S.D. Sharma , "Operational Research", Kedar Nath Ram Nath & Co.,1972
5. B.L. Wadehra, "Law Relating to Patents, Trademarks, Copyright Designs and

Course Outcomes:

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

SHP221.1 Understand research problem formulation.

SHP221.2 Analyze research related information.

SHP221.3 Follow research ethics

SHP221.4 Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasise the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.

SHP221.5 Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits

CEP245 ENVIRONMENTAL ENGINEERING LAB II

Teaching Scheme: 06 P + 00 T Total = 06 Credits: 03
Evaluation Scheme: ICA = 50; ESE = 50 Total Marks: 100

Course Objectives:

I. To design various units of STP and ETP using software

II. To study the characteristics and treatments of Industrial Wastewaters from different industries

III. To Study various instruments & Equipment required for Air Quality Monitoring

IV. To perform Air Quality Monitoring .and perform Statistical Analysis of observed air pollution data

V. To design Air Quality monitoring Equipment

VI. Design Problems/ Laboratory Practical based on curriculum Related with the subjects CEP 211, CEP 212, CEP 213 and CEP 214 :

Part A:

Design Problems based on curriculum Related with CEP 211 Advanced Wastewater Treatment

1. Design of Sewage treatment plant / Effluent treatment plant using Excel / Programming in any Language / Software
2. Report based on field visit to ETP

Part B:

Design Problems based on curriculum Related with CEP 212 Industrial Wastewater Treatment

Part C:Laboratory Practical based on curriculum Related with CEP 213

1. Study of Air Quality Monitoring Instruments & Equipment.
2. Determination of wind velocity, wind direction, temperature, cloud cover, humidity & preparation of wind-rose diagram.
3. Determination of SPM, RSPM, SOx, NOx
4. Determination of CO % & NO % of the exhaust gases from vehicles or gasoline engine.
5. Statistical Analysis of observed air pollution data.
6. Design of Bag filter for controlling dust pollution in particular industry – A case study.
7. Design of cyclone separator.

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Course Outcomes:

After successful completion of the course, students will be able to

CEP245.1	Design STP and ETP using various software
CEP245.2.	Apply the knowledge for effective and sustainable treatments of Industrial Wastewaters from different industries
CEP245.3.	Carry out Air Quality monitoring for various parameters
CEP245.4.	Carry out the Statistical Analysis of observed air pollution data
CEP245.5.	Design various air pollution controlling equipment

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CEP246 SEMINAR II

Teaching Scheme: 04 P Total - 04 **Credit: 02**

Evaluation Scheme: ICA = 50 **Total Marks: 50**

Course Objectives:

I. To know the state of the art in the relevant subjects of Environmental Engineering.

II. To carry out extensive literature survey and identify the research gap.

III. To present literature review report with comparison of results of previous research work.

Student has to select a topic for Seminar in consultation with the allotted guide, carry out literature review, submit the seminar Report and deliver the seminar based on it. The topic for seminar should be related to the literature survey based on Dissertation topic. It is to be evaluated internally by three member panel of examiners wherein guide should be one of the members of the panel.

Last date of submission of report shall be two weeks before the end of semester.

Course Outcomes:

On successful Completion of the course, students will be able to

CEP246.1: Conduct extensive literature survey in subjects of Environmental Engineering.

CEP246.2: Decide approach to apply experimental or mathematical skill to validate theories to relevant subject

CEP246.2: Prepare and present the report with interpretation and bridging the research gap

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CEP 341 PROGRAM ELECTIVE - III

CEP341 (A) WATER SUPPLY AND WASTE WATER COLLECTION SYSTEMS

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To study the Hydraulics of water transmission systems

II. To study the design of rising main

III. To provide knowledge of sewerage system and its design.

IV. To learn the Cost analysis and optimization of sewer system

Course Contents:

Hydraulics of water mains: Water transmission systems and water distribution systems, analysis, different methods Relaxations methods, method of section, Equivalent pipe method, Maintenance of distribution systems.

Design of rising mains

Analysis of flow Analysis of flow in closed and open pipe networks using various methods, Hardy Cross Method, Newton Raphson Method, Linear Method, CPM method Distribution network, Pumps and Pumping station. Design of pump and pumping station

Types of sewer system , requisites for sewerage system design, Flow through sewers Hydraulics of sewers, Self cleansing velocity, Sewer shape-their usefulness, sewer invert drop, Design of sewerage networks.

Pumps and pumping station: Requirement analysis of pumps, Design of pumping mains.

Optimization Techniques Analytical solutions by Calculus, Lagrange Multiplier method, Linear programming Optimization of water distribution systems including branching, water hammer, causes and prevention.

Cost analysis and optimization of sewer system, Principles of Reliability analysis.

Reference Books

1. Watershed Hydrology, Peter E. Black, Prentice Hall, 1991.
2. Water Resources Systems, Planning and Management, R.N. Chaturvedi, New Delhi : Tata McGraw-Hill, 1987

3. Bhave P. R. And Gupta R, Analysis of Water Distribution Networks, Narosa Publishing Co., New Delhi (2006).

4. Bhave P.R, Optimal design of water distribution networks, Narosa Publishing Co., New Delhi (2003).

5. Engineering Optimization: Theory and Practice Book by S. S. Rao

Course Outcomes

On successful Completion of the course, students will be able to

CEP341(A).1: Explain the hydraulics of water transmission systems

CEP341(A).2: Design of rising main and pumping station

CEP341(A) .3: Illustrate the sewerage system and its design

CEP341(A).4: Work out optimization and cost analysis of sewer system.

CEP341 (B) REMOTE SENSING AND GIS IN ENVIRONMENTAL ENGINEERING

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand out ground water modeling using GIS.

II. To understand geospatial and GIS techniques for water supply, wastewater and solid waste collection systems.

III. To know application of geoinformatics for spatial management of water resources, watershed management and sediment yield.

IV. To understand applications of RS and GIS in wildlife mapping, land use planning and EIA.

Course Contents:

Surface-Water Hydrologic Data, Spatial techniques for Surface-Water Hydrology Modeling, Surface-Water Hydrology Models, ArcSWAT model and its applications; Groundwater Data, Ground water Models and spatial techniques for Groundwater Modeling and Visualization, The ArcHydro Data Model.

Geospatial techniques for planning and design of Water-Supply, Geospatial techniques for planning and design of solid waste collection and Irrigation Systems, Spatial Database Development for Wastewater and Storm water Systems, GIS-Based Wastewater Collection System Design and Management Applications, GIS-Based Decision-Support Systems for Wastewater and Storm water Systems.

Geospatial technologies for Water Resources Monitoring and Forecasting; Spatial Decision-Support Systems in River Basin Management; Spatial systems for floodplain mapping and management, Spatial techniques for Water Quality Monitoring and Modeling, GIS for Water Quality Database Development,

Applications of Geoinformatics for spatial management of resources: Run-off estimations, infiltration characteristics, groundwater potential and recharge characteristics, Watershed management, watershed prioritization, Sediment yield estimation, reservoir capacity studies, transportation design and planning, Spatial analyses for Environment Impact assessment, Monitoring and feedback, Natural indices, Concept of E-Governance using Geoinformatics, web GIS, Integrated applications using various technologies within Geoinformatics; methods and approach, Real time and temporal analysis using Geoinformatics. Multidisciplinary applications of Geoinformatics; integration of various segments.

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Geoinformatics for resources management and utilities management

Taxonomy of Environmental Models in the Spatial Sciences, Geographic Data for Environmental Modeling and Assessment, Applications of Remote Sensing and Geographic Information Systems in Wildlife Mapping and Modeling, Land Use Planning and Environmental Impact Assessment Using Geographic Information Systems.

Reference Books

1. Lynn E. Johnson, Geographic Information Systems in Water Resources Engineering, CRC Press, 2008.
2. Praveen Kumar, Mike Folk, Momcilo Markus and Jay C. Alameda, Hydroinformatics: Data Integrative Approaches in Computation, Analysis, and Modeling, CRC Press, 2005.
3. Allan Brimicombe, GIS, Environmental Modeling and Engineering, Second Edition, CRC Press, 2009. 4. Andrew Skidmore (Editor, Environmental Modeling with GIS and Remote Sensing, CRC Press), 2002

Course Outcomes:

On successful Completion of the course, students will able to

CEP341(B).1: Carry out ground water modelling using GIS.

CEP341(B).2: Use geospatial and GIS techniques for water supply, wastewater and solid waste collection systems.

CEP341(B).3: Use application of geoinformatics for spatial management of water resources, watershed management, and sediment yield.

CEP341(B).4: Use applications of RS and GIS in wildlife mapping, land use planning and EIA.

CEP341(C) ENVIRONMENTAL SYSTEMS MODELING AND STATISTICS

Teaching Scheme : 03 L + 00 T Total = 03 Credits: 03

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To understand various air quality models and methods of sensitivity analysis.

II. To Study the mechanisms of transport and fate of pollutants in aquatic, soil and water systems.

III. To study application of models for forecasting and stochastic processes and models.

IV. To understand linear regression analysis, trend analysis, and design of experiments and statistical tests.

Course Contents:

Models for environmental systems Definition; Classification; Examples of models for environmental systems,

Introduction to air quality models; Meteorology; Atmospheric stability and turbulence; Gaussian plume model and modifications;

Numerical models: Urban diffusion models, Calibration and sensitivity analysis; Applications of public domain models, and software,

Global radiation balance and climatic changes, Transport and fate of pollutant in aquatic systems; Introduction to river, estuarine and lake hydrodynamics; Stratification and eutrophication of lakes; Dissolved oxygen model for streams; Temperature models, Transport and fate of pollutants in soils and ground water;

Utility of environmental models for forecasting: Computational methods in environmental modeling

Stochastic Processes in the Environment: Probability concepts; Conditional probability and Bayes theorem. Environmental Data Analysis and QA/QC: Descriptive statistics; Averaging times;

Sampling and analysis Sample size determination; Sampling frequency and duration; Measurement uncertainty; Accuracy testing and precision; Sample and dynamic blanks; Error propagation; Linear least-squares regression; Trend analysis; Non-parametric statistics. Experiment Design and Hypothesis: Testing: Factorial design of experiments; Confidence intervals; Equality of means; T-test; Analysis of variance (ANOVA); F-test; Significance of factor effects and their interactions.

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Reference Books

1. Environmental Statistics and Data Analysis, Wayne R. Ott, CRC Press, 1994
2. Environmental statistics: Methods and Applications, V Barnett, John Wiley & Sons Ltd, 2004
3. Environmental Statistics with S-Plus, Steven P. Millard, Nagaraj K. and Neerchal, CRC Press 2001
4. Principles of Surface Water Quality Modelling and Control, R. V. Thomann and J. A. Muller, Harper International edition, 1987
5. Water Quality, G. Tchibangolous, E. D. Schroedere, Addision Wesley Publishing Co. Massachusettes, 1987
6. Atmospheric Chemistry and Physics, J.H. Seinfeld, and S.N, Pandis, John Wiley and Sons Inc, New York, 1998
7. Experimental Modelling, J.L. Schnoor, Inter Sc. Publications, 1996
8. Fundamentals of Air Pollution, R.W. Boubel, and A.C Stern, Academic Press, 1994

Course Outcomes:

On successful Completion of the course, students will able to

CEP341(C).1: Use various air quality models and carry out sensitivity analysis.

CEP341(C).2: Determine the transport and fate of pollutants in aquatic, soil and water systems.

CEP341(C).3: Use applications of models for forecasting and determine parameters for stochastic processes and probability models.

CEP341(C).4: Carry out linear regression analysis, trend analysis, and design of experiments and statistical tests.

CEP341(D) RURAL WATER SUPPLY AND SANITATION

Teaching Scheme: 03 L + 00 T Total = 03 **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To introduce various techniques for rural water supply

II. To study the sanitation in rural area

III. To provide knowledge of solid waste management in rural area

IV. To study the Non-conventional energy sources

Course Contents:

Rural Water Supply: Issues of rural water supply, various techniques for rural water supply- merits, National rural drinking water program- rural water quality monitoring and surveillance, operation and maintenance of rural water supplies.

Low Cost Water Treatment: Introduction – Epidemiological aspects of water quality methods for low cost water treatment, Specific contaminant removal systems

Rural Sanitation: Introduction to rural sanitation, Community and sanitary latrines, Planning of wastewater collection system in rural areas, Treatment and Disposal of wastewater, Compact and simple wastewater treatment units and systems in rural areas, stabilization ponds - septic tanks - Imhoff tank- soak pits- low cost excreta disposal systems- Effluent disposal.

Industrial Hygiene And Sanitation: Occupational Hazards- Schools- Public Buildings Hospitals- Eating establishments- Swimming pools, Cleanliness and maintenance and comfort- Industrial plant sanitation.

Solid Waste Management: Disposal of Solid Wastes- Composting- land filling incineration- Biogas plants, Rural health - Other specific issues and problems encountered in rural sanitation.

Non-conventional energy sources

Anaerobic digester: terms, principle and theory associated with Anaerobic digestion, Design of Gobar gas plant, construction aspect associated with gobar gas plant, operation and maintenance of gobar gas plant.

Solar power plant: terms, principle and theory associated with solar power generation, suitability and adaptability of solar power plant for rural area, Design of solar power plant for given capacity, construction aspect associated with solar power plant, operation and maintenance of solar power plant.

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Reference Books

1. Eulers, V.M., and Steel, E.W., Municipal and Rural Sanitation, 6th Ed., McGraw Hill Book Company, 1965
2. Park, J.E., and Park, K., Text Book of Preventive and Social Medicine, Banarsidas Bhanot, 1972
3. Wright, F.B., Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York, 1977
4. Juuti, P., Tapio S. K., and Vuorinen H., Environmental History of Water: Global Views on Community Water Supply and Sanitation, IWA Publishing (Intl Water Assoc), 2007

Course Outcomes:

On successful Completion of the course, students will be able to

CEP341(D).1 Explain the various techniques for rural water supply

CEP341(D).2: Select and apply desired method of rural sanitation

CEP341(D).3: Encounter the various problems in rural sanitation.

CEP341(D).4: Identify the Non-conventional energy sources in rural area.

CEP341(E) SOFT COMPUTING TECHNIQUES

Teaching Scheme: 03 L + 00 T Total = 03 **Credits: 03**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To Expose Students to the concepts of soft computing techniques and components of soft computing.

II. To study Artificial Neural Networks (ANN), types and application of ANN

III. To learn and understand Classical sets and fuzzy sets, Logic and reasoning, Fuzzy set operations and fuzzy relations, Neuro-Fuzzy Systems.

IV. To study in detail about Evolutionary computing, Genetic algorithm,

V. To learn and understand Hybrid soft computing techniques, Applications in Civil Engineering.

Course Contents:

Need for soft computing techniques, components of soft computing.

Artificial Neural Networks (ANN), Types of ANN, Learning algorithms, Applications of ANN, Information and uncertainty, Chance versus ambiguity.

Classical sets and fuzzy sets, Logic and reasoning, Fuzzy set operations and fuzzy relations, Membership Functions, Fuzzy Systems, Decision Making with Fuzzy Information, Fuzzy Classification and Pattern Recognition, Neuro-Fuzzy Systems.

Evolutionary computing, Genetic algorithm, Hybrid soft computing techniques, Applications in Civil Engineering

Reference Books

1. Haykin, Neural Networks: A Comprehensive Foundation, Prentice Hall India, New Delhi, 2008
2. Jang, J.R, Sun Chuen-tsai, and Mizutani Eiji, Neuro-Fuzzy and Soft Computing: A Computational Approach to Learning and Machine Intelligence, PHI Learning, 2009 Rajasekaran, S., and Vijayalakshmi Pai, G.A., Neural Networks, Fuzzy Logic and Genetic Algorithms – Synthesis and Applications, Prentice-Hall India, New Delhi, 2003
3. Sivanandam, S N and S N Deepa, Principles of Soft Computing, Wiley India, 2013
4. Karray, Fakhreddin O. and Clarence De Silva, Soft Computing and Intelligent Systems Design – Theory, Tools and Applications, Pearson Education Ltd., 2013

Course Outcomes:

On successful Completion of the course, students will able to

CEP341(E).1: Study concepts of soft computing techniques

CEP341(E).2: Know Artificial Neural Networks (ANN) and its application.

CEP341(E).3:Know Classical sets and fuzzy sets, Logic and reasoning, Fuzzy set operations

CEP341(E).4:Study Genetic algorithm,

CEP341(E).5:Apply soft computing techniques in Civil Engineering.

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OPEN ELECTIVES

SHP321(A)BUSINESS ANALYTIC

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Understand the role of business analytics within an organization.

II. Analyze data using statistical and data mining techniques and understand relationships between the underlying business processes of an organization.

III. To gain an understanding of how managers use business analytics to formulate and solve business problems and to support managerial decision making.

IV. To become familiar with processes needed to develop, report, and analyze business data.

V. Use decision-making tools/Operations research techniques.

VI. Mange business process using analytical and management tools.

VII. Analyze and solve problems from different industries such as manufacturing, service, retail, software, banking and finance, sports, pharmaceutical, aerospace etc.

Course Contents:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics.

Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview.

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

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

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

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

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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.

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making

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

Reference Books:

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

Course Outcomes:

On successful completion of this course students will be able to

SHP321(A).1: demonstrate knowledge of data analytics.

SHP321(A).2: demonstrate the ability of think critically in making decisions based on data and deep analytics.

SHP321(A).3: demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.

SHP321(A).4: demonstrate the ability to translate data into clear, actionable insights.

SHP321(B) INDUSTRIAL SAFETY

Teaching Scheme : 03 L + 00 T Total = 03 **Credits: 03**
Evaluation Scheme: 30 MSE +10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Contents:

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 fire fighting, equipment and methods.

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.

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.

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.

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

Reference Books:

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

SHP321 (C) OPERATIONS RESEARCH

Teaching Scheme: 03TH + 00 T Total = 03 Credit : 3

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE Total Marks: 100

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

Reference Books:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. 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

Course Outcomes:

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

SHP321(C).1: apply the dynamic programming to solve problems of discreet and continuous variables.

SHP321(C).2: apply the concept of non-linear programming

SHP321(C).3: carry out sensitivity analysis

SHP321(C).4: model the real world problem and simulate it.

SHP321 (D) COST MANAGEMENT OF ENGINEERING PROJECTS

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Overview of the Strategic Cost Management Process

Cost concepts in decision-making: Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making

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

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

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

SHP321 (E) COMPOSITE MATERIALS

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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

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

References:

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

SHP321 (F) WASTE TO ENERGY

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

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

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

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

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.

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.

SHP321 (G) FINANCE MANAGEMENT

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Financial Management: objectives and goals, Fixed Capital, Floating Capital, Fund flow analysis and Fund flow statements. Ratio analysis: Classification, structural group, standards for comparison and limitations

Profit planning and Break-even analysis, margin of safety. Financial Budgets, control measures, Authorized capital, working capital, reserve, capital Management, floating of shares, share capitals & fund raising –methods and their appraisal.

Control measures: Payback approach, Standard costing, Actual costing, Operating ratio, techniques of cost control, Marginal cost.

Elements of Costs: Material, Labor, Expenses, Overheads, Direct and Indirect Cost, Fixed and Variable Cost, other classifications. Allocation of overheads Methods for Depreciation calculation, Budgetary control and Variance analysis, Activity based costing (ABC). Biases in cash flow estimation.

Appraisal criteria: Net Present Value, benefit cost ratio, internal rate of returns urgency, payback period, accounting rate of returns, investment appraisal in practice

Analysis of Risk: Types and measure of risk , simple estimation of risk, sensitivity analysis, scenario analysis, Special decision situations: Choice between mutually exclusive projects of unequal life, optimal timing decision, determination of economic life, inter-relationships between investment and financing aspects, inflation and capital budgeting. Analysis of firm and market risk:

Portfolio theory and capital budgeting, Capital Asset Pricing Model.

Reference Books :

1. J Pandey I M., Financial Management, Vikas Publication,10th Edition 2013
2. Henry M. Stenier, “Engineering economics Principles”, Mc Graw Hill Publication.
3. C. B. Gupta, “Fundamentals of Business”, Sultan Chand & Company.
4. S. K. Basu, K.C. Sahu and Rajiv B, “Industrial Organisation and Management”, PHI New Delhi, Nov 2012.

SHP321 (H) PROJECT MANAGEMENT

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Contents:

Introduction: Human Factors and Systems, Information Input and Processing, Visual Displays of Dynamic Information, Human Output and Control: Physical Work and Manual Materials Handling, Motor Skills, Human Control of Systems, Hand Tools and Devices.

Definition of Ergonomics and its significance in designing workplace layout and detailed motion plan of work, Man-Machine Symbiosis, Human Factors in design & manufacturing, Viz. pressure of the environment, temperature, humidity etc., Principles of motion economy, anthropometric condition, stability criterion etc. Biodynamic analysis for design of products & its concept of learning by man and machine;

Measurement of Learning Index and training for each job and each man, Product design – various aspects including ergonomic design and reliability based design.

Dynamic consideration in design of product using vibration stability in biomechanisms, Safety in manufacturing, Considerations of human stress, Allowable limit of stress, stress adjustment.

Estimation of human error and human reliability, combining various forms of human error by random number simulation, Human Error, Accidents and safety, Human Factors and the Automobile, Human Factors in Systems Design.

Dynamic consideration in project operations, leadership, requirement, communication process, motivating a diverse workflow, facilitating team decisions, resolving interpersonal conflicts, managing different people, strengthening team accountability

Reference Books :

1. Sanders, M.M. & Mc Cormick, E.J., Human Factors in Engineering & Design, McGraw-Hill, 7th ed. (1993)
2. S. K. Basu, K.C. Sahu and Rajiv B, Industrial Organisation and Management –, PHI New Delhi, Nov 2012.

SHP321 (I) DATA STRUCTURE AND ALGORITHMS

Teaching Scheme: 03TH + 00 T **Total = 03** **Credit : 3**

Evaluation Scheme: 30 MSE + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Outcomes:

I. Write neat code by selecting appropriate data structure and demonstrate a working solution for a given Problem.

II. Think of all possible inputs to an application and handle all possible errors properly.

III. Analyze "Clearly different possible solutions to a program and select the most efficient one.

IV. Write an application requiring an effort to fat least l000 lines of code to demonstrate a good working solution.

V. Demonstrate the ability to write reusable code and abstract data types in C, using object-based way of thinking

Course Contents:

Introduction: Data, Data types. Object, data structure and abstract data types (ADT). Characteristics of an algorithm' Analyzing progams Frequency count Time and space complexity, Big 'O' and Ω notation. Best, average and worst cases. Dangling pointers and garbage memory

Arrays, Files and Searching: Searching: linear and binary search algorithm. Hashing: hashing functions, chaining, overflow handling with and without chaining, open addressing: linear. Quadratic Teaching Scheme: Examination Scheme: probing. Files handling: text and binary files, use of various libraries for handling files.

Stacks and Queues: Stack and queue. as ADT. Operations on stack and queue, Implementations using arrays and dynamic memory allocation, Application of stack for expression evaluation, expression conversion, Recursion and stacks, Problems like maze and knight's tour.

Lists: List as ADT. Concept of linked organization of data against linked list. Singly linked list, doubly linked list, circular linked list. Representation & manipulations of polynomials/ sets using linked lists. Dynamic memory management, Representation of sparse matrix, Addition and transpose of sparse matrix

Trees and Graphs: Basic terminology. Binary trees and its representation, Binary tree traversals (recursive and non-recusive) and various operations, Insertion and deletion of nodes in binary search tree, Representation of graphs using adjacency matrix, adjacency list,

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Implementation of algorithms for traversals; implementing Kruskal's. Prim's algorithms, Single source shortest paths using Djkstra's algorithm, Applications of graphs and trees

Time Complexity Analysis, Algorithm Design: Verification of programs, invariants, assertions, proof of termination. Best, Average and Worst case analysis of binary search, quick sort, merge sort, insertion sort, hashing techniques, sparse matrix algorithms. Designing data structures for specific applications

Reference Books:

1. E. Horowitz, S. Sahni, S.Anderson-freed, "Fundamentals of Data Structures in C", Second Edition, University Press, ISBN 978-81-7371-605-8
2. B. Kernighan, D. futchie, "The C Programming Language", Prentice Hall of India, Second Edition, ISBN 8 1 -203-0596-5
3. Y. Langsam, M. Augenstin and A. Tarmenbaum, "Data Structues using C", Pearson Education Asia, First Edition, 2002, ISBN 978-81-317-0229-1
4. Ellis Horowitz, S. Sahni, D. Mehta "Fundamentals of Data Structures in C++", Galgotia Book Source, New Delhi 1995 ISBN 16782928
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CEP342 DISSERTATION STAGE-I

Teaching Scheme: 20 P **Total = 20** **Credit : 10**

Evaluation Scheme: ICA = 100 **Total Marks: 100**

Course Objectives:

I. To identify and define the problem with objectives

II. To perform the literature review of past work related to the problem and identify the research gap.

III. To demonstrate the problem with respect to society

IV. To demonstrate understanding, application of relevant methodology, techniques and analysis with 40% of work completion.

Dissertation (Phase-I): Student has to select a topic for Dissertation, carry out literature review, find the literature gap, carry out 40% or more work on Dissertation topic and submit the Report and deliver the seminar based on it. It is to be evaluated internally by three member panel of examiners headed by HOD wherein guide should be one of the members of the panel.

Students opting for industrial dissertation for whole year will complete third semester courses through NPTEL or online courses as per the guidelines.

Course Outcomes:

On successful Completion of the course, students will be able to

CEP342.1: Complete the definition of problem with bridging the research gap

CEP342.2: To demonstrate the problem in-depth knowledge and thoughtful application in stating an in-depth analysis of key theories supporting the study

CEP342.3: Apply the relevant methodology and technique to solve the problem.

CEP 342.4: To complete 40% study on defined problem through mathematical application or experimentation.

Member Secretary (S. W. Thakare) | Chairman, BoS (Dr. M. N. Hedaoo) | Principal (Prof. A.M.Mahalle)

CEP441 DISSERTATION STAGE-II

Teaching Scheme: 32 P **Total= 32** **Credit: 16**

Evaluation Scheme: ICA = 200; ESE = 200 **Total Marks: 400**

Course Objectives:

I. To record the findings of study

II. To co-relate the results with previous work results

III. To prepare the report on complete study with clear interpretation and discussion of the results.

Dissertation (Phase-II): Student has to carry out remaining dissertation work on the selected dissertation topic and submit the report. It is to be evaluated internally by three member panel of examiners headed by HOD wherein guide should be one of the members of the panel. Internal assessment of dissertation (complete work) is to be evaluated for 200 marks. The external assessment of dissertation work is to be evaluated for 200 marks; where the candidate shall present the entire work on Dissertation in front of External examiner followed by viva voce.

Course Outcomes

On successful Completion of the course, students will be able to

CEP441.1: Carry out detailed mathematical modeling or experimental validation.

CEP441.2: Present the report on complete study with clear interpretation and discussion of the results.

CEP441.3 Demonstrate the utility of study to the society.

CEP441 .4 Define future scope of study

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