Curriculum Structure & Syllabi

(As per National Education Policy 2020)

of

B. Tech.

In

Civil Engineering

(w.e.f. 2021-22)

Vision

Mission

Program Educational Objectives

Program Outcomes

Program Specific Outcomes

Overall Credit Structure

Curriculum

Syllabus

Offered By

DEPARTMENT OF CIVIL ENGINEERING

M. M. M. UNIVERSITY OF TECHNOLOGY,

GORAKHPUR-273010, UP

August 2022

CURRICULA & SYLLABI

B. Tech. Civil Engineering

VISION:

To become a premier centre of learning and research in Civil Engineering, nurturing sustainable development by the year 2025.

MISSION:

1. To provide the quality education in the area of civil engineering to transform students into graduates with high professional values.
2. To share and disseminate expertise for use in the solution of problems faced by Civil engineering industry and by society.
3. To insure the continuous improvement in the quality of life of people in the society.
4. To conduct need based research base projects giving priority to the needs of industry.

Program Educational Objectives (PEO)

PEO-1 To enrich the students with state-of-the-art knowledge in the field of Civil Engineering.

PEO-2 To keep abreast the students with the use of modern tools, equipment and software and inculcating the habit of life-long learning.

PEO-3 To foster teamwork and professional ethics among students towards devising feasible solutions to problems and project work.

Program Outcome (POs)

PO-1 Broadening the horizon of the students in the field of Civil Engineering, increasing their ability to apply knowledge of mathematics, science, and engineering to solve real world problems.

PO-2 Increasing the ability of students to identify, formulate and solve problems in a systematic way by appropriate collection, analysis, and interpretation of data.

PO-3 Increasing their ability to design a system, component, or process to meet the desired needs in an environment friendly and socially acceptable way.

PO-4 Enhancing their skills to analyze complex Civil Engineering problems and obtain the solution by synthesizing simple components.

PO-5 Increasing their ability to use the techniques, skills and modern engineering and Information Technology based tools (such as web-based applications and open-source software etc.) to increase the creativity of students.

PO-6 Enhancing awareness of students about the impact of engineering projects in a global and societal context (social, economic, legal and/or environmental implications).

PO-7 Enhancing their ability to practice environmental concerns and related sustainable measures and be capable of carrying out environmental impact of a civil engineering

projects.

PO-8 Informing students about engineering ethics and professional responsibilities.

PO-9 Increasing their decision-making skills and innovative capability not only individually but also in a multi-disciplinary team.

PO-10 Increasing the ability to communicate effectively by enhancing their drawing and report writing skills and oral presentation skills.

PO-11 Increasing awareness of students about cost, time and quality issues in construction helping them to develop social and leadership skills.

PO-12 Providing the students with knowledge on contemporary issues in the field of civil engineering and recognizing the need for an ability to engage in continuous and life- long learning.

Program Specific Outcome (PSOs)

PSO-1 To identify, analyze and suggest solutions for the issues faced by the present and future generation related to Civil Engineering fields.

PSO-2 Plan, analyze, and design infrastructural projects and its components in various areas of Civil Engineering like Structural Engineering, Geotechnical Engineering, Water Resources Engineering, Environmental Engineering, and Transportation Engineering.

PSO-3 Execute the construction of buildings and other components of various projects in Civil engineering including its layout, management, and quality control.

Syllabus and Credit Structure for B. Tech. (Civil Engineering)

(Session 2021-2022 and onwards)

OVERALL CREDIT STRUCTURE FOR B.TECH. (CE) PROGRAM

Credit Courses			
Core Courses (CC)**		**Electives Courses (EC)****	
Category	**Min. Credits**	**Category**	**Min. Credits**
Basic Sciences & Maths (BSM)	17	Program Electives (PE)	12
Engineering Fundamentals (EF)	18	Open Electives (OE) (Other Departments)	3
Professional Skill (PS)	4		
Program Core (PC)	69	Humanities & Social Science elective (HSSE)	2
Management (M)	4		
Humanities & Social Science (HSS)	4		
Project (P)	5		
Seminar (S)	2		
Industrial Practice (IP)/ Industrial Elective (IE)	12		
Program link basic science and engineering courses (PLBSE) (To be decided by the department)	18		
Sub-total	**153**	**Sub-total**	**17**
Grand Total	**170**		

**** subjects to be taught for more than one branch may be scheduled both in odd and even semesters.**

1. Extracurricular Activities Courses (ECA) Two compulsory courses from the following S. No (ii) to (v) non-credit courses: (i) Induction Program (compulsory) (ii) Skill development (iii) Unity and Discipline (NCC or NSS) (iv) Sports, Cultural and Games (v) Personality Development	**Non-Credit**
2. Audit Courses (AC) Two of the Audit Courses are compulsory	**Non-Credit**
3. Industrial Training (Mandatory)	**Non-Credit**

Minor Degree Courses (Optional) from any department	**Credits**
Department Minor (DM) Courses	18-20

DEPARTMENT OF CIVIL ENGINEERING
M.M.M. UNIVERSITY OF TECHNOLOGY
GORAKHPUR

Semester wise Credit Structure for B. Tech. (Civil Engineering)

Category / Semesters	I	II	III	IV	V	VI	VII	VIII	Total
Basic Sciences & Maths (BSM)	4	10	0	3					**17**
Engineering Fundamentals (EF)	7	6	5						**18**
Professional Skill (PS)	2	2							**4**
Program Core (PC)			13	19	13	12	12		**69**
Management (M)					2	2			**4**
Humanities & Social Science (HSS)	2		2						**4**
Humanities & Social Science Elective (HSSE)		2							**2**
Project (P)						2	3		**5**
Seminar (S)						2			**2**
Industrial Practice (IP)/ Without Industrial Practices (Minor project +2 Industrial Elective (IE))								12	**12**
Program link basic science and engineering courses (PLBSE)	**3**	**4**	**3**	**4**	4				**18**
Program Electives (PE)					4	4	4		**12**
Open Electives (OE)							3		**3**
Total	**18**	**24**	**23**	**26**	**23**	**22**	**22**	**12**	**170**

First Year, Semester I

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-101	Calculus and Linear Algebra	3	1	0	4
2.	EF	BCE-102	Mechanics of Structures	3	1	2	5
3.	PS	BCS-107	Computer Programming in Civil Engineering	1	0	2	2
4.	EF	BCE-101	Engineering Graphics	0	0	4	2
5.	PLBSE	BSM-143	Environmental Chemistry	2	1	0	3
6.	HSSE	BHM-111	Technical Writing	2	0	0	2
			Total	**11**	**3**	**8**	**18**
7.	ECA-I	ECA-100	Induction Program	-	-	-	**0**

First Year, Semester II

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	PLBSE	BSM-152	Ordinary and Partial Differential Equations	3	1	0	4
2.	EF	BEE-152	Principles of Electrical Engineering	3	1	0	4
3.	BSM	BSM-191	Engineering Chemistry	3	1	2	5
4.	PS	BCE-152	Engineering Geology & Building Material	0	0	4	2
5.	EF	BCE-153	Building Planning and Drawing	1	0	2	2
6.	BSM	BSM-178	Physics of Engineering Materials	3	1	2	5
7.	HSS	BHM-151	Professional Communication	2	0	0	2
			Total	**15**	**4**	**10**	**24**
8.	ECA-II		Induction Program	**-**	**-**	**-**	**0**

Second Year, Semester III

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	PLBSE	BCE-201	Numerical Methods in Civil Engineering	2	1	0	3
2.	EF	BCE-202	Basic Surveying	3	1	2	5
3.	HSS	BHM-201	Scientific and Technical Writing	2	0	0	2
4.	PC	BCE-203	Structural Mechanics-I	3	1	2	5
5.	PC	BCE-204	Construction Technology and Estimation & Costing	3	0	0	3
6.	PC	BCE-205	Fluid Mechanics	3	1	2	5
			Total	**16**	**4**	**6**	**23**
7.	ECA-III			**-**	**-**	**-**	0
8.	AC	AUC-01-AUC-15		½	-	-	1/2

Second Year, Semester IV

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	BSM	BSM-255	Probability & Statistics	2	1	0	3
2.	PC	BCE-251	Hydraulic and Hydraulic Machines	3	1	2	5
3.	PC	BCE-252	Structural Mechanics-II	3	1	0	4
4.	PLBSE	BCE-253	Advance Surveying	3	0	2	4
5.	PC	BCE-254	Concrete and Concrete Structures	3	1	2	5

6.	PC	BCE-255	Environmental Engineering-I	3	1	2	5
			Total	**17**	**5**	**8**	**26**
7.	ECA-IV			-	-	-	0
8.	AC	AUC-01-AUC-15		1/2	-	-	½

Third Year, Semester V

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-301	Industrial Management	2	0	0	2
2.	PC	BCE-301	Geotechnical Engineering-I	3	1	2	5
3.	PC	BCE-302	Transportation Engineering-I	3	0	2	4
4.	PC	BCE-303	Design of Concrete Structures	3	0	2	4
5.	PLBSE	BCE-304	Environmental Engineering-II	3	1	0	4
6.	PE1	BCE-326-BCE-331	Program Elective-1	3	1	0	4
			Total	**17**	**3**	**6**	**23**
7.	ECA-V			-	-	-	0

Third Year, Semester VI

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	M	BHM-351	Engineering & Managerial Economics	2	0	0	2
2.	PC	BCE-351	Geotechnical Engineering-II	3	0	2	4
3.	PC	BCE-352	Transportation Engineering-II	3	1	0	4
4.	PC	BCE-353	Water Resources Engineering	3	1	0	4
5.	PE2	BCE-376 – BCE-383	Program Elective-2	3	1	0	4
6.	P	BCE-370	Project Part-I	0	0	4	2
7.	S	BCE-380	Seminar	0	0	4	2
			Total	**14**	**3**	**10**	**22**
8.	ECA-VI			-	-	-	0

Final Year, Semester VII

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	PC	BCE-401	Earthquake Resistant Design	3	1	0	4
2.	PC	BCE-402	Steel Structures	3	1	0	4
3.	PC	BCE-403	Analysis and Design of Hydraulic Structures	3	1	0	4
4.	PE3	BCE-426 - BCE-432	Program Elective-3	3	1	0	4
5.	OE	OCE-401-402	Open Elective	2	1	0	3
6.	P	BCE-440	Project Part-II	0	0	6	3
			Total	**14**	**5**	**6**	**22**
7.	ECA-VII			-	-	-	0

Final Year, Semester VIII

S. N.	Category	Paper Code	Subject	L	T	P	Credit
1.	IP	ICE-400	Industrial Practices	0	0	24	12
	Without Industrial Practices (IP)						
2.	MP	BCE-480	Minor project	0	0	8	4
3.	IE	ICE-401	Industrial Elective-1	3	1	0	4
4.	IE	ICE-405	Industrial Elective-2	3	1	0	4
			Total	**0/6**	**0/2**	**8/24**	**12**

Programme Elective-1 (PE1)

S. N.	Paper Code	Subject	L	T	P	Credits
1.	BCE-326	Solid Waste Management	3	1	0	4
2.	BCE-327	Environmental Impact Assessment	3	1	0	4
3.	BCE-328	Rock Mechanics	3	1	0	4
4.	BCE-329	Bridge Engineering	3	1	0	4
5.	BCE-330	Disaster Management	3	1	0	4
6.	BCE-331	Advanced Engineering Hydrology	3	1	0	4

Programme Elective-2 (PE2)

S.N.	PaperCode	Subject	L	T	P	Credits
1.	BCE-376	Geo-environmental Engineering	3	1	0	4
2.	BCE-377	Advanced Structural Engineering	3	1	0	4

3.	BCE-378	Principles of Remote Sensing	3	1	0	4
4.	BCE-379	Airport, Docks & Harbour Engineering	3	1	0	4
5.	BCE-380	Matrix Method of Analysis	3	1	0	4
6.	BCE-381	Open Channel Flow	3	1	0	4
7.	BCE-382	Advanced Construction Technology and Construction Management	3	1	0	4
8.	BCE-383	Ground Improvement Technique	3	1	0	4

Programme Elective-3 (PE3)

S. N.	Paper Code	Subject	L	T	P	Credits
1.	BCE-426	Advanced Foundation Engineering	3	1	0	4
2.	BCE-427	River Engineering	3	1	0	4
3.	BCE-428	Advance Concrete Design	3	1	0	4
4.	BCE-429	Water Resources Systems	3	1	0	4
5.	BCE-430	Principles of Geographic Information System	3	1	0	4
6.	BCE-431	Earth and Earth Retaining Structures	3	1	0	4
7.	BCE-432	Air and Noise Pollution control	3	1	0	4

Open Elective

S. N.	Paper Code	Subject	L	T	P	Credits
1.	OCE-401	Air Pollution: Global Threat To Health	3	0	0	3
2.	OCE-402	Sustainable Energy Resources	3	0	0	3

Industrial Elective-1

S. N.	Paper Code	Subject	L	T	P	Credits
1.	ICE-401	Climate Change & Sustainability	3	1	0	4

Industrial Elective-2

S. N.	Paper Code	Subject	L	T	P	Credits
1.	ICE-405	Pollution Abatement Techniques	3	1	0	4

List of Audit Courses (AC)

S.No.	Subjects	Codes
1.	Constitution of India	AUC01
2.	Indian Culture and Heritage	AUC02
3.	Indian Architecture	AUC03
4.	Indian Festivals	AUC04
5.	Vaidic Mathematics	AUC05
6.	Astronomy	AUC06
7.	Arts of India	AUC07
8.	Intellectual Property Right	AUC08
9.	Human Rights	AUC09
10.	Logical Research	AUC10
11.	Professional Ethics	AUC11
12.	Environmental Law	AUC12
13.	Health Law	AUC13
14.	National Cadet Corps	AUC14
15.	Basics of Human Health and preventive medicines	AUC15

**Note: Detailed syllabus of Audit Courses (AC) is attached as Annexure-01.

List of Extra Curricular Activity (ECA) Courses

ECA-II						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-I	ECA-151	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)-I	ECA-171	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-I	ECA-172	2	0
4.	Open to all Branches	ECA	Games & Sports-I	ECA-181	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-I	ECA-182	2	0

ECA-III						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-II	ECA-201	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- II	ECA-221	2	0

3.	Open to all Branches	ECA	Unity and Discipline (NSS)-II	ECA-222	2	0
4.	Open to all Branches	ECA	Games & Sports-II	ECA-231	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-II	ECA-232	2	0

ECA-IV

S. No.	Branch	Category	Subject Name	Subject Code	Hours /Week	Credit
1.	Open to all Branches	ECA	Skill Development-III	ECA-251	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- III	ECA-271	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)- III	ECA-272	2	0
4.	Open to all Branches	ECA	Games & Sports-III	ECA-281	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-III	ECA-282	2	0

ECA-V

S. No.	Branch	Category	Subject Name	Subject Code	Hours/Week	Credit
1.	Open to all Branches	ECA	Skill Development-IV	ECA-301	2	0
2.	Open to all Branches	ECA	Unity and Discipline (NCC)- IV	ECA-321	2	0
3.	Open to all Branches	ECA	Unity and Discipline (NSS)-IV	ECA-322	2	0
4.	Open to all Branches	ECA	Games & Sports-IV	ECA-331	2	0
5.	Open to all Branches	ECA	Cultural, Art & Literary-IV	ECA-332	2	0

ECA-VI

S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-V	ECA-351	2	0
2.	Open to all Branches	ECA	Games & Sports-V	ECA-381	2	0
3.	Open to all Branches	ECA	Cultural, Art & Literary-V	ECA-382	2	0

ECA-VII						
S. No.	Branch	Category	Subject Name	Subject Code	Hours/ Week	Credit
1.	Open to all Branches	ECA	Skill Development-VI	ECA-401	2	0
2.	Open to all Branches	ECA	Games & Sports-VI	ECA-431	2	0
3.	Open to all Branches	ECA	Cultural, Art & Literary-VI	ECA-432	2	0

**Note: Detailed syllabus of Extra Curricular Activity (ECA) Courses is attached as Annexure-02.

FRAMEWORK FOR THE IMPLEMENTATION OF MOOC COURSES IN B. TECH PROGRAMME

As per the guidelines given by AICTE via GO. No. AICTE/P&AP/SWAYAM/2016 dated 17th August 2016, M. M. M. University of Technology Gorakhpur has decided to implement 20% subjects/courses from MOOCs from SWYAM portal in the curricula of B. Tech programme offered by university from the session 2022-23 onwards. The framework for incorporating the MOOC courses in the curricula of B. Tech programme is given below.

1. The MOOC Courses of Swayam portal will be offered in:
   (a) B. Tech-IInd semester for HSSE Courses of Humanities & Management Science Department.
   (b) B.Tech-IIIrd and IVth semester for Audit Courses (AC) of Humanities & Management Science Department.
   (c) B.Tech-Vth, VIth & VIIth semester as Program Elective (PE) Course of respective Engineering Departments.
   (d) B. Tech-VIIIth semester for Industrial Elective (IE) Course of respective Engineering Departments.
2. It has been indicated in the above GO of AICTE that MOOC Courses of Swayam portal will be announced on 1st June for odd semester and 1st November for the even semester every year. After the announcement of the subjects on Swayam portal, each department of University will identify the subjects against each of the MOCC courses in respective semester from the Swayam portal and send the list of identified subjects to the office of Dean UGS & E after the approval of BOS of respective department. Dean UGS & E will notify the same and notification will be uploaded on the University website well in advance so that students may get registered in the subject in time.
3. Concern department will nominate one of its faculty as a departmental MOOCs Coordinator for each of the MOOC Course and same will be intimated to Dean UGS & E along with the teaching load of the department. The departmental MOOCs Coordinator will be responsible for the registration, assignment submission, term end examination and result of the students who have opted MOOC courses.
4. For the reimbursement of MOOCs registration fee, student will write an application addressed to Dean UGS & E through the concerned Head of Department and departmental MOOCs Coordinator along with the receipt of MOOCs registration fee and admit card/hall ticket. The application of student for the reimbursement of fee will be entertained only if it is recommended by concerned MOOCs Coordinator and Head of Department.
5. Credit will be defined as per clause 6.1.5.5 of B. Tech ordinance for the MOOC Courses on Swayam portal in which credit is not mentioned,
6. If better practical facility is available at virtual lab of different premier institution of national and international importance, then the practical facility of that subject could be availed through the virtual lab. In any practical based subject, if practical lab is not assigned and better practical facility is available on virtual lab then it may be conducted on the virtual lab and one credit will be added through the BOS of concerned department.

7. The evaluation scheme for practical based subjects conducted through virtual lab will be same as the existing evaluation scheme of practical courses of the University.

SYLLABI

Semester-I

BSM-101	**Calculus and Linear Algebra**	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Use of basic differential operators in various engineering problems.
2. Understand the concepts of limit theory and nth order differential equations and their applications to our daily life
3. Solve linear system of equations using matrix algebra.
4. Know about qualitative applications of Gauss, Stoke's and Green's theorem.
5. To know the applications of double and triple integration in finding the area and volume.
6. To inculcate the habit of mathematical thinking and lifelong learning.

Topics Covered	
UNIT-I	9
Differential Calculus: Limit, Continuity and Differentiability, Mean value theorems. Leibnitz theorem, Partial derivatives, Euler's theorem for homogenous function, Total derivative, Change of variable. Taylor's and Maclaurin's theorem. Expansion of function of two variables, Jacobian, Extrema of function of several variables.	
UNIT-II	9
Linear Algebra: Symmetric, Skew-symmetric matrices, Hermitian, Skew Hermitian Matrices, orthogonal and unitary matrices and basic properties, linear independence and dependence of vectors, Rank of Matrix, Inverse of a Matrix, Elementary transformation, Consistency of linear system of equations and their solution, Characteristic equation, Eigenvalues, Eigenvectors, Cayley-Hamilton theorem, Diagonalization of matrices.	
UNIT-III	9
Multiple Integrals: Double and triple integrals, change of order of integration, change of variables. Application of multiple integral to surface area and volume. Beta and Gamma functions, Dirichlet integral.	
UNIT-IV	9
Vector Calculus: Gradient, Divergence and Curl. Directional derivatives, line, surface and volume integrals. Applications of Green's, Stoke's and Gauss divergence theorems (without Proofs).	

Books & References

1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers
2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons.
3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications.
4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd.,

BCE 102		**MECHANICS OF STRUCTURES**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The aim is to introduce engineering students to the basic principles of equilibrium and the behavior of structural elements and systems which include beams, struts, shafts and trusses under applied loads.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Able to compute the magnitude, direction of force, moment and conditions of equilibrium of rigid body and able to compute equivalent force. 2. Able to compute the centroids and center of gravity. 3. Know the moment of inertia of mass and area, and also how to compute it. 4. Understand the principle of virtual work and able apply them to find out forces and reactions. 5. Know the different mechanism of friction and computation of frictional forces. 6. Understand the Newton's second law and apply them on system of particles also develop ability to apply Newton's second law on rigid body.

Topics Covered

UNIT-I	9

Statics –Basics Concepts, Fundamental principles & concepts:

Introduction to Engineering Mechanics: Force Systems, Basic concepts, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant Moment of Forces and its Applications; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams, Equations of Equilibrium of Coplanar Systems.

Friction:

Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, screw jack & differential screw jack.

UNIT-II	**9**

Moment of Inertia:

Centroid and Centre of Gravity, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia of circular plate, Cylinder, Cone, Sphere, Hook.

UNIT-III	**9**

Analysis of structures- Trusses

Basic Structural Analysis, Equilibrium in three dimensions; Analysis of simple trusses by method of sections & method of joints, Zero force members, Simple beams and support reactions. Shear force and Bending Moment Diagram of Statically Determinate Beams.

Review of Particle Dynamics

Review of particle dynamics- rectilinear motion; Plane curvilinear motion (rectangular, path, and polar coordinates). Work-kinetic energy, power, potential energy. Impulse-momentum (linear, angular); Impact (Direct and oblique).

UNIT-IV	**9**

Plane kinematics of rigid bodies- Rotation

Introduction to Kinetics of Rigid Bodies, Basic terms, general principles in dynamics; Types of motion, Instantaneous center of rotation in plane motion and simple problems; D'Alembert's principle and its applications in plane motion and connected bodies; Work energy principle and its application in plane motion of connected bodies; Kinetics of rigid body rotation.

Virtual Work and Energy Method:

Virtual displacements, principle of virtual work for particle and ideal system of rigid bodies, Applications of energy method for equilibrium, Stability of equilibrium.

EXPERIMENTS

Any 10 experiments are to be conducted from the following:

1. To verify the law of parallelogram of forces
2. To study the equilibrium of a body under three forces.
3. To determine the coefficient of friction of a flat surface.
4. Friction experiment on screw-jack.
5. Experiment based on analysis of truss.
6. To determine the mass moment of inertia of rotating disc.
7. To conduct the tensile test and determine the ultimate tensile strength, percentage elongation for mild steel specimen.
8. To conduct the Impact (Izod/Charpy) on Impact-testing machine to find the impact Strength of specimen.
9. To determine the hardness of the given specimen using Vicker/Brinell/Rockwell hardness testing machine.
10. Simple & compound gear-train experiment.
11. Worm &Worm-wheel experiment for load lifting.
12. Belt-Pulley experiment

Textbooks

1. Vector Mechanics for Engineers: Statics and Dynamics – Johnston. R.E., Beer. F., Eisenberg. E. R,& Mazurek. D., McGraw Hill
2. Engineering Mechanics: Statics and Dynamics- Hibbler. R.C., Prentice Hall

Reference books

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
5. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education.

BCS-107		**Computer Programming in Civil Engineering**
Course category	:	Professional Skill (PS)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 1, Tutorial : 0 , Practical: 2
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, One minor practical exam and One Major Practical Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Read and understand C programs. 2. Discuss basic theory and practice of programming. 3. Design and implement practical programs using C language. 4. Use compiler and feel comfortable with Windows environment 5. Identify and fix common C errors. 6. To apply the C program for basic civil engineering problems.

Topics Covered

UNIT-I	**3**

Basics of Computer: Introduction to Digital Computer, Basic Operations of Computer, Functional Components of Computer, Classification of Computers. Introduction to Operating

System: DOS, Windows, Linux, Function, Services and Types. Basics of Programming: Approaches to Problem Solving, Concept of Algorithm and Flow Charts, Types of Computer Languages:- Machine Language, Assembly Language and High-Level Language, Concept of Assembler, Compiler, Loader and Linker.

UNIT-II	**3**

Standard I/O in "C", Fundamental Data Types: Character, Integer, Short, Long, float, double, long double; Storage Classes, Automatic, Register, Static and External, Operators and Expressions: Using Numeric and Relational Operators, Mixed Operands and Type Conversion, Logical Operators, Bit Operations, Operator Precedence and Associativity, C Conditional Program Execution: Applying if and Switch Statements, Nesting if and else, Restrictions on switch Values, Use of Break, Program Loops and Iteration: Uses of while, do and for Loops, Multiple Loop Variables, Assignment Operators, Using Break and Continue keywords

UNIT-III	**3**

Functions: Designing Structured Programs, Functions in C, User Defined and Standard Functions, Formal vs. Actual Arguments, Function Category, Function Prototype, Parameter Passing, Recursive Functions. Storage Classes: Auto, Extern, Register and Static Variables

UNIT-IV	**3**

Arrays, Pointer and Character Strings, Pointers and Functions, Array of Pointers, Pointers to Pointers Dynamic Memory Allocation Structure and Union: Declaration and Initialization of Structures, Structure as Function Parameters, Structure Pointers, Unions. File Management: Defining and Opening A File, Closing A File, Input/Output Operations in Files, Pre-Processor Directives, Command Line Arguments.

EXPERIMENTS

1. Write a program that finds whether a given number is even or odd.
2. Write a program that tells whether a given year is a leap year or not.
3. Write a program that accepts marks of five subjects and finds percentage and prints grades according to the following criteria:
   a. Between90-100%----------Print "A"
   b. 80-90% ----------Print "B"
   c. 60-80% ----------Print "C"
   d. Below60%---------- Print "D"
4. Write a program that takes two operands and one operator from the user and perform the operation and prints the result by using Switch statement.
5. Write a program to print sum of even and odd numbers from 1 to N numbers.
6. Write a program to print the Fibonacci series.
7. Write a program to check whether the entered number is prime or not.
8. Write a program to find the reverse of a number.
9. Write a program to print Armstrong Numbers from 1 to 100.
10. Write a program to convert binary number into decimal number and vice versa.
11. Write a program that simply takes elements of the array from the user and finds the sum of these elements.
12. Write a program that inputs two arrays and saves sum of corresponding elements of these arrays in a third array and prints them.
13. Write a program to find the minimum and maximum element of the array.
14. Write a program to implement the concept of beam and truss.

Reference Books:

1. Jeri R. Hanly, Elliot B. Koffman, Problem Solving and Program Design in C, 7th edition, Pearson.
2. Childt, Herbert Complete reference with C Tata McGraw Hill
3. Kerninghan and Ritchie, The C programming language, Prentice Hall

BCE-101		**ENGINEERING GRAPHICS**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 0, Tutorial : 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, Two minor tests, One Major Theory Exam and major Practical Examination
Course Objectives	:	This course aims at the following educational objectives: Comprehend general projection theory, with emphasis on orthographic projection to represent three-dimensional objects in two-dimensional views (principal, auxiliary, sections). Dimension and annotate two-dimensional engineering drawings.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1.How Engineering Drawing helps to sketch the imagination? 2.Able to effectively practice the different scales for drawings. 3.Effectively analyze the geometrical shapes and to be able to draw. 4.Know about out solids and discuss about their classification. 5.How to implement the different views for a solid placed in 3dspace. 6.Construction of the object from different perspective.

Topics Covered

UNIT-I

Conic Sections and Orthographic Projections Introduction

Introduction to Engineering Drawing covering, Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Conic sections including the Rectangular Hyperbola (General method only);Cycloid, Epicycloid, Hypocycloid and Involute; Scales – Plain, Diagonal and Vernier Scales.

Orthographic Projections

Orthographic Projections covering Principles of Orthographic Projections- Conventions Projections of Pointsand lines inclined to both planes; Projections of planes inclined Planes - Auxiliary Plane

UNIT-II

Projection of Regular Solids

Projections of Regular Solids covering those inclined to both the Planes- Auxiliary Views

UNIT-III

Sections and Sectional Views of Right Angular Solids Sections and Sectional Views of Right Angular Solids covering, Prism, Cylinder, Pyramid, Cone – Auxiliary Views; Development of surfaces of Right Regular Solids - Prism, Pyramid, Cylinder and Cone
UNIT-IV
Isometric Projections Isometric Projections covering, Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions. Overview of computer graphics, demonstrating knowledge of the theory of CAD software.
Textbooks 1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008 **Reference Books** 1. Engineering Drawing and Computer Graphics- Shah, M.B. & B.C. Rana, Pearson Education, 2008 2. A Text Book of Engineering Drawing-Dhawan, R.K., S. Chand Publications,2007 3. Text book on Engineering Drawing-Narayana, K.L. & P Kannaiah, Scitech Publishers, 2008

BSM-143	**ENVIRONMENTAL CHEMISTRY**
Course category:	Program link basic science and engineering courses (PLBSE)
Pre-requisite Subject:	NIL
Contact hours/week:	Lecture : 2, Tutorial : 1, Practical: 0
Number of Credits:	3
Course Assessment methods:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Two Minor Tests and Major Theory Examination
Course Objectives	1. Solve environmental engineering problems and peruse higher studies using solid foundation in Chemistry and environmental science. 2. Design and operate various environmental systems in industries as well as higher studies through interactive education.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Students will acquire basic knowledge about Environment, which allows students to gain qualitative and quantitative skills. 2. Students will aware of environmental pollution and control methods along with quality standards of air, water etc along with waste management.

	3. Students will able to give systematic account of natural resources their use and environmental problems due to overexploitation. 4. Students will acquire basic knowledge about the chemical reactions taking place in the environment. 5. To acquire awareness for ethical principle of environment. 6. To gain knowledge as a leader in multidisciplinary areas.

Topics Covered	
UNIT-I	6
Basic concept of environmental chemistry, Introduction to atmospheric chemistry, Layers of the atmosphere and their chemical composition, chemistry of gaseous and particulate pollutants, Ozone and its control, Green House Effect. Concept of green and sustainable chemistry.	
UNIT-II	6
Chemical and solar light chemical reactions in the atmosphere. The Chemistry of Natural Waters, Oxidation-Reduction Chemistry in Natural Waters, Ion Concentrations in Natural and potable Water, Water Pollution and Purification of Water, Water Disinfection, Ground water: Its Supply, Chemical Contamination, and Remediation The Chemical Contamination and Treatment of Wastewater and Sewage .	
UNIT-III	6
Chemical properties–Cation Exchange Capacity and Anion Exchange Capacity. The Recycling of Household and Commercial Waste, Hazardous Wastes and methods of disposal, Toxic Heavy Metals, Mercury, Lead, Arsenic and cadmium. Soil pollution, Domestic and Commercial Garbage: solid waste management.	
UNIT-IV	6
Polynuclear Aromatic Hydrocarbons Chemistry of food additives, Toxic Organic Compounds, Pesticides, Insecticides, Herbicides, Dioxins, Furans, and PCBs, dyes, detergents and bleaching agents, Hazardous waste and their environmental effects.	
Books & References 1. Environmental Chemistry - Colin Baird and Michael Cann, W. H. Freeman 2. Environmental Chemistry - Stanley E. Manahan, CRC Press; 9th edition. 3. Sonja Krause, Herbert M. Clark, James P. Ferris, Robert L. Strong Chemistry of the Environment, Elsevier Science & Technology Books. 4. Eugene R. Weiner Applications of Environmental Chemistry, CRC Press, LLC. By Clair N.Sawyer,Perry 5. L. McCarty, Gene F.Parkin Chemistry for environmental engineering and science (5th edition), McGraw-Hill Professional.	

BHM-111 **TECHNICAL WRITING**

Course Category: Humanities & Social Science Elective (HSSE)
Pre-requisite Subject: None
Contact hours/week: Lecture: 2, Tutorial: 1, Practical: 0
No of Credits: 3
Course Assessment Methods: Continuous assessment through tutorials, Attendance, home assignments, quizzes, two minor test and one Major Theory Examination.

Course Objectives: To Prepare Professionals with a view to developing the power of know-how of the subject and enhance them face challenges in English language.

Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

1. Overcome the problems he/she faces in oral and written communication.
2. Acquire knowledge of and methods for using technical communication, such as, reports, proposals, and business letters etc.
3. Use and practice compositions correctly.
4. Give Presentations in different sessions and make self-appraisal.
5. Focusing on effortless speaking and writing.
6.Give Presentations in different sessions and make self-appraisal

Topics Covered

UNIT-I **6**

The Sentence, The paragraph: Structure, types and Linking, Technical Vocabulary, Impersonal Style, Scientific Attitude Plain Statement, Interesting Composition, Miscellaneous Exercises, Definition, Description, Description of a process, Diagrams, Explanations, Technical Communication-Simplicity, Clarity and Conciseness of a Presentation, Blending of Artistic and Technical Writing, Usages in Grammar, Comprehension—Reading Listening, Précis Writing.

UNIT-II **6**

Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis.
Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper, Order of a thesis and Paper Elements, Concluding Remarks ,Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis .

UNIT-III **6**

Letter Writing_ Formal and Informal Letters, Parts of a Letter, Types of Letters, Business Letters, Examples of Letter-Writing, Job Applications, C.V and Resume Writing, Stylistic Faults in Letter Writing.
Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal

UNIT-IV **6**

Technical seminar-purpose, modes and methods, Interviewing skills-body language, gesture, posture, tips and tactics of interview, resume making. Case study- objectives, methods, examples of various case studies

Audience Analysis: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas;
Multicultural issues; Analyzing real-world examples Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, Provide resources and leadership, Evaluate the project, Appendixes and Annexure, References, Peripherals—Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences. Project making: Making a final Project on topics, given by the instructor.

Books & References

1. Acharya Anita, (2013) *Interview Skills : Tips & Techniques*, Yking Books. Jaipur.
2. Basu, B.N., (2007) *Technical Writing* - PHI Learning Pvt. Ltd., New Delhi.
3. Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters*, Pankaj Publication International, New Delhi.
4. Hamilton, Richard, (2009) *Managing Writers*, XML Press, Denver, Colorado.
5. Pandey, O.N., (2013) *Technical Writing*, SK Kataria & Sons, New Delhi.
6. Raymond V. Lesikar, John Pettit, Und John D. Pettit Lesikar and Petit, *(1997) Report Writing for Business*, Mc Graw Hill, NOIDA.
7. Schwarzman, Steven A., (2011) *Technical Writing Management: A Practical Guide,*
   Sharma, R.S., (2004) *Technical Writing*, Radha Publications, New Delhi.

Semester-II

BSM-152		**Ordinary and Partial Differential Equations**
Course category	:	Program link basic science and engineering courses (PLBSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The course is aimed to develop the basic mathematical skills of engineering students that are imperative for effective understanding of engineering subjects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. To solve the ordinary differential equations. 2. To solve the partial differential equations using Lagrange and charpit's method. 3. To solve and understand the properties of Bessel`s and Legendre`s differential equation. 4. Application of partial differential equation in real life problems 5. To solve Wave, Heat and Laplace equation upto two dimensions. 6. To inculcate the habit of mathematical thinking and lifelong learning.
Topics Covered		
UNIT-I		9
Ordinary Differential Equations I: Linear differential equations with constant coefficients ($n^{th} order$), complementary function and particular integral. Simultaneous linear differential equations, solution of second order differential equations by changing dependent and independent variables, Method of variation of parameters, Applications of differential equations to engineering problems		

UNIT-II	9
Ordinary Differential Equations II: Series solution of second order differential equations with variable coefficient (Frobeneous method). Bessel and Legendre equations and their series solutions, Properties of Bessel function and Legendre polynomials.	
UNIT-III	9
Partial Differential equations I: Partial differential equations of the first order, Lagrange's solution, Charpit's general method of solution, Partial differential equations of the second order: Constant coefficient and reducible to constant coefficient, Classification of linear partial differential equations of second order.	
UNIT-IV	9
Partial Differential Equations II: Method of separation of variables for solving partial differential equations, Wave equation up to two-dimensions, Laplace equation in two dimensions, Heat conduction equations up to two dimensions	
Books & References 1. B.S. Grewal: Higher Engineering Mathematics; Khanna Publishers 2. Erwin kreyszig: Advanced Engineering Mathematics, John Wiley & Sons. 3. R. K. Jain and Iyenger: Advanced Engineering Mathematics, Narosa Publications. 4. B.V. Ramana: Higher Engineering Mathematics, Tata Mc. Graw Hill Education Pvt. Ltd. 5. M.D. Raisinghania, Ordinary and Partial Differential Equations. S Chand Publications.	

BEE-102/ 152		**Principles of Electrical Engineering**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Two Minor tests, and One Major Theory Examination.
Course Objective	:	**1.** To demonstrate and understand the basic concepts of Alternating current and voltage such as Amplitude, frequency, Average and RMS values, phasors, analysis of R, L, C series and parallel circuits. **2.** Apply the basic concepts in Electrical engineering for multi-disciplinary tasks.
Course Outcomes: The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course: 1. Recall basic concepts of Electrical Engineering. 2. Understand the basic properties of electrical elements, and solve problem based on basic electrical circuits & DC network theorems. 3. Understand the fundamental behaviour of AC circuits and solve AC circuit problems. 4. Apply the knowledge gained to explain the behaviour of the circuit at series & parallel resonance of circuit & the effect of resonance. 5. Understand the basic concepts of measurements and magnetic circuits. 6. Explain construction and working principle of transformer.		
Topic Covered		
UNIT I		**9**

D C Circuit Analysis and Network Theorems: Circuit Concepts: Concepts of network, Active and passive elements, Voltage and current sources, Concept of linearity and linear network, Unilateral and bilateral elements, R, L and C as linear elements, Source transformation, Kirchhoff's laws, Loop and nodal methods of analysis, Star-delta transformation, Network theorems: Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum Power Transfer theorem.	
UNIT II	**9**
Steady- State Analysis of Single-Phase AC Circuits: AC fundamentals: Sinusoidal, square, and triangular waveforms – Average and effective values, Form and peak factors, Concept of phasor, phasor representation of sinusoidally varying voltage and current, Analysis of series, parallel and series-parallel RLC Circuits, Resonance in series and Parallel circuit Three Phase AC Circuits: Three phase system-its necessity and advantages, Star and delta connections, Balanced supply and balanced load, Line and phase voltage/current relations, three-phase power, and its measurement	
UNIT III	**9**
Measuring Instruments & Magnetic Circuit: Types of instruments, Construction and working principles of PMMC and Moving Iron type voltmeters & ammeters, Use of shunts and multipliers. Magnetic circuit, concepts, analogy between electric & magnetic circuits, B-H curve, Hysteresis, and eddy current losses.	
UNIT IV	**9**
Single-Phase Transformers: Single Phase Transformer: Principle of operation, Construction, EMF equation, Power losses, Efficiency, O.C & S.C Test and Introduction to auto transformer.	
Textbooks: 1. Fundamentals of Electric Circuits, C.K. Alexander and M.N.O. Sadiku; TATA McGraw-Hill. 2. Principles of Electrical Engineering, V. Del Toro; Prentice Hall International. 3. Electrical and Electronics Technology, Edward Hughes; Pearson. 4. Basic Electrical Engineering, D P Kothari, I.J. Nagarath; Tata McGraw Hill 5. Electrical Technology, B. L. Thareja and A. K. Thareja; S. Chand.	

BSM-191	**ENGINEERING CHEMISTRY**
Course category:	Basic Sciences & Maths (BSM)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits:	5
Course Assessment methods:	Continuous assessment through attendance, assignments, quizzes, practical work, record, viva voce, two minor tests and One Major theory & One practical Examination

Course Objectives	1. Solve industrial problems and peruse higher studies using solid foundation in Chemistry. 2. Design and operate various research and development in industries as well as higher studies through interactive education.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Students will acquire basic knowledge in Engineering Chemistry, which allows students to gain qualitative and quantitative skills. 2. Make good scientific observations and develop experimental method of evaluation of different systems at industrial or research level. 3. Students will develop Interdisciplinary skills which can help them to thrive in the life-long changing environment in various fields of Industry. 4. Students will acquire practical knowledge and will be able to analyse data constructively and formulate new ideas. Place in the environment. 5. To acquire knowledge for chemical process and methods. 6. To gain knowledge as a leader in multidisciplinary areas.

Topics Covered

UNIT-I	9
Molecular theory of hetero-mono and diatomic molecules, Band theory of bonding in metals, Hydrogen bonding. Order and molecularity of reactions. First and second order reactions. Energy of activation. Phase Rule, its application to one component system (water). One and Two Dimensional solids, Graphite as two dimensional solid and its conducting properties. Fullerene and its applications.	
UNIT-II	9
Stability of reaction intermediates, e.g. Carbanions, Carbocations and free radicals. Types of organic reactions: Addition, Substitution, Elimination and Rearrangement reaction. Organic Name reactions and their mechanism. Configurational and conformational isomerism. Conformation and energy level diagram of n-butane.	
UNIT-III	9
Polymerization: Introduction, Mechanism of polymerization, Types of polymerization. Classification of polymers, Biodegradable and Conducting polymers. Cement Chemistry and its applications. Paint Chemistry and its applications. Classification of Fuels, calorific value of fuel, gross & net calorific value, determination of calorific value using Bomb calorimeter	
UNIT-IV	9

Basic principles of spectroscopic methods. The use of UV-Visible, Infra-red spectroscopy (IR), ^{1}HNMR, for the determination of structure of simple organic compounds. Hardness and Softening of water by different techniques. Determination of metals in water.

EXPERIMENTS

1. Determination of iron content in the given sample using K3[Fe(CN)6] as an external indicator. Determination of temporary and permanent hardness in water sample using EDTA as standard solution.
2. Determination of alkalinity in the given water sample.
3. Determination of chloride content in the given water sample by Mohr's method.
4. Determination of percentage of available chlorine in bleaching powder sample.
5. pH-metric titration between strong acid and strong base.
6. Viscosity of a polymer like polystyrene by Viscometric method.
7. Element detection & functional group identification in organic compounds
8. Preparation of a polymer like Bakelite or PMMA. 10. Preparation of Sodium Cobaltinitrite salt.

Books & References

1. Engineering Chemistry, Wiley India
2. Engineering Chemistry, Tata McGraw Hill
3. Concise Inorganic Chemistry - J.D. Lee; Wiley India
4. Organic Chemistry- Morrison & Boyd, 6th edition, Pearson Education
5. Physical Chemistry - Gordon M. Barrow; McGraw Hill
6. Physical Chemistry - Peter Atkins & Julio De Paula, Oxford University Press

BCE-152		**Engineering Geology & Building Material**
Course category	:	Mechanics of Structures (BCE-01)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 0, Tutorial : 0 , Practical: 4
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce, One minor practical exam and One Major Practical Examination.
Course Objectives	:	This course aims at the following educational objectives: 1. To study and identify different types of natural materials like rocks & minerals and soil. 2. To understand the various natural dynamic processes their influence on the surficial features, natural material, and their consequences. 3. To know the physical properties of rocks & minerals. 4. To know the importance of geological maps and language helpful for Civil Engineering projects. 5. To understand the internal structure and composition of the

		earth. 6. Ability to understand the physical properties of materials.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understanding of rocks and their minerals 2. Understanding of properties of building materials like cement, aggregates, concrete, lime, and bricks. 3. To perform several experiments to find out consistency, initial and final setting time of cement, workability of concrete, crushing strength of aggregates etc. 4. Recognize the fundamentals of the Earth as a planet, earth's dynamic actions and their importance for civil engineering structures. 5. Appreciate the usefulness and utilization of natural materials in civil engineering works. 6. Analyze and interpret geological reports and information and the latest geological exploration methods for suitable site selection.

Topics Covered

UNIT-I

Physical and mechanical properties: reinforcing steel, bricks, lime, fine aggregate, cement, coarse aggregate, geology.
Cement: Normal Consistency of cement, Initial & Final Setting time of cement, Compressive strength of cement, fineness of cement by air permeability and Le-chatalier's apparatus, Soundness of cement, Tensile strength of cement.

UNIT-II

Coarse Aggregate: Crushing value of aggregate, Impact value of aggregate, Water absorption of aggregate, Sieve Analysis and Grading of aggregate, Specific gravity, bulk density
Fine Aggregate: Sieve analysis of sand and Fineness Modulus, Silt content of sand, Bulking of sand
Lime: Fineness, Setting time and Soundness

UNIT-III

Physical and mechanical properties of reinforcing steel.
Bricks: Water absorption, Dimension Tolerance, Compressive Strength, Efflorescence.

UNIT-IV

Geology: 1. Megascopic study of minerals (physical properties and identification).
2. Determination of Specific Gravity of minerals.
3. Megascopic study of the following rocks with special reference to their suitability in Civil Engineering works– (a) Igneous rocks (b) Sedimentary rocks (c) Metamorphic rocks
4. Determination of strike and dip & completion of outcrop.
5. Preparation of geological section and study of geological maps with emphasis on the site selection for dams, tunnels, and highways.

Text Books:

1. Prabin Singh: Engg. and General Geology, Katson Publishing House.

2. F G Bell: Fundamentals of Engineering Geology, B S Publication.

Reference Books

1. Tony Waltham : Fundamentals of Engineering Geology ,SPON Press.
2. J.M. Treteth : Geology of Engineers, Princeton, Von. Nostrand.

BCE-153		**Building Planning and Drawing**
Course category	:	Engineering Fundamentals (EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 1, Tutorial : 0 , Practical: 2
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce two Minor tests, one Major theory exam and Practical Examination.
Course Objectives	:	This course aims at the following educational objectives: 1. To understand the fundamental principles and concepts of planning and architecture for buildings. 2. To study about different views of layout. 3. To learn the development controls covered by building bye laws and national building code for buildings.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Apply the concepts of building planning considering climatic parameters, building bye laws, classification of buildings and design buildings. 2. Draw site plan, plans, elevations and sectional views of residential, commercial and public buildings, showing maximum details of various building components using the available construction area effectively according to codal provisions and standard units Effectively analyse the geometrical shapes and to be able to draw. 3. Prepare building services drawings How to implement the different views for a solid placed in 3dspace. 4. Apply his knowledge to evaluate existing projects, suggest economical modifications for sustainable development and strengthen his professional skills through self-employability and lifelong learning. 5. Able to prepare a water supply line diagram. 6. Able to prepare a firefighting layout for buildings.
Topics Covered		
UNIT-I		3
Introduction		

Building Planning- Factors Shape size and topography of site, Climatic conditions of the site, Functional requirements of the building, Local Bye laws requirements of size of different components, setbacks, neighborhood, Owner :– Status-Choices-Preferences, Economy. Building Planning- Principles Aspects, Prospects, roominess, furniture requirements, groupings, circulation, privacy, elegance, lighting & ventilation, sanitation, flexibility, economy, practical considerations.

UNIT-II	3

Building Bye Laws

Building Bye Laws Means of access, internal and external open spaces, floor area ratio, height of building, safety precautions. Building Sanction procedures, key plan (layout plan), site plan, building plan, working plan, validity of sanction, completion certificate.

UNIT-III	3

Site Plan &Planning of Buildings

Drawing of site plan showing setbacks, Floor Area Ratio, Height of Building, and Minimum Distance from Power line, as per National Building Code (NBC).

Given the floor area or carpet areas of rooms, plan the building and draw a Single line diagram of building. a) Residential building b) School Buildings c) Hostel Buildings d) Primary Health Centre Draw the Plan, Elevation and Sectional views for the following types of buildings. a) Residential buildings. b) School Buildings c) Hostel Buildings d) Primary Health Centre e) Canteen Building f) Two storied residential building g)Small workshop Building.

UNIT-IV	3

Building Basic Services

Preparation of water supply Layout for residential building.
Preparation of Electrical Layout for residential building.
Preparation of Sanitary Layout for residential building.
Preparation of Shallow Well Rain Water Harvesting Method for Building.

Preparation of Fire Fighting layout for buildings.

Reference Books:

1. Civil Engg: Drawing Balagopal and RS Prabhu – Spades.
2. Time Savers standards for Building types – Joseph Deciara and john Callender Tata Mc Graw hill

BSM-178		**PHYSICS OF ENGINEERING MATERIALS**
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	Physics at 12th standard
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination.
Course Objective:		Understanding of the principle and concepts of Crystal Structure, Waves and Oscillations, architectural acoustics and smart materials for their applications in Civil Engineering.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
.	:	1. Basics of crystallography and its applications in civil engineering 2. Oscillation and waves and their applications in civil engineering. 3. Basic principles of Architectural Acoustics applied in civil Engineering. 4. Principles of Non-destructive Testing applied in civil Engineering. 5. Basic principles of mechanical properties of materials and its application in civil engineering. 6. Nano materials and their applications in civil engineering.

Topics Covered	
UNIT-I	**9**
Crystal Structures and X-ray Diffraction: Space lattice, basis, Unit cell, Lattice parameter, Seven crystal systems and Fourteen Bravais lattices, Crystal-System Structure, Packing factor (cubic, body and face), Lattice planes and Miller Indices, Diffraction of X-rays by crystal, Bragg's Law, Bragg's spectrometer.	
UNIT-II :	**9**
Oscillation and Waves: Simple harmonic motion, differential equation for SHM, Potential and Kinetic Energy, Damped harmonic motion, differential equation for DHM, Forced Oscillator, differential equation for Forced Oscillator, equation of motion of force oscillation.	
Ultrasonics: Production of ultrasonics by Piezo-electric and magnetostriction; Detection of ultrasonics, measurement of wavelength of ultrasonic waves, properties of ultrasonic waves, applications of ultrasonic waves.	
UNIT-III:	**9**
Architectural Acoustics: Sound waves, intensity, loudness, reflection of sound, echo; Reverberation, reverberation time, Sabine's formula, remedies over reverberation; Absorption of sound, absorption coefficient, absorbent materials; Conditions for good acoustics of a building; Noise, its effects and remedies, sound insulation. **Non-destructive Testing:** Objectives of non-destructive testing, Methods of non-destructive testing, Liquid penetration method, ultrasonic inspection method and pulse echo method.	
UNIT-IV:	9

Mechanical Properties of Materials: Stress, Strain, Longitudinal or Tensile Strain, Shear or Shearing Strain, Volumetric Strain, Behaviour of a Wire Under Increasing Load, Hooke's Law, Young's Modulus (Y), Bulk Modulus (K), Modulus of Rigidity or Shear Modulus, Poisson's Ratio, Determination of Young's Modulus (Y), Determination of Moment of Inertia
Experiments 1. To determine the moment of inertia of a flywheel. 2. To determine the velocity of Ultrasonic waves 3. To determine the Young Modulus by Searl's method 4. To determine the height of Tower by Sextant. 5. To determination the velocity of sound wave. 6. To measure liquid and plastic limit of clay composites.
Books & References
1. Introduction to Solid State Physics- Kittel , 7th edition, Wiley Eastern Ltd. 2. Solid State Physics - S. O. Pillai, 5th edition, New Age International. 3. Master Handbook of Acoustics - F. Alton Everest and Ken Pohlmann, 5th edition, McGraw Hill 4. Elements of Properties of Matter by D.S. Mathur, S. Chand an Company, India 5. Engineering Physics by B. K. Pandey and S. Chaturvedi, Cengage Learning Pvt. Limited India. 6. Introduction to Nano Technology - Poole Owens, Wiley India 7. Master Hand book of Acoustics - F. Alton Everest and Ken Pohlmann, 5th edition, McGraw Hill

BHM-151	**PROFESSIONAL COMMUNICATION**
Course category:	Humanities & Social Science (HSS)
Pre-requisite Subject:	NIL
Contact hours/week	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits:	2
Course Assessment methods:	Continuous assessment through tutorials, Attendance, home assignments, quizzes, Two Minor Test and one Major Theory Exam.
Course Objective	The course aims: To sensitize the students to understand the role & importance of communication for personal & professional success and enable learners to exhibit knowledge, skills, and judgment in and around human communication that facilitate their ability to work collaboratively with others in an interpersonal environment.
Course Outcomes:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course. 1) Use of various facets of communication skills, such as, Reading, Writing, Listening and speaking skills.

	2) To identify, formulate and solve the real life problems with positive attitude. 3) To inculcate the habit of learning and developing the communication and soft skills by practice. 4) To create an amicable ambience so as to make them learn the different part of English language with the correction of the language. 5) Enhancing word power by counselling scientific literature 6) Focusing on effortless speaking and writing.

Topics Covered

UNIT-I	6

VERBAL COMMUNICATION:
Received Pronunciation; how to activate passive vocabulary; Technical/non-technical and Business Presentations; questioning and answer skills; soft skills for professionals; role of body postures, movements, gestures, facial expressions, dress in effective communication; Information/ Desk/ Front Office/ Telephone conversation; how to face an interview/press conference; Group discussions, debates, elocution.

UNIT-II	6

READING COMPREHENSION
Skimming and Scanning; factual and inferential comprehension; prediction; guessing meaning of words from context; word reference; use and interpretation of visuals and graphics in technical writing.

UNIT-III	6

P **WRITTEN COMMUNICATION:**
Note Making and Note Taking; summarizing; invitation, advertisement, agenda, notice and memos; official and commercial letters; job application; resume and curriculum vitae; utility, technical, project and enquiry reports; paragraph writing: General – Specific, Problem – Solution, Process – Description, Data – Comment.

UNIT-IV	6

SHORT ESSAYS:
Description and Argument; comparison and contrast; illustration; using graphics in writing: tables and charts, diagrams and flow charts, maps and plans, graphs; how to write research paper; skills of editing and revising; skills of referencing; what is a bibliography and how to prepare it.

Books & References

1) Bansal, R.K. & Harrison J.B., (1972) *Spoken English*, Orient Longman, India.
2) Chauhan, Narender Kr. & Singh, Sudhir N., (2013) *Formal Letters,* Pankaj Publication International, New Delhi.
3) Chhabra T.N., (2019) *Business Communication*, Sun India Publication, New Delhi.
4) Dixon Robert J., (1986) *Complete Course in English,* Prentice Hall of India, New Delhi.
5) Jones, Daniel., (2012) *Cambridge English Pronouncing Dictionary*, 18th Edition, Paperback, CUP, India.
6) Lewis, Norman, (2015) *Word Power Made Easy,* Penguin India.

Semester-III

BCE-201	**NUMERICAL METHODS IN CIVIL ENGINEERING**

Course category	:	Program link basic science and engineering courses (PLBSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 1 , Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination.
Course Objectives	:	1. Numerical Methods for Solving Linear Systems 2. Methods to solve equations of One Variable as well as system of equations with two variables. 3. Interpolating Polynomials and best curve fitting methods for the given data. 4. Numerical Differentiation and Integration 5. Numerical Solutions of Ordinary Differential Equations 6. Numerical Methods to solve partial differential equations.
Course Outcomes	:	On completion of this course, the students will able to: 1. Compute numerical solution of given system AX=B by direct and iterative methods. 2. Compute largest eigenvalue and its corresponding eigenvector of matrix A. 3. Compute numerical solution of f(x)=0 and nonlinear equations with two variables, 4. Interpolate function and approximate the function by polynomial. 5. Compute best curve fit for the given data by curve fitting method. 6. Compute numerical solution of ordinary and partial differential equations by finite difference method.

Topics Covered

UNIT-I	**6**
Solution of linear system - Gaussian elimination and Gauss-Jordan methods - LU - decomposition methods - Crout's method - Jacobi and Gauss-Seidel iterative methods - sufficient conditions for convergence - Power method to find the dominant eigenvalue and eigenvector.	
UNIT-II	**6**
Solution of nonlinear equation - Bisection method - Secant method - Regula falsi method - Newton-Raphson method for f(x) = 0 and for f(x,y) = 0, g(x,y) = 0 - Order of convergence - Horner's method - Graeffe's method - Bairstow's method. Newton's forward, backward and divided difference interpolation – Lagrange's interpolation – Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 and 3/8 rules - Curve fitting - Method of least squares and group averages.	
UNIT-III	**6**
Numerical Solution of Ordinary Differential Equations- Euler's method - Euler's modified method - Taylor's method and Runge-Kutta method for simultaneous equations and 2nd order equations - Multistep methods - Milne's and Adams' methods.	
UNIT-IV	**6**
Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one-dimensional heat flow equation - Bender - Schmidt recurrence relation - Crank - Nicolson	

method - Solution of one-dimensional wave equation.

Textbooks

1. David Kincaid and Ward Cheney, Numerical Analysis\, 3rd edition, American Mathematics Society, (Indian edition) – 2010.

Reference Books

1. Gerald C.F., and Wheatley P.O., Applied Numerical Analysis, AddisonWesley Publishing Company, 1994
2. Jain, M.K., Iyengar, S.R. and Jain, R.K., Numerical Methods for Scientific and Engineering Computation, New Age international, 2003
3. Atkinson, K.E., An Introduction to numerical Analysis, John Wiley & Sons, 2008.

BCE-202		**BASIC SURVEYING**
Course category	:	Engineering Fundamentals(EF)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial: 1, Practical:2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance home assignments, quizzes, practical work, record, viva voce and two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The objective of this course is to develop an understanding of the basic principles of surveying including the traditional measurements and representations and thereby preparation of maps and plans showing the relative position of existing features by which areas, volumes and other related quantities can be determined.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. To understand the importance of surveying in the field of civil engineering 2. To be able to use conventional surveying tools such as chain/tape, compass, plane table, in the field of civil engineering applications 3. To know the basics of levelling and theodolite/ Tacheometer in elevation and angular measurements 4. To understand traversing and numerical aspects of traversing 5. To take accurate measurements, and carry out field booking, plotting and adjustment of errors in a traverse 6. Students learn to work with others, respect the contributions of others, resolve difficulties, andunderstand responsibility

Topics Covered

UNIT-I	9

Introduction and Principles of surveying, Plane and Geodetic Surveying, Control Points, Classification of surveys, Horizontal and Vertical Control Measurement by chain and tape. Sources of errors and precautions, Corrections to tape measurements, Compass surveying, Instruments, Surveyors and Prismatic compass, Bearing of survey lines, systems and conversions, Local attraction, Traversing, Latitude and departure, Traverse adjustment of closing errors,

Computation of coordinates. Maps, their scales, referencing system and uses, plotting accuracy; Map coordinate system; projections and their types.

UNIT-II	9

Different methods of determining elevation; Spirit levelling: Definition of terms, Principle, Construction, Temporary adjustments of levels. Automatic levels, Digital Level, Levelling staves, Methods of spirit levelling, Booking and reduction of fields notes, Curvature and refraction, Reciprocal leveling, Trigonometric leveling - simple and reciprocal observations, Sources of errors and precision of leveling procedures. Contouring: Definition and characteristics of contours, contour interval, horizontal equivalent, Direct and Indirect methods of contouring, Use of contour maps, Digital Elevation Model.

UNIT-III	9

Theodolite surveying, Vernier theodolite, Temporary adjustments, Measurement of horizontal and vertical angles, Methods of repetition and reiteration, errors in theodolite surveying, elimination of errors, working of Electronic Theodolites, Tacheometric surveying, Principles, Methods – Stadia system – Fixed hair methods, Methods with staff held vertical and normal, Analytic lens, Subtense bar, Tangential method.

UNIT-IV	9

Plane Table surveying, instruments and accessories, advantages and disadvantages of plane table surveying, methods – radiation, intersection, traversing, resection – Two- and three-point problems, errors in plane table surveying. Map preparation with plane table. Area and volume computation: area from latitude and departure, Simpson's rule and Trapezoidal rule. Volume of level and two level sections, Trapezoidal and prismoidal formulae with corrections

Basic Survey Lab/ Field Work

Minimum Eight experiments are to be conducted from the following:

1. To study instruments used in chain surveying and to measure distance between two points by ranging.
2. To determine the bearing of sides of a given traverse using Prismatic Compass and plotting of the traverse.
3. To find out the reduced levels of given points using level. (Reduction by Height of Collimation method and Rise and Fall Method).
4. To determine and draw the longitudinal and cross-section profiles along a given route.
5. Practice for temporary adjustments of a Vernier Theodolite and taking horizontal (by Repetition and Reiteration methods) and Vertical angular measurements.
6. Measurement of horizontal angles by Repetition method.
7. Determination of the Tacheometric constants of a given theodolite.
8. To plot details using radiation and intersection methods in plane tabling.
9. To solve three-point problem in plane tabling

Textbooks

1. K.R. Arora, "Surveying", Vol. I & II Standard Book House, Delhi,
2. B.C Punmia, "Surveying", Vol. I, II & III Laxmi Publication
3. S.K. Duggal., Surveying Vol. I & II Tata McGraw Hill
4. A.M. Chandra,. "Plane Surveying", New Age International Publishers, Delhi
5. R. Subramanian Surveying and Levelling Oxford University Press
6. W. Schofield Engineering Surveying Elsevier
7. Charles D Ghilani and Paul R Wolf Elementary Surveying Pearson

Reference books

1. W. Schofield Engineering Surveying Elsevier
2. Charles D Ghilani and Paul R Wolf Elementary Surveying Pearson

BHM-201	SCIENTIFIC AND TECHNICAL WRITING	
Course category	:	Humanities & Social Science Elective (HSSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through tutorials, Attendance, home assignments, quizzes, two Minor Test and one Major Theory Exam.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Overcome the problems he/she faces in oral and written communication. 2. Acquire knowledge of and methods for using technical communication, such as, reports, proposals and business letters etc. 3. Use and practice compositions correctly. 4. Enhancing word power by counselling scientific literature. 5. Focusing on effortless speaking and writing. 6. Give Presentations in different sessions and make self-appraisal.

Topics Covered

UNIT-I	**6**

Language Vs communication: Communication as coding and decoding – signs, symbols & pictograph – verbal and non –verbal symbols – Language & communication; Types of Communication- functional, situational, verbal, and non-verbal, interpersonal, group, interactive, public, Mass Communication. Thinking and Articulation – cognitive, affect, critical, creative aspects of articulation.

Skills of Language Acquisition: Natural Language Acquisition Skills: Listening, Speaking, Reading & Writing {LSRW}; Language Acquisition Through Training: Listening, Speaking, Reading, Writing, Grammar & Vocabulary {LSRWGV}

Phrase, Clause & Sentence: Professional Drafting-Simplicity, Clarity and Conciseness of a Presentation, Differentiating between Professional & Creative Writing, Blending of Artistic/Professional Writing, Avoiding gender, racial and other forms of bias in Professional Writing. Pre Writing, Drafting and Re-writing.

Processing Professional Data: Data Collection, Literature Review, Data Analysis, Drafting Data & Deriving Inferences.

UNIT-II	**6**

Technical Paper Writing: Professional Paper Elements-Front Matter of a Paper, Main Text of a Paper, End Matter of a Paper: Organising References and Bibliography, Order of a thesis and Paper Elements, Concluding Remarks. **Methods of Research Paper Writing:** Identification of Author and His Writing-Author's name and Affiliation, Joint Authorship of a Paper, Identification of Writing-Title, Keywords, Synopsis, Preface and abstract. Drafting Research Article & Methodology.

Thesis/Dissertation Writing: Thesis Elements-Front Matter of a Thesis, Main Text of a Thesis, End Matter of a Thesis, Specimen—Thesis and Research Paper, Chapters and Sections-Introductory

Chapters and Sections, Statement of the Problems, Plan and Scope, Core Chapters and Sections-Theoretical Analysis and Synthesis, Basic Assumption and Hypothesis.

Professional Presentation & Seminar Delivery Tools: Designing the Presentation; Establishing the Objectives. Making Professional Power Point Presentations, Signalling Structure of Presentation through Sentences and Crisp Phrases, Preparing Notes for Professional/Technical Presentation, Text Animation, White Board, Flip Charts, Diagrams, Preparing Cards. Seminar Presentations: Purpose modes and methods. Nascent Emerging Platforms for On-line Presentations viz. Zoom, Webex, Team & Meet etc.

UNIT-III	**6**

Introduction to Generation–Z, Cyber Identity & Professional Netiquettes for Netizens: Drafting E-mails, Blogs on social media, Videoconferencing. Managing Profiles on social media. What to Write and Share on social media.

Professional Drafting: Letters Vs E-mails, Formal and Informal mails, Parts of e-mails, Types of e-mails, Managing tone of E-mails & Business Letters, Examples of Letters & E-mail, Professional Correspondence through E-mail, Job Applications & Covering Letters. Introduction to DOs (Demi-Official Letters)

Conducting Professional Meeting: Pre-meeting Preparation, During Meeting: Action Taken Report (ATR) & New Agenda Points, Post Meeting Follow ups. Notice, Circular, Agenda & Minutes.

Career & Correspondence: Developing a Professional C.V, Bio Data & Resume Building. Report Writing, Kinds of Reports, Length of Report, Parts of a Report, Terms of Reference, Collection of Facts, Outlines of Report, Examples of Report, Technical Proposal, Elements of Proposal, Examples of Proposal, drafting of proposal.

UNIT-IV	**6**

Professional Interviews- Interview skills-body language, gesture, posture, tips, and tactics of interview. Professional interview of an expert. Questioning & Answering Skills.

Case study- objectives, methods, examples of various case-study.

Audience Analysis in Technical Writing: Industrial vs. non-industrial users; Exploring primary, secondary, tertiary users in contexts of production and use; Creating personas; Multicultural issues; Analysing real-world examples. Estimating, tracking, and managing tech writing projects. Determine the project scope, Estimates and schedules, Assemble the team, provide resources and leadership, Evaluate the project, Appendixes and Annexure, References, Peripherals—Official Formalities, Rights and Permission, Certificate and Copyright, Dedication, Acknowledgement, Correspondences. Managing Tone in Writing.

Project Writing: Elements of a Professional Project Making: Making a final Project on topics, given by the instructor, Result & Discussion.

Text / Reference Books

1. Acharya Anita. (2012) Interview Skills- Tips & Techniques. Yking Books, Jaipur.
2. Basu, B. N., (2008) Technical Writing. PHI Learning Pvt. Ltd.., New Delhi.
3. Chauhan, N. K & Singh, S. N. (2013) Formal Letters, Pankaj Publication International, New Delhi.
4. Chhabra T.N. (2018) Business Communication. Sun India Publication New Delhi.
5. Dubey Arjun et.al. (2016) Communication for Professionals. Alfa Publications, Delhi.
6. Gibaldi, Joseph (2021). The MLA Handbook for Writers of Research Papers. Ed. IXth, Modern Language Association of America, NY, US.
7. Gurumani, N. (2010) Scientific Thesis Writing and Paper Presentation, MJP Publishers, Chennai.
8. Hamilton Richard. (2009) Managing Writers. Penguin, India.
9. Mc Graw S. J. (2008) Basic Managerial Skills for All. Ed. 08th, Prentice Hall of India, New Delhi.
10. Murphy & Hildebrandt. (2008) Effective Business Communication. Tata McGraw Hill New Delhi.

11. Schwarzman Steven A. (2011) Technical Writing Management: A Practical Guide. CreateSpace Independent Publishing Platform.
12. Sharma R.C. & Mohan Krishna. (2017) Business Correspondence and Report Writing. Tata McGraw Hill New Delhi.
13. Sharma R. S., (2007) Technical Writing. Radha Publications, New Delhi.

BCE-203		**STRUCTURAL MECHANICS - I**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Mechanics of structures
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and Two Minor tests and One Major Theory & Practical Examination.
Course Objectives	:	The objective of this course is: 1. To learn the fundamental concepts of stress, strain, and deformation of solids with applications to bars, beams, and columns. 2. Detailed study of engineering properties of materials is also introduced. 3. Fundamentals of applying equilibrium, compatibility, theories of failure and energy methods and force deformation relationships to structural elements are also emphasized. 4. To introduce the concepts for calculating the deflection of beams with various loading conditions. And builds the fundamental concepts of unsymmetrical bending and curved beams.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Identify the basic concepts of structural mechanics including static equilibrium, geometry of deformation, and material constitutive behavior. 2. Executing the fundamental concepts of stress, strain, and elastic behaviour of materials to analyze structural members subjected to tension, compression, torsion. 3. Analyse the bending and shear stress on different types of sections. 4. Formulate appropriate theoretical basis for the analysis of combined axial and bending stresses. 5. Understand the behavior of columns and struts under axial loading. 6. Demonstrate the use of critical thinking and problem-solving techniques as applied to structural systems.

Topics Covered	
UNIT-I	9
Simple Stress and Strain, Poisson’s ratio, Different Moduli of elasticity and their relations. Compound stresses and strains: Introduction: normal stress and strain, shear stress and strain, stresses on inclined plane, strain energy, impact loads and stresses, state of plane stress, principal stress and strain, maximum shear stress, Mohr‟s stress circle three-dimensional state of stress & strain, equilibrium	

equation, generalized Hook‟s law, theories of failure, composite bars, Temperature stresses	
UNIT-II	9
Bending Moment, Shear Force Diagram for beams and determinate structural members. Bending Stresses: Derivation of formula, bending stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, composite beam Shear Stresses: Derivation of formula, Shear stress distribution across various beam sections like rectangular, circular, triangular, I, T angle sections, composite beam.	
UNIT-III	9
Deflection of beam: Equation of elastic curve, cantilever and simply supported beam, Macaulay‟s method, Moment Area method, Unit Load Method. Strain Energy Methods and Strain Energy theorems. Torsion- Derivation of torsion equation and its assumptions. Applications of the equation of the hollow and solid circular shafts, torsional rigidity, Combined torsion and bending of circular shafts, principal stress and maximum shear stresses under combined loading of bending and torsion.	
UNIT-IV	9
Combined bending and direct stress, middle third and quarter fourth rules. Columns and struts: Buckling and Stability, slenderness ratio, Euler‟s Crippling Load, Buckling Loads for columns with various end conditions. Empirical formulae for evaluation of Buckling Load. Curved Beams: Bending of beams with initial curvature. Unsymmetrical Bending. Shear Centre	
List of Experiments: Following experiments to be carried out: 1. Flexural Rigidity of Beam 2. Unsymmetrical Bending 3. Buckling Load of Struts 4. Deflection of curved members 5. Verification of Maxwell Betti's Reciprocal theorems	
Textbooks 1.Hibbeler, R. C. Mechanics of Materials. 6th ed. East Rutherford, NJ: Pearson Prentice Hall, 2004 2.Timoshenko, S. and Young, D. H., "Elements of Strength of Materials", DVNC, New York, USA. 3.Jain, O.P. and Jain, B.K., "Theory & Analysis of Structures. Vol. I & II Nem Chand. 4. James M. Gere, Barry J. Goodno, "Mechanics of Materials" Cengage Learning	
Reference Books 1. Coates, Coates, R.C., Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson,1980. 2. Ghali, A. & Neville, M., "Structural Analysis", Chapman & Hall Publications, 1974. 25 3. Jain, A.K. "Advanced Structural Analysis", Nem Chand & Bros, Roorkee, India, 1996. 4. Kazmi, S. M. A., "Solid Mechanics" TMH, Delhi, India.	

BCE-204		**CONSTRUCTION TECHNOLOGY AND ESTIMATION & COSTING**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination.

Course Objectives	:	The aim is to introduce engineering students to the basic principles of high-performance concretes, modular construction practices, durability properties and inspection report preparation.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Understand the limitations of construction techniques 2. Implement modular construction practices 3. Understand reliable proportioning concepts in construction techniques. 4. Understand various tests on fresh, hardened concrete, special concrete, the methods of manufacturing of concrete and exposed to means of quality control. 5. Understand the safety aspects in construction. 6. Understand the aspects of estimation and costing in construction practices

Topics Covered

UNIT-I	9
High Performance Concretes: Definition & Introduction, Classification, general properties, Advantages, Disadvantages, Applications, Description of types. Guidelines for Mix design and use of following concretes: Light weight concrete, High strength concrete, Ultra-high strength concrete (reactive powder concrete), High workability concrete/Self compacting concrete, Fiber reinforced concrete, Polymer-concrete composites	
UNIT-II	9
Durability of Concrete: Definitions, Deterioration processes – Physical, Chemical, Environmental & Biological; Measures for ensuring durability, Corrosion of reinforcing steel, protective measures. Testing and Quality Control of Concrete: Classification of test methods, In-situ, Non-Destructive & Partially– Destructive tests for fresh concrete, hardened concrete and durability of concrete.	
UNIT-III	9
Introduction to estimation- Necessity of Estimation, Data required for preparation of estimates, Importance of estimation, and different types of estimates, specifications: general and detailed. Methods of estimation, Estimates of RC works, Estimates of Buildings	
UNIT-IV	9
Valuation, necessity of valuation of a property, cost, value, price, gross income, net income, outgoing, sinking fund, cost of rent, insurances, scrap value, salvage value, distress value, sentimental value, market value, speculative value, potential value, monopoly value, book value, depreciation	

Textbooks

1. M.S.Shetty, Concrete Technology S.Chand & Company New Delhi 2005
2. P.Kumar Mehata, Paulo & J.M. Monteiro, Concrete microstructure, properties & materials, Prentice Hall INC & Mcgraw Hill USA.

Reference books

1. Allen E, Iano, J, Fundamentals of Building Construction subscription E Book, Material and Method, John Wiley and Sons, 2011.

2. Cameron K. Andres, Ronald C. Smith, Principles and Practices of Commercial Construction, 8th Ed., Prentice Hall, 2009.
3. Gambhir M.L: Concrete Technology Tata McGraw Hill (Second Edition) 1995
4. Neville A.M., J.J.Brook Properties of Concrete Addison Wesley 1999

BCE-205		**FLUID MECHANICS**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, Two Minor tests, and One Major Theory & Practical Examination
Course Objective	:	1. Conceptualize of basic fluid properties including behavior of Newtonian fluid at rest and motion. 2. Apply mass, momentum, and energy equation in open channel flow. Estimate velocity distribution, Shear stress distribution and head loss in laminar and turbulent flow in pipes. 3. Analyze pipes in series and parallels, and water distribution networks. 4. Measure flow through pipes using various flow measuring devices.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understand how to make measurements of flow. 2. Understand the type and nature of the flow. 3. Apply the principle of momentum, energy, and mass conservation in various fluid flows. 4. Explain and describe the difference between smooth and rough surface. 5. Figure out the problems in different pipe flows. 6. To understand the concept of boundary layer theory and flow separation.

Topics Covered

UNIT-I	**9**

Introduction: Fluids and continuum, Fluid Statics, Dimensional Analysis and Model Studies Introduction: Fluids and continuum; Physical properties of fluids: Viscosity, Compressibility, Surface Tension, Capillarity, Vapor Pressure; Cavitation's; Classification of fluids including rheological classification.

Fluid Statics: Pressure-density-height relationship; Measurement of pressure by Manometers and mechanical gauges; Pressure on plane and curved surfaces; The Hydrostatic law; Total Pressure and Centre of pressure; Buoyancy; Stability of immersed and floating bodies.

Dimensional Analysis: Units and Dimensions, Rayleigh's method, Buckingham's Π theorem, Important dimensionless numbers used in fluid mechanics and their significance. Hydraulic Similitude and Model Studies: Model and prototype; Similitude; Geometric, Kinematic and Dynamic similarity; Model Laws; Un-distorted model studies.

UNIT-II	**9**

Fluid Kinematics and Fluid Dynamics-I

Fluid Kinematics: Description of Fluid flow: Lagrangian and Eulerian approach; Types of fluid Flows: Steady and unsteady, Uniform and non-uniform, Laminar and turbulent flows, 1, 2 and 3-D flows; Streamlines, Path lines and Streak lines; Stream tube; Acceleration of a fluid particle along a straight and curved path; Differential and Integral form of Continuity equation; Rotation, Vorticity and Circulation; Elementary explanation of Stream function and Velocity potential; Flow net characteristics, uses and experimental and graphical methods of drawing.

Fluid Dynamics-I: Concept of control volume and control surface, Reynolds Transport Theorem, Introduction to Naiver-Stokes Equations, Euler's equation of motion along a streamline and its integration, Bernoulli's equation and its applications – Pitot tube, Flow through orifices, Mouthpieces, Nozzles, Notches, Weirs, Sluice gates under free and submerged flow conditions; Free and Forced vortex motion.

UNIT-III	**9**

Fluid Dynamics-II, Flow Through Pipes and Boundary Layer Analysis

Fluid Dynamics-II: Impulse-Momentum Principle; Moment of momentum equation; Momentum equation application to stationary and moving vanes, pipe bends, Problems related to, combined application of energy and momentum equations, flow measurements, determination of coefficients of discharge, velocity and contraction, and energy loss.

Laminar Flow: Reynolds Experiment; Equation of motion for laminar flow through pipes; Flow between parallel plates; Kinetic energy and Momentum correction factors; Stokes law; Flow through porous media; Darcy's Law; Measurement of viscosity.

Turbulent Flow: Turbulence; Equation for turbulent flow; Reynolds stresses; Eddy viscosity; Mixing length concept and velocity distribution in turbulent flow; Boundary Layer Analysis: Boundary layer thicknesses; Boundary layer over a flat plate; Laminar boundary layer**;** Application of Von-Karman Integral Momentum Equation; Turbulent boundary layer; Laminar sub-layer; Hydro-dynamically Smooth and rough boundaries; Local and average friction coefficient; Total drag; Boundary layer separation and its control.

UNIT-IV	9

Flow Through Pipes: Nature of turbulent flow in pipes; Major and Minor energy losses; Hydraulic gradient and total energy lines; Flow in sudden expansion, contraction, bends, valves and siph**9**ons; Concept of equivalent length; Branched pipes; Pipes in series and parallel; Simple pipe networks and its analysis.

Compressibility Effects in Pipe Flow: Transmission of pressure waves in rigid and elastic pipes; Water hammer; Analysis of simple surge tank excluding friction.

Flow Past Submerged Bodies: Drag and lift, Types of drag force, Drag on sphere, Cylinder andair foil; Circulation and Lift on a cylinder and air foil; Magnus effect.

EXPERIMENTS

1. To measure the surface tension of a liquid.
2. To determine the metacentric height of a ship model experimentally.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To determine the coefficients of velocity, contraction, and discharge of an orifice (or a mouthpiece) of a given shape.
5. To plot the flow-net for a given model using the concept of electrical analogy.
6. To calibrate an orifice meter and venturi meter and to study the variation of the coefficient of dischargewith the Reynolds number.
7. To calibrate and determine the coefficient of discharge for rectangular and triangular notches.
8. To verify Darcy's law and to find out the coefficient of permeability of the given medium.
9. To verify the momentum equation.
10. To determine the loss coefficients for the various pipe fittings.

Textbooks

1. R J Fox: Introduction to Fluid Mechanics
2. Hunter Rouse: Elementary Mechanics of Fluids, John Wiley and sons, Omc/ 1946.
3. L H Shames: Mechanics of Fluids, McGraw Hill, International student edition.
4. Garde, R J and A G Mirajgaonkar: Engineering Fluid Mechanics (including Hydraulicmachines), second ed., Nemchand and Bros, Roorkee, 1983.
5. K L Kumar: Engineering Fluid Mechanics
6. Munson, Bruce R, Donald F Young and T H Okishi, Fundamentals of Fluid Mechanics, 2nd Ed, wiley Eastern.
7. V Gupta and S K Gupta, Fluid Mechanics and its Applications, Wiley eastern ltd.
8. Som and Biswas: Introduction to Fluid Mechanics and Machines, TMH.

Reference Books

1. Hydraulics and Fluid Mechanics by Dr. P. N. Modi and Dr. S.M Seth.

Semester-IV

BSM-255	**Probability and Statistics**	
Course category	:	Basic Sciences & Maths (BSM)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 1, Practical: 0
Number of Credits	:	3
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives		

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Use of moments and kurtosis to find the type of curve. 2. Choose a statistical method for solving practical problems 3. To understand the meaning and importance of correlation and regression analysis. 4. To have a proper understanding of Statistical applications. 5. Able to apply the concept of estimation and testing of hypothesis. 6. To apply statistical methods to obtain approximate solutions to engineering problems.

Topics Covered	
UNIT-1	**6**
Statistical Techniques: Moments, Skewness, Measurement of Skewness, Kurtosis, Measurement of Kurtosis, Curve fitting: Method of Least Squares, Fitting of Straight lines and Parabola. 6	
UNIT-II	6
Correlation and Regression: Correlation, Karl`s Pearson correlation coefficient, Spearman's rank correlation coefficient, Regression, Equation of regression lines, Relation between Regression Analysis and Correlation Analysis. 6	
UNIT-III	6
Probability Distributions: Introduction to Probability, Expectations, Binomial Distribution, Poisson Distribution, Normal Distribution. Problems related to Binomial, Poisson, and Normal Distributions. 6	
UNIT-IV	6
Estimation and Testing of Hypothesis: Population, sample, parameters. Point estimation, method of moments, maximum likelihood estimator, unbiasedness, consistency. Testing of hypothesis; Null and alternate hypothesis, Neyman Pearson fundamental lemma, Tests for one sample and two sample problems for normal populations. 6	
Books & References	
1. D. C. Montgomery and G. C. Runger, Applied Statistics and Probability for Engineers, Wiley. 2. J. L. Devore, Probability and Statistics for Engineering and the Sciences, Cengage Learning. 3. S.M. Ross, Introduction to Probability and Statistics for Engineers and Scientists, Academic Press; 5th edition 4. Robert V Hogg, Joseph McKean, Allen T Craig, Introduction to Mathematical Statistics, Pearson Edu. 5. Mood, Graybill and Boes, Introduction to the Theory of Statistics, Tata McGraw-Hill.	

BCE-251	**HYDRAULIC AND HYDRAULIC MACHINES**	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Fluid Mechanics (BCE-205)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5

Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce, Two Minor tests, and One Major Theory & Practical Examination
Course Objective	:	1. Classify open channel flow and compute velocity distribution and pressure distribution in open channel flow. 2. Compute normal and critical depth and design of efficient channel. 3. Identify and compute backwater and drawdown profiles in open channel encountered in water resources project. 4. Study of characteristics and type of hydraulic jumps. 5. Locate the hydraulic jump encountered in design of hydraulic structures in open channel. 6. Select and design hydraulic machines such as pumps and Turbines based on the system requirements.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this Course.
		1. To identify the different types of flow in Open Channel. 2. To understand the concept of Hydraulic Jump. 3. To classify the various types of flow profiles 4. To study the characteristics of rotodynamic Pumps. 5. To understand the working of Turbines. 6. To have throughout knowledge on selection of turbines and pumps for practical purposes.

Topics Covered

UNIT-I	**9**

Introduction: Difference between open channel flow and pipe flow, geometrical parameters of a channel, continuity equation. Critical depth, concepts of specific energy and specific force, application of specific energy principles for the interpretation of open channel phenomena, flow throughvertical and horizontal contractions.

Uniform Flow: Chezy's and Manning's equations for uniform flow in an open channel, factors affecting Manning's coefficient "n", Velocity distribution, Velocity distribution coefficients, most efficient channel section

UNIT-II	**9**

Gradually Varied Flow: Equation of gradually varied flow and its limitations, flow classification and surface profiles, integration of varied flow equation by graphical and numerical method and analytical and analysis of water surface profiles.

UNIT-III	**9**

Rapidly Varied Flow: Classical hydraulic jump, evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, open channel surge, celerity of the gravity wave.

Hydraulic Pumps: Rotodynamic pumps, classification on different basis, basic equations, Velocity triangles, manometric head, efficiencies, cavitation in pumps, characteristics curves.

UNIT-IV	**9**

Hydraulic turbines: Introduction, Rotodynamic Machines, Impulse turbines, Pelton Turbine, equations for jet and rotor size, efficiency, spear valve, reaction turbines, Francis and Kaplan type, Head on reaction turbine, unit quantities, similarity laws and specific speed, cavitation, characteristic curves

EXPERIMENTS

1. To determine the Manning's roughness coefficient "n" for the given flume.
2. To determine the Chezy's coefficient "C" for the given flume.
3. To study the flow characteristics over a hump placed in an open channel.
4. To study the flow through a horizontal contraction in a rectangular channel.
5. To calibrate a broad-crested weir.
6. To study the characteristics of free hydraulic jump.
7. To study rotodynamic pumps and their characteristics
8. To study characteristics of reaction turbines (Francis/ Kaplan / Pelton)

Textbooks

1. Jain A.K., Fluid Mechanics including Hydraulic Machine, Khanna publisher, 8th edition.
2. Modi P.N and S. M Seth, Hydraulics and Fluid Mechanics including Hydraulic machines, Standard Book Pub; New Delhi.

Reference Books

1. Garde, R.J., "Fluid Mechanics through Problems", New Age International
2. Streeter, V.L. and White, E.B., "Fluid Mechanics", McGraw Hill, New York, 8th
3. Asawa, G.L., "Experimental Fluid Mechanics", Vol.1, Nem Chand and Bros.,
4. Ranga Raju, K.G., Flow through open channels, T.M.H. 2nd edition
5. Rajesh Srivastava, Flow through Open Channels, Oxford University Press.
6. K. Subramanya, Flow through Open Channels, TMH
7. Vasundani, Hydraulic Machines

BCE-252		**STRUCTURAL MECHANICS – II**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Structural Mechanics -I
Contact hours/week	:	Lecture: 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, assignments, quizzes and Two Minor tests and One Major Theory Examination.
Course Objectives	:	The main objectives of the course are: 1. To impart the principles of elastic structural analysis and behaviour of indeterminate structures and to get a feeling of how real-life structures behaves 2. To enable the student to get the knowledge about various methods involved in the analysis of indeterminate structures and apply those methods to evaluate the response of structures.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

		1. Understand the concept of structural systems, loads, supports and displacements, statically determinate and indeterminate structural systems. 2. Apply a suitable analysis technique for statically indeterminate structures. 3. Analyze the beams and frames using the Classical Methods of analysis. 4. Develop and use the concept of influence line diagram for calculating maximum values of different structural quantities in a statically determinate structure, like BM, SF and displacement. 5. Compute reactive forces in the two hinged and three hinged arches using Conventional Methods of analysis of structures. 6. Evaluate the plastic behaviour of structural system based on the plastic theory

Topics Covered

UNIT-I	9
Indeterminacy: static and Kinematic, Analysis of Indeterminate structures: Analysis of fixed beams, Continuous beams, and simple frames with and without translation of joint, Method of Consistent Deformation, Slope-Deflection method, Moment Distribution method, Strain Energy method.	
UNIT-II	9
Moving loads for determinate beams: Different load cases, Influence lines for forces for determinate beams; Influence lines for indeterminate beams using Muller Breslau principle. Absolute maximum bending moment.	
UNIT-III	9
Analysis of Arches, Linear arch, Eddy‟s theorem, three hinged parabolic and circular arch, two hinged arch, spandrel braced arch, Influence lines for Arches and stiffening girders, Influence line diagrams for maximum bending moment, Shear force and thrust.	
UNIT-IV	9
Basics of Plastic Analysis, Plastic moment of resistance, Plastic section modulus, Shape factor, Load factor, Plastic hinge and mechanism, Plastic analysis of indeterminate beams and frames – Upper and lower bound theorems.	

Textbooks

1. Theory and Analysis of Structures, Vol. I & II - O. P. Jain & B. K. Jain, Nem Chand & Bros., Roorkee.
2. Wang, C.K., Intermediate Structural Analysis, McGraw Hill.
3. Analyse Devadas Menon, “Structural Analysis”, Narosa Publishing House, 2008.
4. Hibbeler, R.C., Structural Analysis, 7th ed. East Rutherford, NJ: Pearson Prentice Hall, 2008.

Reference Books

1. Theory of Structures - S. P. Timoshenko and D. Young, McGraw Hill Book Publishing Company Ltd., New Delhi
2. Reddy. C.S., "Basic Structural Analysis", Tata McGraw Hill Education Pvt. Ltd., New Delhi, 2013.
3. Introduction to Matrix Methods of Structural Analysis by H. C. Martin, McGraw Hill Book Publishing Company Ltd.
4. Matrix Analysis of Framed Structures - Weaver and Gere.
5. Theory of Structures Vol. II - Vazirani & Ratwani. 4. Influence Line Diagrams - Dhavilkar.
6. Analysis of Statically Indeterminate Structures - P. Dayaratnam, Affiliated East- West Press.
7. Norris, C.H., Wilbur, J.B., and Utku, S., Elementary Structural Analysis, TMH,2003,1983

BCE-253	**ADVANCED SURVEYING**	
Course category	:	Program link basic science and engineering courses (PLBSE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3,Tutorial:0, Practical:2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance home assignments, quizzes, practical work, record, viva voce and two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The main objectives of the course are: • To make students aware with different advance surveying methodologies applied to carry out large scale survey works using modern techniques such as total stations, photogrammetry remote sensing etc. • To make students able to set out curves, buildings, and culverts for construction projects.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. To understand the method of triangulation and the concept of photogrammetry and photo interpretation 2. To learn on the principles of Electronic distance measurements, Total station and their accuracy 3. To analyse the precision and accuracy of observations and least square adjustment of triangle and quadrilateral without central station. 4. To compute and set different types of curves. 5. To be aware of modern advanced surveying techniques such as Remote sensing, GPS and GIS 6. Students learn to work with others, respect the contributions of others, resolve difficulties, andunderstand responsibility

Topics Covered	
UNIT-I	9
Triangulation, different networks, orders and accuracies, inter visibility and height of stations, signals and towers, Baseline measurement, instruments and accessories, extension of baseline, satellite stations, Reduction to centre. Method of observation equations – conditioned quantities, method of correlates, adjustment of simple triangle and quadrilateral network without central station . Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Distomat, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, Field Procedure for total station survey, Errors in Total Station Survey; Trilateration.	
UNIT-II	9
Curve setting – Horizontal curves - Elements and Methods of setting out simple, compound and Reverse curves, Transition curve (true spiral, cubic spiral and cubic parabola), Vertical curve (parabola). Setting out of buildings – culverts – tunnels	
UNIT-III	9
Photogrammetry – Terrestrial and Aerial Photogrammetry, Geometry and scale of vertical photographs, relief and tilt displacement, Stereoscopy and elevation of a point – Flight Planning for vertical photographs– Planimetric mapping from vertical photos — Fundamentals of aerial photo interpretation, mosaics, map substitutes.	
UNIT-IV	9
Global Positioning Systems- Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. **Remote Sensing**- Introduction – Remote sensing concepts, Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation; digital image processing. **Geographic Information System**- Basic concepts of geographic data, GIS and its components, Data models, Topology, Process in GIS: Data capture, data sources, data encoding, geospatial analysis, GIS Applications	
Experiments 1. Demonstration and working on Total Station 2. To layout a precise traverse in a given area and to compute the adjusted coordinates of survey stations 3. Aerial Photo interpretation 4. Demonstration and working with Mirror stereoscopes, Parallax bar and Aerial photographs. 5. Visual Interpretation using false colour composite 6. Demonstration and practice work with handheld GPS	
Textbooks 1. K.R. Arora, “Surveying” , Vol. I & II Standard Book House, Delhi, 2. B.C Punmia, “Surveying”, Vol. I, II & III Laxmi Publications New Delhi, 3. S.K. Duggal., Surveying Vol. I & II Tata McGraw Hill 4. A.M. Chandra., “Plane Surveying”, New Age International Publishers, Delhi 5. R. Subramanian Surveying and Levelling Oxford University Press **Reference books** 1. W. Schofield Engineering Surveying Elsevier 2. Charles D Ghilani and Paul R Wolf Elementary Surveying Pearson	

BCE-254		CONCRETE & CONCRETE STRUCTURES
Course category	:	Program Core (DC)
Pre-requisite Subject	:	BCE-204
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce Two Minor tests and One Major Theory and Practical Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
Course Outcomes	:	1. Able to test all the concrete materials as per IS code design the concrete mix using IS code method. 2. Able to determine the properties of fresh and hardened of concrete design special concretes and their specific applications ensure quality control while testing/ sampling and acceptance criteria. 3. Understand limit state design philosophy. 4. Understand the behavior of beam under flexure and shear. 5. Able to design beams using limit state method. 6. Able to design one way slab using limit state method.

Topics Covered

UNIT-I	9

Constituent of concrete, grade of concrete, manufacturing of concrete, importance of water cement ratio, properties of fresh concrete workability, factor affecting workability, consistency, cohesiveness, bleeding, segregation Properties of hard concrete, compressive, tensile and flexure strength, modulus of elasticity, shrinkage and creep.

UNIT-II	9

Mix design for compressive strength by various methods, mix design for flexural strength, Admixtures used in cement concrete. Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams.

UNIT-III	9

Behavior of RC beams in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement. Introduction to development length, Anchorage bond, flexural bond, Failure of beam under shear.

UNIT-IV	9

Design of one way and two-way slabs. Serviceability Limit States, Control of deflection, cracking and vibrations. Design of Columns by Limit State Design Method. Effective height of columns, Minimum eccentricity, column under axial compression, requirements for reinforcement, Column with helical reinforcement.

LIST OF EXPERIMENTS

1. Compressive Strength of Concrete.
2. Workability by Compaction Factor, Slump Test.
3. Determination of Constituents of Hardened Mortar.
4. Mix Design by IS Code Method

Text/Reference Books

1. Nilson, A. H. Design of Concrete Structures. 13th edition. McGraw Hill, 2004
2. Wang C-K. and Salmon, C. G., Reinforced Concrete Design, 6th Edition, AddisonWesley, New York
3. Fundamentals of Reinforced Concrete by M L Gambhir, PHI
4. IS:456-2000 , IS:10262-2009
5. Concrete Structure – Limit State Design by A.K. Jain, Nem Chand & Bros
6. Reinforced Concrete Design by S. Unnikrishna Pillai & D. Menon, Tata McGraw

BCE-255		**ENVIRONMENTAL ENGINEERING-I**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and two minor tests and one major theory & practical examination.
Course Objectives	:	This course aims to provide the basics of environmental engineering practices in areas such as water pollution, air pollution, water resources, or related fields.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course: 1. Discuss water demand, sources of water and intake structures. 2. Understand transmission of water. 3. Basics about various types of conduits, laying and testing of water supply pipelines and related issues. 4. Describe storage and distribution of water, design of water distribution system and plumbingsystems in buildings. 5. Design the systems of sanitation and wastewater collection. 6. Estimate wastewater flows and variations.

Topics Covered

UNIT-I	**9**

Water supply: Water demands and domestic use, variation in demands; population forecasting by various methods using logistic curve method; per capita supply, basic needs and factors affecting consumption; design period.

Sources of water: Kinds of water sources and their characteristics, collection of surface and ground water; factors governing the selection of a source of water supply; intakes and their design for lakes, streams and rivers.

UNIT-II	**9**

Transmission of water: Various types of conduits, capacity and sizes including economical sizes of rising main, structural requirements; laying and testing of water supply pipelines; pipe materials, joints, appurtenances, and valves; leakages and control.

UNIT-III	**9**

Storage and distribution of water: Methods of distribution, pressure and gravity distribution systems, concept of service and balancing reservoirs, capacity of distribution reservoirs; general design guidelines for distribution system, Hardy - Cross method, Equivalent pipe method of pipe network analysis.

Water supply, plumbing systems in buildings and houses: water connections, different cocks and pipe fittings.

UNIT-IV	**9**

Wastewater collection: Systems of sanitation and wastewater collection, estimation of wastewater flows and variations in wastewater flows. Storm water: Collection and estimation of storm water by different formulae.

Flow in sewers: Flow in full and partially full sewers and design of sewers; types of sewers, materials and construction of sewers, joints and sewer appurtenances, layout and construction of sewer lines; small bore sewer systems. Planning of sewerage systems.

Environmental Engineering Lab: Experiments

1. Determination of turbidity, colour, and conductivity.
2. Determination of pH, alkalinity and acidity.
3. Determination of hardness and chlorides.
4. Determination of dissolved oxygen.
5. Determination of most probable number of coliforms.
6. Measurement of air pollutants with high volume sampler.
7. Measurement of sound level with sound level meter.
8. Determination of BOD of sample.
9. Determination of COD of sample.

Textbooks

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering published by Tata McGraw-Hill Education.
2. Metcalf and Eddy Inc.: Wastewater Engineering, McGraw-Hill Series in Civil and *Environmental Engineering*
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I) Khanna Publishers.
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. II) Khanna Publishers.
5. Sawyer, McCarty and Parkin: Chemistry for Environmental Engineering, McGraw-Hill Series in Civil and *Environmental Engineering*
6. Mathur: Water and Wastewater Testing. Laboratory Manual, Nem Chand & Bros, 1982.

Reference books

1. Manual on Water Supply and Treatment, C.P.H.E.E.O., Ministry of Housing and Urban Affairs, Goverment of India
2. Manual on Sewerage and Sewage Treatment, C.P.H.E.E.O., Ministry of Housing and Urban Affairs, Goverment of India
3. Steel and McGhee: Water Supply and Sewerage, McGraw-Hill Kogakusha, Ltd.
4. Fair and Geyer: Water Supply and Wastewater Disposal, Wiley eBook.
5. Standard Methods for the Examination of Water and Wastewater, A. P. H. A., New York. Copyright 1999 by American Public Health Association, American Water Works Association, Water Environment Federation
6. W. H. O.: Selected Methods of Measuring Air Pollutants, WHO Geneva 1976.
7. Cunniff: Environmental Noise Pollution. John Wiley & Sons Inc.

Semester-V

BHM-301	INDUSTRIAL MANAGEMENT	
Course category	:	HMSD
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 2, Tutorial: 0, Practical: 0
Number of Credits	:	2
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes Two Minor tests, and One Major Theory Examination.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Students will become efficient and acquire acumen for more profitable business practices. 2. Able to understand concept of plant location and layout 3. Students will understand the importance of better customer service and product quality. 4. Able to make work safer, faster, easier, and more rewarding. 5. Able to help the industry in the production of more products that possess all utility factors. 6. Reducing costs associated with new technologies.

UNIT-I	6
Introduction of Modern Management: Definition, Nature and Scope of Management, Process of Management, Elements of Management, Definition of Industrial Management, Scope and Application of Industrial Management. **Plant Location and Layout**: Factors affecting Plant Location, Objectives and Principles of Plant Layout, Types of Plant-Layout	
UNIT-II	6
Work Analysis and Measurement: Design of work Study, Steps involved in Work-study process, Definition and Concept of Method study, Procedure involved in Method Study, Objectives and techniques of Work Measurement, Work-sampling and its application, Selection of Personnel and wage payment plans.	
UNIT-III	6
Organizational Structures: Types of organizations, Functions, and objectives of industrial organizations, Ownership of Industries; Proprietorship, Partnership, Joint-stock companies, Public and Private undertakings, Co-operative organizations. Sources of finance, Types of Bank accounts.	
UNIT-IV	6
Material Management: Meaning of Inventory management, Economic Order Quantity (EOQ) Model, ABC analysis, Just-in-time (JIT), Minimum Safety Stock **Industrial Safety:** Occupational safety, safety programs; Safety aspects in work system design,	

Books & References

1. P. Crowson. Economics for Managers, Macmillan, London.
2. J. Russell (Joseph Russell) Smith, "The Elements of Industrial Management", Hard Press
3. Rieske, David W., Asfahl and C. Ray, "Industrial Safety and Health Management", 6th Ed., Prentice Hall Professional Technical Ref.
4. Gavriel Salvendy, "Handbook of Industrial Engineering: Technology and Operations Management", John Wiley & Sons, Inc.
5. Herman B. Henderson, Albert E. Haas, "Industrial Organization and Management Fundamentals",

Industrial Press, The University of California.

BCE-301		GEOTECHNICAL ENGINEERING - I
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 2
Number of Credits	:	5
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The objectives of the course are as follows: 1. To develop an appreciation of soil as a vital construction material, so that it may subsequently be used in the design and construction of foundation for civil engineering structures. 2.To develop an understanding of the relationships between physical characteristics and mechanical properties of soils. 3.To inculcate the basic knowledge of classification and engineering properties of soil and its suitability as a foundation/subgrade material. 4. To understand the experimental methods for physical and mechanical soil properties
Course Outcomes	:	After completion of this course the students to demonstrate following knowledge, skills and attitudes. 1. Fundamental differences in engineering behavior between cohesive and cohesionless soils. 2. Compute the groundwater seepage and distribution of ground water pressure. 3. Compute the applied stress beneath the ground surface. 4. Demonstrate the fundamental difference in the strength and deformation characteristics of cohesive and cohesionless soils. 5. Analyze field and laboratory data to determine the strength and deformation properties of cohesive and cohesionless soils. 6. Compute settlements due to consolidation of soil.

Topics Covered	
UNIT-I	9
Geotechnical field problems in Civil Engineering, Soil formation, transport and deposit, Soil composition, Basic definitions, Clay minerals, Index properties, Particle size analysis, Soil classification.	
UNIT-II	9
Soil-water systems, capillarity-flow, Darcy's law, permeability, field and lab tests, piping, quick sand condition, seepage, flow nets, flow through dams, filters. Soil compaction, water content – dry unit weight relationships, field compaction control, Proctor needle method. Standard and modified proctor test.	

UNIT-III	9
Effective stress principle, Stresses due to applied loads, Boussinesq and Westergaard equations, Compressibility and consolidation characteristics, Rate of consolidation, Terzaghi's one dimensional theory of consolidation and its applications, Over Consolidation Ratio, determination of coefficient of consolidation and secondary consolidation (creep).	
UNIT-IV	9
Shear strength - direct & triaxial shear tests, Mohr – Coulomb strength criterion, drained, consolidated, undrained and unconsolidated tests, strength of loose and dense sands, Normally Consolidated and Over Consolidated soils, dilation, pore pressure, Skempton"s coefficient. Stability of slopes with or without pore pressure, limit equilibrium methods, methods of slices and simplified Bishop method, factor of safety.	
Geotechnical Engineering Lab Experiments 1. Sieve Analysis 2.Hydrometer Analysis 3.Specific Gravity 4.Liquid & Plastic Limit Tests 5.Shrinkage Limit Test 6.Proctor Compaction Test 7.Relative Density 8.In Situ Density – Core cutter & Sand Replacement 9. Permeability Test- Falling Head & Constant Head	
Textbooks 1. Alam Singh – Modern Geotechnical Engineering, Asia Publishing House, New, Delhi 2. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age Intl (P) Ltd. **ReferenceBooks** 1.Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning 2.I.H. Khan – Text Book of Geotechnical Engineering. Prentice-Hall of India Ltd., New Delhi 3. C. Venkataramaiah – Geotechnical Engineering, New Age Intl(P) Ltd., New Delhi 4. Shashi Gulati &Manoj Datta – Geotechnical Engineering, Tata McGraw Hill, New Delhi 5. J. E. Bowles- Foundation Analysis & Design, McGraw Hills, New Delhi 6. K. R. Arora – Soil Mechanics & Foundation Engg. Standard Publishers & Distributors, Delhi 7. V.N.S. Murthy – Soil Mechanics and Foundation Engineering, C B S Publication	

BCE-302	**Transportation Engineering-I**	
Course category	**:**	Program Core (PC)
Pre-requisite Subject	**:**	NIL
Contact hours/week	**:**	Lecture:3, Tutorial: 0, Practical:2
Number of Credits	**:**	4
Course Assessment methods	**:**	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	**:**	1. To introduce the students with the principles and practice of transportation engineering which focuses on Traffic and Transportation Engineering and Highway Engineering. 2. To enable the students to have a strong analytical and practical

		knowledge of Planning, Designing, and solving the transportation problems. 3. To introduce the recent advancements in the field of Sustainable Urban Development, Traffic Engineering and Management, Systems Dynamics Approach to Transport Planning, Highway Design and Construction, Economic and Environment Evaluation of Transport Projects. 4. To strength the students' knowledge and technical know-how to be efficient Transport Engineers.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understanding the types of pavements and their components. 2. Materials used for highway construction. 3. Methods of design of flexible and rigid pavement including IRC method. 4. Construction and maintenance of different types of pavements 5. Basic concept about highway engineering 6. Various types of intersection and their suitability.

Topics Covered

UNIT-I	9

Introduction: Role of transportation, Mode of transportation, History of road development, Nagpur Road plan, Bombay Road plan & 3rd 20-Year-Old Road Plan, Road Types and Pattern. Geometric design: cross-sectional elements, camber, shoulder, sight distance, horizontal curves, super elevation, extra widening, transition curves and gradient, vehicle curves, summit, and valley curves

UNIT-II	9

Traffic Engineering: Traffic characteristic, volume studies, speed study, capacity, density, traffic control devices, signs, signals, design of signals, Island, Intersection at grade and grade separated intersections, design of rotary intersection.

UNIT-III	9

Design of Highway Pavement: Types of pavements, Design factors, Design of flexible pavements by CBR method (IRC: 37-2001, 2012 and 2018), Design of rigid pavement, Westergaard theory, load and temperature stresses, joints, IRC method of rigid pavement design. (IRC 58-2002, 2011 and 2015).

UNIT-IV	9

Road Construction Methods: WBM, WMM, Surface Dressing, Bituminous carpeting, Bituminous Bound Macadam and Asphaltic Concrete, Cement Concrete Road construction.

List of EXPERIMENTS

1. Impact value test of Aggregate
2. Shape test (Flakiness, Index, Elongation Index) of Aggregate
3. Crushing value test of Aggregates
4. Los Angeles Abrasion Value test for Aggregate

5. Stripping test of Bituminous Sample.
6. Ductility test of Bituminous Sample
7. Penetration test of Bituminous Sample
8. Softening point test of Bituminous sample
9. Flash and Fire Test of Bituminous Sample
10. Classified Both directional Traffic Volume study
11. Traffic speed study (using radar speedometer).
12. Determination of Marshall Stability Value
13. CBT Test for soil
14. Proctor Test for soil

Textbooks

1. Highway Engineering by S. K. Khanna and C.E.G. Justo, Nem Chand & brothers, Roorkee.
2. Traffic Engineering by L. R. Kadiyali, Khanna Publishers, New Delhi.
3. Principles of Transportation and Highway Engineering by G.V. Rao, Tata McGraw Hill, New Delhi.
4. Highway and Traffic Engineering by Subhash C. Saxena, CSB Publishers and Distributers Ltd. New Delhi.

Reference books

1. Transportation Engineering by James S. Banks Tata McGraw Hill, New Delhi.
2. Transportation Engg. by Papakosta and P.D. Prevedouros, Prentice Hall India, New Delhi.
3. Principles of Transportation Engineering by P. Chakraborti and A. Das, Prentice Hall India, New Delhi.
4. Highway Material Testing S.K. Khanna and C.E.G. Justo. 5. Highway Material Testing by A.K. Duggal.

BCE-303		**Design of Concrete Structures**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Engineering Geology & Building Material (BCE-152)
Contact hours/week	:	Lecture: 3, Tutorial: 0, Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	To introduce the students to the fundamentals of reinforced concrete design with emphasis on the design of rectangular and T beams, short and slender columns, slabs, and footings and foundations. In addition, student will learn how to analyze and design reinforced concrete structural members under bending, shear, and/or axial loads according to the IS code requirements.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, sand attitudes after completing this course 1. Understand various philosophies for design of reinforced

		concrete. 2. Design one way and two-way slab by limit state method. 3. Understand the provisions of IS 456:2000 for design of R.C.C. Columns with and without eccentricity. 4. To use Design Chart for design of columns subjected to uni-axial biaxial bending 5. Know the method of pre-stressing, their advantages, and losses in pre-stress. 6. Able to analyses pre-stressed rectangular and T-section.

Topics Covered

UNIT-I	9

Nature of Stresses in flat slabs with and without drops, coefficient for design of flat slabs, reinforcement in flat slabs. (IS Code Method). Structural behaviour of footings, design of footing for a wall and a single column, combined rectangular and trapezoidal footings, Design of strap footing.

UNIT-II	9

Structural behaviour of retaining wall, stability of retaining wall against overturning and sliding, Design of T-shaped retaining wall, Concept of Counter fort retaining wall. Loads, forces and I.R.C. bridge loadings, Design of R.C. slab culvert.

UNIT-III	9

Design criteria, material specifications and permissible stresses for tanks, design concept of circular and rectangular tanks situated on the ground / underground, design of overhead tanks.

UNIT-IV	9

Advantages of pre-stressing, methods of pre-stressing, losses in pre-stress, analysis of simple prestressed rectangular and T-section

LIST OF EXPERIMENTS

1. Comparison of strength of cylinder and cube strength of concrete.
2. Modulus of rupture of concrete.
3. Study of admixtures and their effect on workability.
4. Study of effect of w/c ratio on strength of concrete.
5. Study of variation of strength of cement concrete and determination of standard deviation and gradation of concrete.
6. Study and draw compression test diagram of concrete.
7. To determine quality/ strength of concrete by using Rebound hammer/ Ultrasonic pulse velocity instruments

Textbooks and References

1. Nilson, A. H. Design of Concrete Structures. 13th edition. McGraw Hill, 2004
2. Wang C-K. and Salmon, C. G., Reinforced Concrete Design, 6th Edition, Addison Wesley, New York
3. Fundamentals of Reinforced Concrete by M L Gambhir, PHI 4. IS:456-2000, IS:10262-2009
4. Concrete Structure – Limit State Design by A.K. Jain, Nem Chand & Bros
5. Reinforced Concrete Design by S. Unnikrishna Pillai & D. Menon, Tata McGraw.

BCE-304	**ENVIRONMENTAL ENGINEERING-II**

Course category	:	Program link basic science and engineering courses (PLBSE)
Pre-requisite Subject	:	Environmental Engineering-I (BCE-255)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce and two minor tests and one major theory examination.
Course Objectives	:	To provide a coherent development to the students for the courses in sector of engineering like Wastewater treatment, solid Waste Management, house drainage etc. To analyse the Wastewater sources and wastewater characteristics and various wastewater treatment process.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course: 1. Discuss beneficial uses of water, quality requirements and standards. 2. Understand water borne diseases and their prevention and control. 3. Awareness of water and wastewater treatment, unit operations and processes and flowsheets. 4. Practical knowledge settling phenomena, coagulation, and flocculation. 5. Design criteria of primary and secondary settling tanks, flocculators and clariflocculators. 6. Theory of filtration and various types of filters, disinfection process and water softening along with dosing requirements.

Topics Covered

UNIT-I	9

Introduction: Beneficial uses of water and quality requirements, standards. Concepts of water and wastewater quality: physical, chemical and bacteriological examination of water and wastewater. Water borne diseases and their control.

Wastewater characteristics: Temperature, pH, colour and odour, solids, nitrogen and phosphorus, chlorides, toxic metals and compounds, BOD, COD etc.

Objectives of treatment: Water and wastewater treatment, unit operations and processes and flowsheets.

Sedimentation: Determination of settling velocity, efficiency of ideal sedimentation tank, short circuiting; different classes of settling; design of primary and secondary settling tanks.

UNIT-II	9

Calculating removal efficiency for discrete and flocculent settling. Coagulation: Mechanisms of coagulation, coagulants and their reactions, coagulant aids; design of flocculators and clariflocculators.

Filtration: Theory of filtration; hydraulics of filtration; Carmen - Kozeny and other equations; slow sand, rapid sand and pressure filters, backwashing; brief introduction to other filters; design of filters.

Disinfection: Requirements of an ideal disinfectant; kinetics of disinfection, various disinfectants, chlorination and practices of chlorination. Water softening and ion exchange: calculation of dose of chemicals. Adsorption.

UNIT-III	9

Wastewater Treatment: Preliminary, primary, secondary and tertiary treatment processes.

Primary Treatment: Screens, grit chamber and their design, sedimentation and chemical treatment to be given.

Secondary Treatment: Theory of organic matter removal; activated sludge process, design of different units and modifications, extended aeration systems; trickling filters; aerated lagoons, waste stabilization ponds, oxidation ditches, R.B. C. etc.	
UNIT-IV	9
Anaerobic digestion of sludge: Design of low and high-rate anaerobic digesters and septic tank. Basic concept of anaerobic contact process, anaerobic filter, anaerobic fixed film reactor, fluidized bed and expanded bed reactors and up-flow anaerobic sludge blanket (UASB) reactor. Disposal of wastewater on land and in water bodies. Introduction to Duckweed pond, vermiculture and root zone technologies and other emerging technologies for wastewater treatment.	

Textbooks

1. Peavy, Rowe and Tchobanoglous: Environmental Engineering published by Tata McGraw-Hill Education.
2. Metcalf and Eddy Inc.: Wastewater Engineering, McGraw-Hill Series in Civil and *Environmental Engineering*
3. Garg: Water Supply Engineering (Environmental Engineering Vol. – I) Khanna Publishers.
4. Garg: Sewage Disposal and Air Pollution Engineering (Environmental Engineering Vol. II) Khanna Publishers.

Reference books

1. Manual on Water Supply and Treatment, C.P.H.E.E.O., Ministry of Housing and Urban Affairs, Government of India
2. Manual on Sewerage and Sewage Treatment, C.P.H.E.E.O., Ministry of Housing and Urban Affairs, Government of India
3. Steel and McGhee: Water Supply and Sewerage, McGraw-Hill Kogakusha, Ltd.
4. Fair and Geyer: Water Supply and Wastewater Disposal, Wiley eBook.
5. Arceivala: Wastewater Treatment for Pollution Control, McGraw Hill Education; 3rd edition
6. Hammer and Hammer Jr.: Water and Wastewater Technology, Pearson Ed Asia; 5th edition
7. Raju: Water Supply and Wastewater Engineering, McGraw Hill Education India Pvt Ltd
8. Sincero and Sincero: Environmental Engineering: A Design Approach, Prentice Hall; Har/Dskt edition.
9. Pandey and Carney: Environmental Engineering, McGraw Hill Education.
10. Rao: Textbook of Environmental Engineering, Prentice Hall India Learning Private Limited.
11. Davis and Cornwell: Introduction to Environmental Engineering, McGraw-Hill Inc.,US; 2nd edition.
12. Punmia: Water Supply and Wastewater Engineering Vol. I and II, Laxmi Publications Pvt Ltd; 2nd edition.
13. Birdie: Water Supply and Sanitary Engineering, Dhanpat Rai Publishing Company (p) Ltd
14. Ramalho: Introduction to Wastewater Treatment Processes, Academic Press.
15. Parker: Wastewater Systems Engineering, Prentice Hall
16. Mara: Sewage Treatment in Hot climates, London-New York-Sydney-Toronto: John Wiley & Sons 1976.

Semester-VI

BHM-351		**ENGINEERING AND MANAGERIAL ECONOMICS**
Course category	:	HMSD
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 2, Tutorial : 0, Practical: 0

Number of Credits	:	2
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes and Two Minor tests and One Major TheoryExamination.
Course Objective	:	1. To make fundamentally strong base for decision making skills by applying the concepts of economics. 2. Educate the students on how to systematically evaluate the various cost elements of a typical manufactured product or service, with a view to determining the price offer. 3. Prepare engineering students to analyse profit/revenue data and carry out make economic analysis in the decision-making process to justify or reject alternatives/projects. 4. Be equipped with the tools necessary in forecasting product demand. 5. Understand and analyse the macro environment affecting the business decision making. 6. To make students understand basic elements of Indian Economy.
Course Outcomes		The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Students will acquire basic knowledge in Engineering Economics, which allows students to gain theoretical and empirical skill of Economics. 2. To develop the basic understanding of Microeconomics and Macroeconomics and its application to decision making and Managerial Economics. 3. Become acquainted with basic economic concepts such as demand and supply and Elasticity of Demand. 4. To develop a significant understanding of various concepts of cost. 5. To develop the ability to understand the various kinds of market structure. 6. To develop the ability to acquire the knowledge of National Income and its measurement.

UNIT-I	6
Introduction to the Managerial Economics- Economics and Managerial economics, Review of Economic Terms and Economic Rationality, Law of diminishing marginal utility, Theories of Profit, Decision making Process with reference to Managerial economics, Managerial Economics and its application in engineering perspective.	
UNIT-II	6
Theory of Demand: Law of Demand, Demand Function, Types of Demand, Demand Schedule, Demand Curve, Shift in Demand Curve, Factors affecting Demand, Elasticity of Demand, Theory of consumer behaviour **Demand Forecasting:** Qualitative and Quantitative Techniques of forecasting.	
UNIT-III	6
Theory of Supply: Law of Supply, Supply Function, Supply Schedule, Supply Curve, Factors, affecting Supply. **Types of cost:** fixed cost, variable cost, average cost, marginal cost, opportunity cost, Economies of scale.	

UNIT-IV	**6**
Market Structure: Perfect Competition, Imperfect competition – Monopolistic, Oligopoly, Monopoly, Meaning of Inflation, Types o Inflation, Causes of inflation, Deflation, Business cycle.	
Books & References 1. Mote, Paul and Gupta, Managerial Economics, T M H, New Delhi. 2. H L Ahuja, Managerial Economics, S Chand & Co. New Delhi 3. P.L. Mehta, Managerial Economics, Analysis, Problems and Cases, Sultan Chand Sons, NewDelhi. 4. Prof. D.N. Kakkar , Managerial Economics for Engineering, PHI publication, New Delhi 5. Varshney and Maheshwari, Managerial Economics, Sultan Chand and Sons, New Delhi.	

BCE-351	**GEOTECHNICAL ENGINEERING - II**	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Geotechnical Engineering-I (BCE-301)
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 2
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through attendance, home assignments, quizzes, practical work, record, viva voce and two Minor tests and One Major Theory & Practical Examination
Course Objectives	:	The objectives of the course are as follows: 1. To introduce the theory and application for analysis and design of earth retaining structures, slope stability analysis, shallow and deep foundations and machine foundations. 2. To understanding the behavior and design of rigid, flexible walls and pile foundations of the structures subjected to static and dynamic loads. 3. To develop an understanding to perform site investigations and to determine the soil parameters needed to carry out foundation design. 4. To learn the subsurface exploration techniques and apply them to design the foundations and retaining walls. 5. To enable students to prepare professional reports for design projects and data presentation skill
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Good scientific details of site investigations and in-situ tests 2. Practical knowledge of sub soil investigation report 3. The earth pressure theories and Coloumb and Rankine approaches for soils 4. Knowledge of retaining structures 5. The basic and deep knowledge about foundations and bearing

		capacity determination of soil 6. The basic knowledge of pile foundation, their design and construction

Topics Covered

UNIT-I	9

Review of principles of soil mechanics. site investigations, methods of drilling, sampling, *in-situ* test, SPT, CPT, DCPT, Pressure meter test, geophysical exploration, Components of Sub-soil investigation report.

UNIT-II	9

Lateral Earth Pressure: Active, passive and earth pressure at rest. Rankine, Coulomb, Terzaghi theory and Culmann's graphical method. Analytical and graphical methods of determination of earth pressures on cosion-less and cohesive soils. Effect of surcharge, water table and wall friction. Arching in soils. Reinforced earth retaining walls.

UNIT-III	9

Types of foundations–shallow, deep, isolated, combined, mat, etc., Definitions, Bearing capacity Of shallow foundations (Terzaghi and I.S. Code method), general, local and punching shear failures, corrections for size, shape, depth, water table, Bearing capacity by consolidation method, in-situ bearing capacity determination, Provisions of IS code of practice, eccentrically loaded footings.

UNIT-IV	9

Classifications of piles, load capacity of single pile in clay, silt and sand by static and dynamic formula methods. Pile groups, under-reamed piles – their design and construction, negative skin friction, pile load test, Well foundations – various parts, Scour Depth, Grip length, forces acting on well.

Geotechnical Engineering Lab Experiments

1. Direct Shear Test
2. Unconfined compression test
3. Vane Shear Test
4. Consolidation Test
5. Standard Penetration Test
6. Static Cone Penetration Test
7. Dynamic Cone Penetration Test.
8. CBR Test
9. Model Pile load Test
10. Visit to sub-surface exploration site.
11. Study of Tri-axial Shear Test

Textbooks

1. Singh, A – Modern Geotechnical Engineering, CBS Publishers and Distributors Pvt. Ltd; Third Edition
2. Ranjan, G and. Rao, A.S.R – Basic and Applied Soil Mechanics, New Age International (P) Limited

Reference Books

1. Ventatramaiah, C. "Geotechnical Engineering" , New Age International Ltd.
2. Poulos, H.G. and Davis E.H. "Pile Foundation Analysis and Design". Wiley.
3. Purushottam Raj "Geotechnical Engineering", Tata McGrawHill.
4. S.K. Gulhati and Manoj Dutta "Geotechnical Engineering", Tata McGrawHill
5. Bowles J.E. "Foundation Analysis and Design", 5th Edition McGraw-Hill.

BCE-352	Transportation Engineering-II	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial: 1, Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, and Two Minor tests and One Major Theory Examination.
Course Objectives	:	1. To explain Components of Railway Track, different Railway Gauges. 2. To design track Gradients as per given requirements. 3. To discuss various Types of Track Turnouts. 4. To describe purposes and facilities at Railway Stations. 5. To explain Interlocking and modern signal system. 6. To describe Surface Defects on Railway Track and Their Remedial Measures.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understand the knowledge of various systems of railway, airport, and water transportation. 2. Understand the components of railway tracks, components, and types of air crafts etc. 3. Understand the design concept of railway track, runway, taxiway. 4. Apply the concept of geometric design of railway, runway, taxiway, docks & harbours etc. 5. Apply the knowledge of various signaling system for railway engineering, air traffic control, navigational aids, etc. 6. Understand the concepts of air traffic control, navigational aids, etc.

Topics Covered

UNIT-I	9

Indian Railways: Development and organization of Indian Railways. Permanent way: Sub-grade formation, embankment and cutting, track damage. Rails: Rail gauges, types of rails, defects in rails, rail failure, creep of rail. Rail Fastenings: Fish plates, spikes, chairs, keys, bearing plates. Sleepers: Timber, steel, cast iron, concrete and prestressed concrete sleepers, manufacturing of concrete sleepers, sleeper density. Ballast: Ballast materials, size of ballast, screening of ballast, specification of ballast, tests on ballast.

UNIT-II	9

Railway Track Geometry: Gradients, horizontal curves, super elevation, safe speed on curves, can't deficiency, negative super elevation, compensation for curvature on gradients, track resistance and tractive power. Points and Crossings: Elements of simple turn-out, details of switch, details of crossings, number and angle of crossings, design of turn-out.

UNIT-III	9
Stations & Yards: Site section for a railway station, layout of different types of stations, classification of stations, types of railway yard, functioning of Marshalling yards. Signaling and Interlocking: Classification of signals, methods of train working, absolute block system, mechanical interlocking of two-line railway stations.	
UNIT-IV	9
Airport Engineering: Aircraft characteristics, types of airports, layout of airports, airport planning and design, runway orientation, wind-rose diagram, estimation of runway length and correction. Harbors, Layout and port facilities; inland waterways; inland water operation.	
Textbooks 1. A Textbook of Railway Engineering by S. P. Arora & S. C. Saxena. 2. Airport Planning and Design by S. K. Khanna, M. G. Arora **Reference books** 1. Railway Engineering - M.M. Aggarwal. 2. Railway Engineering - Vasvani. 3. Railway Engineering - B.L. Gupta and Amit Gupta.	

BCE-353		**WATER RESOURCES ENGINEERING**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Fluid Mechanics (BCE-205)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination
Course Objective	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understand the concept of hydrological cycle, mechanism of precipitation, evapotranspiration, and infiltration. 2. Measure and compute serial rainfall and intensity-duration curve. Estimate floods using rational, empirical unit hydrograph and flood frequency analysis. 3. Estimate water requirements of crops and storage capacity of reservoir. 4. Design of unlined channel of silt theories. 5. Different methods to determine suspended loads and bed load. 6. To know different River training methods.

Course Outcomes :	Understand the interaction among various processes in the hydrologic cycle. 1. Design of water management systems utilizing the basic principles of the hydrologic cycle. 2. Apply knowledge for efficient design methods for rapid conveyance of water with lesser loss inirrigation canals. 3. To demonstrate a knowledge of the multi-disciplinary nature of water resources engineering. 4. Realize the importance of optimal water use for growing the crops, and apply methods for saving land from water-logging. 5. To demonstrate technique involved in making design problems of canal and related structures tobe safe and cost-effective. 6. Apply the knowledge in the design of hydraulic structures to be constructed for conveyance of irrigation water.
Topics Covered	
UNIT-I	**9**
Introduction– Irrigation, water resources of India, need of irrigation in India, development of irrigation in India, impact of irrigation on human environment, irrigation systems: minor and major irrigation projects, command area development. **Hydrology**– hydrologic cycle, rainfall-runoff process, factors affecting runoff, runoff hydrograph, runoff computations, flood discharge calculations for ungauged and gauged sites, unit hydrograph method, S -hydrograph, different methods of flood forecasting.	
UNIT-II	**9**
Water requirement of crops: Crops and crop seasons in India, cropping pattern; Quality of irrigation water; Soil-water relationships- soil characteristics significant from irrigation considerations, root-zone soil water, infiltration, consumptive use, irrigation requirement, frequency of irrigation; duty and delta. Methods of applying water to the fields: surface, sub-surface, sprinkler, and trickle/drip irrigation types and its design and drawing.	
UNIT-III	**9**
Sediment Transportation: Suspended, Bed load and Total load and its estimation by Einstein, Van Rijn,Rottner, Bagnold, Engelund and Hansen, Yang, Karim & Kennedy, Ackers and White method. **Irrigation channels:** Sediment threshold and method of calculation, and design of lined and unlined channels. **Silt Theories:** Kennedy's, Lacey's, Tractive force Ackers and White and Engelund & Hansen method; Design procedure for irrigation channels, Longitudinal cross section, Schedule of area statistics and channel dimensions, use of Garret's Diagrams in channel design, cross sections of an Irrigation channel, Computer programs for design of channels, Lining of Irrigation Canals: Advantages and types, factors for selection of a particular type, design of lined channels, cross section of lined channels, Economics of canal lining. **Water- logging:** Definition, effects, causes and anti-water logging measures, Drainage of water-loggedland, Types of drains open and closed, spacing of closed drains.	
UNIT-IV	**9**
Irrigation Outlets: Requirements, types, non-modular, semi-module and rigid module, selection criterion. **River Training:** Objective and need, classification of rivers, and river training works, Lane Weight Balance Theory, meandering, stages, different methods of river training, design and drawing with field example problem as per IS code and IRC, bank protection, Methods for measurement of discharge.	

Textbooks

1. Irrigation Engg. and Hydraulic Structures -.K. Garg, Khanna Publishers.
2. Irrigation and water Power engineering - B.C. Punmia, Laxmi Publications.
3. Engineering Hydrology - K. Subramanya, TMH.
4. Irrigation Water Power and Water Resource Engg. - K.R. Arora.

Reference Books

1. Water Resources Engg. - Larry W. Mays, John Wiley India.
2. Water resources Engg. - Wurbs and James, John Wiley India.
3. Water Resources Engg. - R. K. Linsley, McGraw Hill.
4. Irrigation and water Resources Engg. - G L Asawa, New age International Publishers.
5. Irrigation Theory and practices - A.M. Michel.

Semester-VII

BCE-401		**EARTHQUAKE RESISTANT DESIGN**
Course category	:	Program Core (PC)
Pre-requisite Subject	:	Structural Mechanics-II (BCE-17)
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Two Minor tests and One Major Theory Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
Course Outcomes	:	1.To introduce nature and characteristics of various dynamics loads. 2.To have considerable knowledge of theory of vibrations including multi-degree of freedom systems. 3.To assess of structural failure due to earthquakes. 4.To analyze and design structures subjected to seismic loading as per IS codes. 5. To introduce ductile detailing of structures, concept of soft story and design of shear walls as per IS codes. 6. Understand the concept of base shear, natural time period and natural frequency.

Topics Covered

UNIT-I	9
Seismological background: Seismicity of a region, earthquake faults and waves, structure of earth, plate tectonics, elastic-rebound theory of earthquake, Richter scale, measurement of ground motion, seismogram	
UNIT-II	9
Definitions of basic problems in dynamics, static versus dynamic loads, different types of dynamic loads, un-damped and damped vibration of SDOF system, natural frequency, and periods of vibration, damping in structure, response to periodic loads, response to general dynamic load, response of structure subject to gravitational motion, lumped SDOF elastic systems, translational excitation.	

UNIT-III	9
Multi Degree of Freedom Systems Two degree and multi-degree freedom systems lumped MDOF elastic systems, translational excitation time history analysis, multistoried buildings with symmetric plans, multistoried buildings with unsymmetrical plans, combining maximum modal responses using mean square response of a single mode, SRSS and CQCC combination of modal responses. earthquake response spectra, factors influencing response spectra, design response spectra for elastic systems, peak ground acceleration, response spectrum shapes, deformation, pseudo-velocity, pseudo-acceleration response spectra, peak structural response from the response spectrum, response spectrum characteristics.	
UNIT-IV	9
Concepts of Earthquake Resistant Design of Reinforced Concrete Buildings – Earthquake and vibration effects on structure, identification of seismic damages in R.C. buildings, Effect of structural irregularities on the performance of R.C. buildings during earthquakes and seismo- resistant building architecture Seismic Analysis and Modelling of R.C. Buildings: I. S. code method of seismic analysis: seismic co-efficient method and its limitation, response spectrum method, IS: 1893 (Part 1)-2016. seismic design considerations, allowable ductility demand, ductility capacity, reinforcement detailing for members and joints as per IS 13920 - 2016, E.R.D. of R.C. building,	
Textbooks 1. Earthquake Resistant Design of Structures - P. Agarwal & M. Shrikhande 2. Structural Dynamics – Theory & Computation - Mario Paz 3. Dynamics of Structures Theory and Applications to Earthquake Engineering - Anil K. Chopra **Reference books** 1. Introduction to Structural Dynamics - J.M. Biggs 2. Elements of Earthquake Engineering - Jai Krishna and A.R. Chandrasekharan 3. Fundamental of Earthquake Engineering - N.M. Neumarks and E. Rosenblueth 4. Engineering Vibrations - L.S. Jacobsen & R.S. Ayre 5. Structural Dynamics - R. Roy Craig Jr. 6. Dynamics of Structures - R.W. Clough & J. Penjien	

BCE-402	**STEEL STRUCTURES**	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, Two Minor tests and One Major Theory Examination.
Course Objectives	:	1. Analysis and design of steel structure. 2. Design of bolted and welded connections. 3. Analysis and design of axially loaded tension member, axially loaded column, design of lacing and batten system, design of slab base foundation.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. To know the basic properties of steel and to understand the behaviour according to it. 2. To know the different steel structure analysis and design. 3. To know the design and analysis of angle sections, bolted & welded connection. 4. Design of steel structures according to IS-800-2007 by limit state method. 5. To understand concepts of strength and stiffness considerations. 6. Analyze, and design the riveted and bolted connections.

Topics Covered	
UNIT-I	9
Introduction to rolled steel sections, loads, factor of safety, permissible and working stresses. Riveted, welded and bolted connections, strength, efficiency and design of joints, Introduction to moment resistant connections.	
UNIT-II	9
Tension members – Net and Gross sectional areas, Strength of members and their design.	
UNIT-III	9
Compression members- Effective length, Slenderness ratio, Strength of Compression members, Design of Struts, Columns, Built-up Columns, Design of eccentrically loaded columns. Column Base: design of slab and Gusseted base.	
UNIT-IV	9
Introduction to Plastic analysis; Simple cases of beams and frames, Beams – web crippling and web buckling, design of laterally supported beam, design of laterally unsupported beam, Purlins, Design of Plate Girders conventional behavior, and tension field action.	
Textbooks: 1.Design of Steel Structures by N. Subramaniam, Oxford Publication 2.Design of Steel Structures by S. K. Duggal, Tata Mc-Graw-Hill Publishing Company **Reference books:** 1.Design of Steel Structures by A. S. Arya & J. L. Ajmani, Nem Chand & Bros.,Roorkee. 2. Design of Steel Structures by Gaylord & Gaylord. 3. IS : 800 –2007.	

BCE-403	**ANALYSIS AND DESIGN OF HYDRAULIC STRUCTURES**	
Course category	:	Program Core (PC)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory Examination.

Course Objective	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Design and selection of cross drainage works. 2. Planning and design of the section of dams, reservoir capacity and operations. 3. Analysis of weir and barrages. 4. River training works for weir/barrages. 5. Design of gravity and embankment dams. 6. Flood routing for reservoir capacity.
Course Outcomes		The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Use and integrate the fundamental and basic studies towards the goal of selecting, analysing, anddesigning of hydraulic structures. 2. Cope with decision-making and satisfy competing objectives. 3. Design, analyse and prove that the hydraulic structures are safe and economical. 4. Work in a team and learn successful group interaction for a project. 5. Deliver an oral presentation for the project. 6. Perform studies of various hydraulic structures such as weir/barrages and cross-drainage works.

Topics Covered

UNIT-I	**9**

Types of Headworks: Component parts of a diversion headwork, Failure of hydraulic structures founded on permeable foundations, principles of design; Bligh's theory, Khosla's theory for determination of pressure and exit gradient. Design and drawing of weir and barrages.
Regulation Works Falls, Classification, Introduction to design principle of falls, Design and drawing of Sarda type and straight glacis tall. Principle and design & drawing of Distributary head- regulator and cross-regulator, canal escape, Bed bars.

UNIT-II	**9**

Canal Headworks Functions, Location, Layout of headworks. Weir and Barrage, Canal head regulator, Introduction to the design principles of Weirs and barrages on permeable foundations, Design of vertical drop and sloping glacis weir and barrage.
Cross Drainage works Necessity and types. Aqueduct, Siphon Aqueduct, supper passage, canal siphon, level crossing, Introduction to design principles and design and drawing of cross-drainage works.

UNIT-III	**9**

Flood routing: Types, methods of reservoir routing, channel routing by Muskingham Method. Investigation and planning of dams and Reservoirs: Zones of storage, Estimation of storage capacity, Reservoir losses, Reservoir sedimentation, and its control, the life of a reservoir.
Dams: classification and selection criteria.
Earth Dams: Classification, causes of failure Phreatic line, and its determination Introduction to stability analysis.

UNIT-IV	**9**

Gravity dams: Forces method of analysis, modes of failure and factor of safety, Elementary profile,

stability analysis, galleries, joints, control of cracks.
Spillways: Spillway capacity, types of spillways, Design of ogee spillway, Energy dissipation below the spillway, Design criteria for Hydraulic Jump type stilling basins with horizontal and sloping aprons, designprinciples of different types of spillway gates.

Textbooks

1. Water Resources Engg. - Larry W Mays, John Wiley India
2. Water resources Engg. - Wurbs and James, John Wiley India
3. Water Resources Engg. - R.K. Linsley, McGraw Hill 29
4. Irrigation and Water Resources Engg. - G L Asawa, New age International Publishers

Reference Books

1. Irrigation Engg. And Hydraulic Structures - S. K. Garg, Khanna Publishers
2. Irrigation and Water Power Engineering- B. C. Punamia & Pande B.B. Lal

Programme Elective-1 (PE1)

BCE-326		**SOLID WASTE MANAGEMENT**
Course category	:	Program Elective-1 (PE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, viva voce and two minor tests and one major theory examination.
Course Objectives	:	To get on broader understandings on various aspects of solid waste management (starting from its generation to processing with options for reuse and recycle, transport, and disposal) practiced in different municipalities.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course: 1. Illustrate the waste generation in a technological society and analyze the waste generation trends. 2. Discuss the essential elements for solid waste management. 3. Propose a mathematical approach for handling waste on-site and off-site. 4. Calculate the efficiencies of each collection system. 5. Measure the actual volume of waste produced and reduced in terms of volume estimation. 6. Measurement the actual amount of energy that can be recovered from waste.

Topics Covered

UNIT-I	9

Solid waste: Public health and ecological impacts. Sources, types and composition of solid wastes,

Functional elements: Waste generation, storage collection, transfer and transport, processing, and recovery disposal

UNIT-II	9

Physical, chemical, and biological properties of solid waste integrated solid waste management, hierarchy of waste management options. Storage: movable bins, fixed bins. Collection: home to home collection, community bin system. Theory and design of hauled container system, stationary container system.

UNIT-III	9

Transportation: Layout of routes. Engineering system for on-site handling and processing of solid waste. Waste reduction and segregation equipment and methods.

Landfilling: Site selection criteria, landfill layout, landfill sections. Occurrence of gases and leachate landfills, control ofleachates and different phases.

Composting: Composting, types of composting, process description, design and operational consideration of aerobic and anaerobic composting.

UNIT-IV	9

Hazardous waste management: radioactive waste, Electronic waste, Bio-Medical Waste, technologies for their identification and disposal; Incineration and pyrolysis system, energy recovery system. Overview of Solid waste management practices in India.

Textbooks:

1. Tchobanoglous, G., Theisen, H. & Vigil, S.A; Integrated Solid Waste Management: McGraw Hill, New York

Reference books:

1. Tchobanoglous, G., Kreith, F; Handbook of solid waste management: McGraw Hill, New York
2. Solid Waste Engineering, Principle & Management issues by VenTe Chow.
3. Bhide, A.D., B.B. Sundaresan, Solid Waste Management in developing Countries. Published by Indian National Scientific Documentations Centre, New Delhi.
4. Manual on Municipal solid waste management, CPHEEO, Ministry of Housing and Urban Affairs, Government of India
5. Guidelines for Management and Handling of Hazardous wastes MOEF(1991), Govt. of India.
6. Datta, M; Waste Disposal in Engineered Landfills, Narosa Publishers, Delhi.

BCE-327		**ENVIRONMENTAL IMPACT ASSESSMENT**
Course category	:	Program Elective-1 (PE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4

Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor tests and one major theory examination.
Course Objectives	:	Identifying, predicting, and evaluating economic, environmental, and social impacts of development activities. Providing information on the environmental consequences for decision making.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course: 1. Discuss and illustrate the importance of EIA for various processes of decision making in various projects. 2. Categorize the different assessment methodology for various fields of concern air, water, noise, and wildlife. 3. Defend the different stages of EIS production. 4. Illustrate the difference among various case studies. 5. Figure out the Environmental Management plan to be adopted for various programmes. 6. To identify and explore impact assessment fields and approaches.

Topics Covered

UNIT-I	9

Environmental impact assessment, concept, Brief history of EIA, Significance of EIA, Role of EIA in planning and decision-making process, objective of EIA, Provisions of various environmental acts of India.

UNIT-II	9

Environmental assessment process, Assessment methodology, Socioeconomic impact assessment, Air quality impact analysis, Noise impact analysis, Water quality impact analysis, Vegetation and wild life impact analysis, Ecological impact assessment.

UNIT-III	9

Environmental Impact statement, Basic concept behind EIS, Stages in EIS production: Screening, scoping, prediction, evaluation, reducing impact, monitoring, conclusions, typical EIS outline. Recent case studies.

UNIT-IV	9

Environmental Management Plan, Preparation, implementation and review-Mitigation and rehabilitation plans-Policy and guideline for planning and monitoring programmes.
Post Audit-Ethical and Quality aspects of Environmental Impact Assessment.

Textbooks:

1. Environmental Impact Assessment: Harry W. Conter, McGraw Hill, New York.

Reference books:

1. Corporate Environmental Management: Welphort R, University Press
2. Environmental Impact Assessment: Canter L. W. McGraw Hill, New York
3. Environmental Impact Assessment: Handbook: John G. Rau and DC Wooren McGraw Hill,
4. EIA Notification-MOEF, Govt. of India 2014

BCE-328	**ROCK MECHANICS**	
Course category	:	Program Elective-1 (PE1)

Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor test/s and One Major Theory Examination
Course Objectives	:	The course objectives are given below: 1. Concepts of rock mass properties governed by deformation of rocks and development of discontinuity features. 2. Insight to presence of in-situ and forced stresses in rock mass, their measurement will be able to solve engineering problems. 3. Safe excavation techniques for construction of underground structures. 4. Knowledge of Ground conditions in tunnelling with special reference to rock mass.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course. 1. Identification of the different types of rocks. 2. Laboratory experiments to be done for the rock mass properties. 3. Index properties of rock and rock mass. 4. Determination of the strength of the rock by various failure criteria. 5. Stress-strain behaviour of a rock mass. 6. Foundations on weak rocks.

Topics Covered	
UNIT-I	9
Rock Formation: rock forming minerals, identification, geological classification of rock, geological structures, faults, folds, joints. Laboratory Testing of Rocks for the determination of physical properties, uniaxial compressive strength, tensile strength, oblique shear stress. Triaxial test, slake durability test, stress-strain responses of rocks.	
UNIT-II	9
Engineering Classification of Rocks & Rock Masses: Deere and Miller classification, rock quality designation, rock mass rating, rock mass quality, geological strength index and their applications. Strength Criteria for Rocks & Rock Mass: Mohr-Coulomb criterion, Hoek and Brown criterion, Barton's theory.	
UNIT-III	9
Tunneling: Ground conditions in tunneling, elastic analysis under uniaxial, biaxial and hydrostatic conditions, Concrete lining: elastic analysis, elasto-plastic analysis: Tresca criterion, rock mass-tunnel support interaction analysis, design of support system.	
UNIT-IV	9

Rock Slope Stability Analysis: Modes of failure, limit equilibrium approaches, application of stereographic projections, remedial measures.

Foundations of Weak Rocks: Bell's approach, bearing capacity based on classification approaches, UCS, plate load test, special considerations

Textbooks

1. Goodman, RE (1989). Introduction to Rock Mechanics, Canada, John Wiley & Sons.
2. Singh, B and Goel RK (2011). Engineering Rock Mass Classification. Oxford, UK, Elsevier Inc.
3. Jaeger, JG, Cook, NGW and Zimmerman, RW (2007). Fundamentals of Rock Mechanics. 4th Ed., Singapore, Blackwell Publishing.

Reference Books

1. Hoek, E and Bray, JW (1977). Rock Slope Engineering. The Institution of Mining and Metallurgy, London.
2. Hoek, E and Brown, ET (1988). Underground Excavations. Spon Press.
3. Ramamurthy, T (2007). Engineering in Rocks for Slopes, Foundation and Tunnels. N. Delhi, PHI Pvt. Ltd.
4. Sivakugan, N, Shukla, SK and Das, BM (2013). Rock Mechanics: an introduction. Boca Raton, FL, CRC Press.
5. Wyllie, DC and Mah CW (2004). Rock Slope Engineering, Civil and Mining. NY, Spon Press.

BCE-329	**Bridge Engineering**	
Course category	:	Program Elective-1 (PE1)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, Two Minor tests and One Major Theory Examination.
Course Objectives	:	1. The main aim of this course is to enable students to choose the appropriate bridge type for a given project, and to analyses and design the main components of the chosen bridge. 2. The course also provides students with fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering. 3. Upon completion of this course, students should have learned the analysis and design of bridge superstructures, foundations, bearings, and deck joints.
Course Outcomes	:	1. Students will have fundamental knowledge in a wide range of state-of-the-art practices, including code specifications, in bridge engineering. 2. Students will be able to develop expertise in the analysis and design of bridge superstructures. 3. Students will be able to design short and medium span bridges using existing codes of practice, taking into account the structural strength, service life, and durability. 4. Students will be able to develop expertise in the analysis and design of foundations.

		5. Students will be able to develop expertise in the analysis and design of bearings. 6. Students will be able to develop expertise in the analysis and design of deck joints.

Topics Covered

UNIT-I	9

Site selection, various types of bridges and their suitability, loads, forces and IRC bridge loading and permissible stresses, Design of RC bridges under concentrated loads using effective width and Pigeauds Method, Courbon's method of load distribution.

UNIT-II	9

Detail design of slab culvert, box culverts.

UNIT-III	9

Detail design T-beam bridge.

UNIT-IV	9

Bridge substructure and bearings, Design of piers and pier caps. Abutments, Different types of foundations, used for design of substructure.

Text/Reference Books:

1. Victor D J, essentials of Bridge Engineering, Oxford & IBH
2. Raju N K, Design of Bridges, Oxford & IBH
3. Ponnuswamy S, Bridge Engineering, Tata McGraw Hill
4. Raina V K, Concrete Bridge Practice, Tata McGraw Hill.
5. IRC: 5, 6, 78, 112-2011

BCE-330		**DISASTER MANAGEMENT**
Course category	:	Program Elective-1 (PE1)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination
Course Objectives	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Discuss the various modes of disaster arising in different areas 2. Identify the roles of NDRF and SDRF in disaster management 3. Illustrate the various trends of disaster management in Indian context 4. Recommend the various disaster prevention techniques for different context. 5. Define the role of engineers in Disaster mitigation

		6. Understand the concepts of disaster factors.

Topics Covered	
UNIT-I	9
Type of disasters, Accent on land slides, earthquakes, flash flood, avalanches, snow blizzards. Causes, consequences and mitigation techniques, Flash floods their management and relief, Contingency planning for dam failures	
UNIT-II	9
Characteristics of glaciers and protection of important monuments from glacial flow, Management of snow avalanche, Disaster management planning, Roles of NDRF and SDRF in Disaster Management	
UNIT-III	9
Landslides, their classification, causes, & preventive measures. Concept, growth presents trends status in India and concept of contingency planning and systems approach of disaster management. Sociology of disasters, Human and media response and role.	
UNIT-IV	9
Disaster prevention techniques, Disaster legislation, Disaster prone area building codes, Vulnerability analysis, Health and sanitation aspects, Relief administration in India and role of engineers in disaster mitigation	
Textbooks 1. Disaster Management and Strategies by AshuPasricha, Kiyanoush Ghalav and Jai Narain Sharma **Reference books** 1. Disaster Management and Preparedness - Larry R. Collins, CRC Press. 2. Disaster Management Handbook - Jack Pinkowski, CRC Press.	

BCE-331		**ADVANCED ENGINEERING HYDROLOGY**
Course category	:	Program Elective-1 (PE1)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination.
Course Objective	:	1. Understand the concept of hydrological cycle, mechanism of precipitation, evapotranspiration, and infiltration. 2. Measure and compute serial rainfall and intensity-duration curve. Estimate floods using rational, empirical unit hydrograph and flood frequency analysis. 3. Compute aquifer parameters using the concept of flow through porous media. 4. Estimate water requirements of crops and storage capacity of reservoir.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. To demonstrate about the knowledge of the Hydrological cycle 2. To know the different forms of precipitation and measurement of precipitation 3. To prepare the hydrograph and different types of the hydrograph 4. To predict the flood and design flood 5. To calculate flood by different flood routing method 6. To have a knowledge of groundwater hydrology

Topics Covered

UNIT-I	**9**

Introduction: Hydrologic cycle, water budget equations, world water balance, application in engineering. Precipitation: Forms of precipitation, measurement, depth-area-duration & intensity duration-frequency relationships, probable maximum precipitation. Abstraction from Precipitation: Evaporation – process, measurement and estimation; Evapotranspiration-measurement and estimation; Initial Losses- Interception & Depression storage; Infiltration- process, capacities, indices, measurement & estimation

UNIT-II	**9**

Runoff and Hydrographs: Hydrograph, runoff characteristics of a stream, Yield, Rainfall-runoff correlations, flow duration curve, mass curve, droughts, and floods. SCS-CN method of estimating runoff volume. Factors affecting flood hydrographs, unit hydrographs, and their analysis, S-curve hydrograph, synthetic and instantaneous unit hydrographs.

UNIT-III	**9**

Flood: Rational method, empirical formulae, unit hydrograph method, flood frequency studies, statistical analysis, regional flood frequency analysis, design storm & design flood, risk/reliability and safety factor; Flood Routing: Basic equation, hydrologic storage routing & attenuation, hydrologic channel routing, flood forecasting & control, hydraulic method of flood routing.

UNIT-IV	**9**

Groundwater: introduction, forms of subsurface water, aquifers & their properties, Compressibility of aquifers, flow equations for confined and unconfined aquifers, well hydraulics - steady and unsteady flow to a well in a confined aquifer, well losses, specific capacity, groundwater irrigation, rainwater harvesting

Textbooks

1. Engineering Hydrology by "K. Subramanyam".

Reference Books

1. Hydrology for Engineers" by Linsley R. K., Kohler M. A. and Paulhus J. L. H".
2. Hydrology: Principles. Analysis. Design" by Raghunath H. M".
3. Handbook of Applied Hydrology" by Chow V. T".
4. Irrigation: Theory & Practice" by Michael A. M".
5. Hydrology for Engineers" by Linsley R. K., Kohler M. A. and Paulhus J. L. H".

Programme Elective-2 (PE2)

BCE-376	**GEO-ENVIRONMENTAL ENGINEERING**	
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL

Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor tests and One Major Theory Examination.
Course Objectives	:	The course objectives are 1. To make students aware about subsurface contamination and its sources. 2. Learn about geotechnical aspects of planning and design of facilities for disposal of different kinds of solid waste. 3. Understand the detection & monitoring of subsurface contamination and control & remediation of contaminated sites. 4. Awareness about rehabilitation of waste dumps and geotechnical re-use of waste.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course. 1.Understand the environmental cycle and their interaction with geotechnology. 2. Knowledge of waste characterization, solid waste interaction and hazardous waste. 3. Discuss the transportation of the contaminants in the soils. 4. Response of Geomaterials to Electromagnetic Field. 5. The Nature of the Environment and Soil. 6. Geomaterial Characterization: Conventional- and Neo-Geomaterials.

Topics Covered

UNIT-I	9
Background, Aspects of Environmental Geotechnology, Characterization of Geomaterials, Role of Environmental Geotechnology in Carbon Capture, Soil–Environment Interaction, Factors affecting soil response, Particle-Energy-Field Theory, Neo-Soil Classification, Application of Industrial Waste as Neo-Geomaterial.	
UNIT-II	9
Geomaterials, Forms of Wastes, Industrial (Waste) Byproducts, Geomaterial Characterization: Mineralogical, Morphological, Magnetic, Physical, Thermal and Geotechnical Characterization, Indentation of Geomaterials, Nano-indentation, Penetration resistance, Biological Characteristics and Chemical Characterization	
UNIT-III	9
Heat Migration in Geomaterials: Thermal Properties of Geomaterials and its determination: Transient heat method, Heat migration in geomaterials: Thermal flux method (TFM), Effect of temperature on soil properties: Pre-consolidation pressure, Coefficient of consolidation and compression index, Shear strength, Thermal Stresses on Geomaterials: Computation of normal stress and shear stress, Determination of the Heat of Wetting.	
UNIT-IV	9
Response of Geomaterials to Electromagnetic Field: Electrical Properties of Geomaterials, Parameters Influencing Electrical Properties, Methods for Determining Electrical Properties: Geomaterial resistivity, Electromagnetic techniques, Flow of Current in Geomaterials: Basic Models, Applications	

of Electrical Properties: Consolidation characteristics, Swelling potential, Liquefaction potential and Electrokinetic remediation, Assessment of corrosion potential
Textbooks 1. D. N. Singh, Afshin Asadi and Goli Venkata Siva Naga (2022) Environmental Geotechnology: Meeting Challenges Through Needs-based Instrumentation, World Scientific Publishing Company. **Reference Books** 1 Hsai-Yang Fang, Ronald C. Chaney Introduction to Environmental Geotechnology (2016) 2nd Edition, CRC Press

BCE-378		**PRINCIPLES OF REMOTE SENSING**
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial: 1,Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance home assignments, quizzes, two Minor tests and One Major Theory Examination
Course Objectives	:	This course aims to develop the skill on understanding, handling and processing of remote sensing data. The course has specific objectives to: i) To congregate the basic concepts and fundamentals of physical principles of remote sensing ii) Carryout image and data preprocessing techniques for handling radiometric and geometric corrections. iii) To create a firm basis for successful integration of remote sensing in any field of application.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Understand the way in which electromagnetic radiation interacts with the earth's atmosphere, the earth's surface and the remote sensing system. 2. Develop some skills in image interpretation and analysis. 3. Be familiar with different types of sensors and remote sensing space missions that are used to detect and record certain parts of the electromagnetic spectrum. 4. Understand simple image enhancement , filtering operations, spectral classification of digital images for feature extraction and the principles of GPS and its role in Remote sensing ground truthing 5. To carry out corrections of geometric distortions in digital images 6. Apply and evaluate the potential of remote sensing for some applications in the field of civil engineering

Topics Covered	
UNIT-I	9

Remote sensing system and its components, Electromagnetic spectrum, definition of emissivity, reflectance, absorbance and transmittance. Spectral signature, atmospheric window, active and passive remote sensing systems, Interaction of electromagnetic energy with atmosphere and earth features, factors affecting the reflectance	
UNIT-II	9
Airborne and space platforms, Advantages and disadvantages of each, principle and functioning of multi-spectral, thermal & line scanners, Multi concept of remote sensing, Different satellite and sensor combinations: LANDSAT, SPOT, IRS series of satellites and sensors. Their important characteristics: such as flight altitude, IFOV, spatial resolution, swath, spectral bands, and repetivity.	
UNIT-III	9
Introduction to Digital Image Processing, digital image representation, and characterization, Concept of colour, Colour composites, histograms and scatter plot, image enhancement, contrast stretching, radiometric processing including correction of atmospheric corrections; geometric corrections, Image Transformations such as subtraction, ratioing, NDVI and PCA	
UNIT-IV	9
Ground truth: Geographic and Radiometric, Principles of Global Positioning Systems and its role to remote sensing data, Digital terrain models. Thematic classification and clustering to include unsupervised and supervised classification based on parallelepiped, minimum distance and maximum likelihood classification, accuracy assessment of classification. Applications of remote sensing.	
Textbooks 1. Thomas Lillesand, Ralph W. Kiefer, Jonathan Chipman., Remote Sensing and Image Interpretation. Wiley 2. Reddy, M. Anji, Remote sensing and Geographic Information System BS Publications 3. B. Bhatta, Remote Sensing and GIS, Oxford University Press **Reference books** 1. Curran, Paul J., Principles of Remote sensing Longman 2. Campbell, J.B., Introduction of Remote Sensing Taylor and Francis, 3. Sabins, F.F., Remote Sensing: Principles and Interpretations Waveland Pr Inc Publishers	

BCE-380	**Matrix Method of Analysis**	
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, record, two Minor tests and One Major Theory Examination.
Course Objectives	:	The main objective is to expand the student knowledge of the stiffness and flexibility methods studied in the basic structural analysis courses. This course is also expected to enable a good understanding of how standard software packages and students will be able to implement the method developing their own computer

		program to analyze structures.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course

1. To understand the basic concepts of structural analysis and matrix algebra.
2. To understand the matrix methods can be applied to plane and space trusses; beams and grids; plane and spaceframes.
3. To identify a suitable system of releases (flexibility method) or an appropriate set of degrees of freedom (stiffness method).
4. To formulate and solve the equilibrium equations (stiffness method) or boundary conditions (flexibility method).
5. Ability to use modern structural analysis software.
6. Able to understand and analysis complex structures.

Topics Covered

UNIT-I	9

Introduction to Flexibility and stiffness method. Hand computation of problems on beam.

UNIT-II	9

Hand computation of problems on trusses, frames and grids.

UNIT-III	9

Generalized computer-oriented treatment of stiffness method, Method of assembling the stiffness matrix, substructure technique for solving very large structures.

UNIT-IV	9

Analysis for imposed deformation, temperature, support settlement, etc. Transfer matrix method of analyzing framed structure.

Textbooks

1.H.C. Matrix, Introduction to Matrix Methods, of structural Analysis, McGraw Hill, New York.

Reference books

1.Weaver & Gere, Matrix Analysis of Framed structures.

BCE-379		**Airport, Docks & Harbour Engineering**
Course category	:	Program Electives-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3, Tutorial: 1, Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, practical work, record, viva voce and Two Minor tests and One Major Theory Examination
Course Objectives	:	1. To have an overall knowledge of the design and construction of airport, docks, harbours and ports as a whole. 2. To understand the function of different components of airports, docks and harbours.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course

		1. Understand the components of aircrafts & different types of aircrafts. 2. Carryout the survey for airports, docks &harbours. 3. Perform geometric design for the airports, docks & harbour. 4. Plan and layout of different types of terminals. 5. Understand the various methods of design of runways. 6. Analyze the concepts of geometric design parameters.

Topics Covered

UNIT-I	9

Introduction, Aircraft characteristics and airport selection: Air transport development in India, national and international organization in air transport, aircraft characteristics and their impact on planning of airport, selection of site for airport, airport obstruction, imaginary surfaces, runway orientation, calm period and wind coverage.

UNIT-II	9

Geometric Designs: Runway and taxiway geometric designs, exit taxiway, its design and fillet curves, runway configuration, separation clearance, design of aprons and their layouts. Airport Traffic Control Aids: Visual aids, marking and lightening of runway and apron area, wind and landing direction indicator.

UNIT-III	9

Planning and layout of Docks and Harbour: Harbour planning principles, terminology, layout of a harbour, classification of harbour, Docks: Classification of Docks, transit sheds and Warehouses.

UNIT-IV	9

Construction and Maintenance of Docks and Harbours: Introduction, Construction of Quay walls, Construction of Breakwaters, Tides and Tidal data analysis, types of Types, Tidal theories, Tidal data analysis, Application of Tidal data analysis, Dredging, Maintenance of ports and harbours.

Textbooks

1. A Text Book of Harbour and Docks Engineering by S. C. Rangwala.
2. Airport Planning and Design by S. K. Khanna, M. G. Arora

Reference books

1. Transportation Engineering by V.N Vazirani and S. P. Chandola. .
2. Airport Engineering byS.C. Saxena 3. Planning and design of airports by Horonjeff , Robert and McKelvey

BCE-381		**OPEN CHANNEL FLOW**
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0

Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination
Course Objectives		1. To understand the behaviour free surface flow conditions under varying depths of flow in open channel. 2. To classify the types of flows in open channel and also to design open channel sections in a most economical manner. 3. Compute normal and critical depth and design of efficient channel. 4. To study about non uniform flows in open channel and longitudinal slopes in open channel and also to learn about the characteristics of hydraulic jump.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course
		1. To explain the terms of the open channel flow equations and explain the interaction among the terms. 2. To develop the open channel flow equations from the basic conservation equations. 3. To solve open channel flow problems through the selection and use of appropriate equations. 4. To explain the physical mechanisms and mathematical relationships for hydraulic jumps, surges,and critical, uniform, and gradually varying flows as well as spatially varied flow. 5. Analysis and design of open channel controls, upstream and downstream controls, & spatiallyvaried flow. 6. Analysis and design of open channel transition, functions, and energy dissipaters.
Topics Covered		
UNIT-I		**9**
Introduction: Basic concepts of free-surface flow, velocity and pressure distribution, Mass, energy, and momentum principle for prismatic and non-prismatic channels, Review of Uniform flow: Standard equations, hydraulically efficient channel sections, compound sections. **Energy-depth relations:** Concept of specific energy, specific force, critical flow, critical depth, hydraulic exponents, and channel transitions.		
UNIT-II		**9**
Gradually Varied Flow (GVF): Equation of gradually varied low and its limitations, flow classificationand surface profiles, Control sections, Computation methods and analysis, Integration of varied flow equation by analytical, graphical and advanced numerical methods, Transitions of subcritical and supercritical flow, flow in curved channels.		
UNIT-III		**9**
Rapidly Varied Flow (RVF): Characteristics of rapidly varied flow, Classical hydraulic jump,		

Evaluation of the jump elements in rectangular and non-rectangular channels on horizontal and sloping beds, Hydraulic jump in gradually and suddenly expanding channels, submerged hydraulic jump, rolling and sky jump, use of jump as an energy dissipater.

Flow measurement: by sharp-crested and broad crested weirs, critical depth flumes, sluice gate, Free- overfall. **Bold Rapidly varied unsteady flow**: Equation of motion for unsteady flow, "Celerity" of the gravity wave, deep and shallow water waves, open channel -positive and negative surge.

UNIT-IV	**9**

Spatially Varied Flow (SVF): Basic principles, Differential SVF equations for increasing and decreasing discharge, Classifications and solutions, Numerical methods for profile computation, Flow over side-weir and bottom-rack.

Textbooks

1. Chow, V.T., Open channel Hydraulics, McGraw Hill International.

Reference Books

1. Henderson, F.M., Open Channel Flow, McGraw Hill International.
2. Subramanya, K., Flow in Open Channels, Tata McGraw Hill.
3. Ranga Raju, K.G., Flow through open channels, T.M.H.
4. M. Hanif Chaudhry, Open Channel Flow, PHI.
5. French, R.H., Open channel Hydraulics, McGraw Hill International.

BCE-382		**ADVANCED CONSTRUCTION TECHNOLOGY AND CONSTRUCTION MANAGEMENT**
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minortests and One Major Theory & Practical Examination
Course Objectives	:	This course aims at the following educational objectives: To plan Bar Chart, CPM chart, PERT chart material requirement schedule, Manpower schedule, Machinery Schedule, Construction Management, to analyze, evaluate and design construction contract documents.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Understand the use of advanced materials in construction projects 2. Plan and develop management solutions to construction projects. 3. Evaluate construction project economics, cost-benefit analysis and breakeven analysis. 4. Understand the principles of project management, resource management and inventory

		5. Understand the different types of contracts in construction arbitration and legal aspects and its provision 6. Analyse the different aspects of the contracts and their legal provisions.

Topics Covered

UNIT-I	9

Neo Construction Materials
Special Concretes: High strength concrete, Effect of RHA on the properties of HSC, High performance concrete –applications, Self-Compacting Concrete, Concrete made with waste rubber, Special Concretes, Sulfur Concrete, Ferro cement, Geo synthetics, Nano Concrete, Changes in concrete with respect to time

UNIT-II	9

Elements of Management:
Project cycle, Organisation, planning, scheduling monitoring updating and management system in construction.
Network Techniques:
Bar charts, milestone charts, work break down structure and preparation of networks. Application of network Techniques like PERT, GERT, CPM AON and AOA in construction management. Project monitoring, cost planning, resource allocation through network techniques. Line of balance technique.

UNIT-III	9

Engineering Economics:
Time value of money, Present economy studies, Equivalence concept, financing of projects, economic comparison present worth method Equivalent annual cost method, discounted cash flow method, analytical criteria for postponing of investment retirement and replacement of asset. Depreciation and break even cost analysis.

UNIT-IV	9

Contract Management:
Legal aspects of contraction, laws related to contracts, land acquisition, labour safety and welfare. Different types of contracts, their relative advantages and disadvantages. Elements of tender preparation, process of tendering pre-qualification of contracts, Evaluation of tenders, contract negotiation and award of work, monitoring of contract extra items, settlements of disputes, arbitration and commissioning of project.

Textbooks
1. Engineering Drawing-Bhat, N.D.& M. Panchal, Charotar Publishing House, 2008

Reference books
1. Callahan, M. T., Quackenbush, D. G., and Rowings, J. E., Construction Project Scheduling, McGraw-Hill, New York, 1992.
2. Cleland, D. I. and Ireland, L. R., Project Management: Strategic Design and Implementation 4th Edition, McGraw-Hill, New York, 2002.
3. Danny Myers, Construction Economics: A New Approach, Taylor and Francis Publisher, 2004.
4. Harold Kerzner Project Management CBS Publisers & Distributors 2nd Edition
5. Kumar Neeraj Jha, Construction Project Management, Pearson Publication

BCE-377		**Advanced Structural Engineering**
Course category	**:**	Program Elective-2 (PE2)
Pre-requisite Subject	**:**	NIL
Contact hours/week	**:**	Lecture: 3, Tutorial: 1, Practical: 0

Number of Credits	**:**	4
Course Assessment methods	**:**	Continuous assessment through tutorials, attendance, home assignments, quizzes, and Two Minor tests and One Major Theory Examination.
Course Objectives	**:**	To analyze structural engineering systems by various approaches.
Course Outcomes	**:**	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. To understand how to represent real structures by idealized structural systems. 2. To understand the classification of structures, static indeterminacy, kinematic indeterminacy. 3. To understand the stain energy and complimentary strain energy of the structures. 4. To understand the concept of flexibility method and be able to apply it for analysis of statically indeterminate structures. 5. To understand the concept of stiffness method and be able to apply stiffness methods for analysis of statically indeterminate structures. 6. To understand the equilibrium of forces for cable bridges and analysis of suspended cable bridges.

Topics Covered

UNIT-I	9

Review of basic concepts in structural analysis: stability, rigidity and static indeterminacy, kinematic indeterminacy.

Loads, Response (equilibrium, compatibility, force-displacement relations); analysis of statically determinate structures (trusses, beams, frames); Applications of principle of virtual work, Classification of Structures, stress resultants, Strain Energy, and Complimentary Strain Energy. Introduction to various methods of structural analysis

UNIT-II	9

Matrix concepts and Matrix analysis of structures: Force Method of analysis: Application to beams and frames, Construction, and Use of Flexibility Matrix for analysing rigid jointed and pin jointed structures. Displacement Method of analysis: Application to beams and frames, Construction, and Use of Stiffness Matrix for analysing rigid jointed and pin jointed structures.

UNIT-III	9

Equilibrium of light cable, General Cable theorem, uniformly loaded cable, anchor cables, temperature stresses in suspension cables, three hinged stiffening girder, two hinged stiffening girder, temperature stresses in two hinged girders. Equilibrium of light cable, General Cable theorem, uniformly loaded cable, anchor cables, temperature stresses in suspension cables, three hinged stiffening girder, two hinged stiffening girder, temperature stresses in two hinged girders.

UNIT-IV	9

Introduction to Finite element method for structural analysis; Review of principle of virtual work, Ritz method, Discretization of domain, Basic element shape.

Textbooks

1. Advanced Structural Analysis by A. K. Jain, Nem Chand & Bros., Roorkee.
2. Devdas Menon, "Advanced Structural Analysis", Narosa Publishing House, 2009.
3. Theory of Structures Vol 1 & 2 by Gupta & Gupta, TMH
4. Krishnamoorthy, C. S. (1994). Finite element analysis: theory and programming. New Delhi, India: Tata McGraw-Hill.

Reference books

1. Coates, Reddy, C.S., "Basic Structural Analysis", Tata McGraw Hill.
2. Coates, R.C., Coutie, M.G. & Kong, F.K., "Structural Analysis", English Language Book Society & Nelson, 1980.
3. Ghali, A. & Neville, M., "Structural Analysis", Chapman & Hall Publications, 1974
4. Jain, A.K. "Advanced Structural Analysis", Nem Chand & Bors, Roorkee, India, 1996.
5. Jain, O.P. & Arya A.S., "Theory of Structure", Vol. II, Nem Chand Bros., Roorkee, 1976.
6. Kinney, J.S., "Intermediate Structural Analysis", McGraw Hill Book Company, 1957.
7. Wang, C.K. "Intermediate Structural Analysis", McGraw Hill Book Company, 1983
8. Nautiyal, B.D., "Introduction to Structural Analysis", New Age International, 2001
9. Bathe, K.J., & Bathe, K.J. (2002). Finite element procedures. New Delhi: Prentice-Hall of India. 620.00422 BAT

BCE-383	**GROUND IMPROVEMENT TECHNIQUES**	
Course category	:	Program Elective-2 (PE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor tests and One Major Theory Examination
Course Objectives	:	This course will enable students to 1. Understand the fundamental concepts of ground improvement techniques 2. Apply knowledge of mathematics, Science and Geotechnical Engineering to solve problems in the field of modification of ground required for construction of civil engineering structures. 3. Understand the concepts of chemical compaction, grouting and other miscellaneous methods. 4. Impart the knowledge of underpinning and geosynthetics.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course 1. Analyze the suitability of soil for the ground improvement. 2. Identification of the appropriate method for ground improvement. 3. Knowledge of various in situ densification methods in granular as well as cohesive soils

		4. Application of dewatering and pre-loading 5. Knowledge of Grouting 6. Understanding of Shoring and Underpinning Techniques.

Topics Covered

UNIT-I	9
Introduction, Review of compaction theory, effect of compaction on surface behaviour, Field methods of compaction, Quality Control, Design of soil-lime, soil-cement, soil-bitumen and soil-lime-fly-ash mixes. Recent Advances.	
UNIT-II	9
In-situ densification methods in granular soils, Deep compaction: Introduction, Terra-Probe, Vibro-flotation techniques, Ground Suitability for Vibro-flotation, Mueller Resonance Compaction, Dynamic Compaction, Depth of the Improvement	
UNIT-III	9
In-situ densification methods in cohesive soil: Introduction, Pre-loading and de-watering, Vertical drains, Electrical method, Thermal method, Granular Piles: Ultimate bearing capacity and settlement, method of construction, load test	
UNIT-IV	9
Grouting: Introduction, suspension grout, solution grout, grouting equipment and methods, Grouting design and layout. Retrofitting of foundations: Shoring and Underpinning, methodology, typical examples. Introduction to geosynthetics.	

Textbooks

1.Purshotham Raj– Ground Improvement Techniques, Laxmi publications, New Delhi.

Reference Books

1. S. K. Garg Soil Mechanics & Foundation Engineering, Khanna Publishers, New Delhi.
2. Satyendra Mittal An Introduction to Ground Improvement Techniques, Medtech; 1st edition
3. Gopal Ranjan and A. S. R. Rao(– Basic and Applied Soil Mechanics, New Age International(P) Limited New Delhi.
4. J. N. Mandal – Geosynthetics World, New Age International Private Limited (1 January 1994)
5. Koerner, R. M. Designing with geosynthetics, Prentice Hall, Englewood Cliffs.

Programme Elective-3 (PE3)

BCE-426		**ADVANCED FOUNDATION ENGINEERING**
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor tests and One Major Theory Examination

Course Objectives	:	The objectives of this course are to impart knowledge and abilities the students to: 1. Design a shallow foundation subjected to eccentric & inclined loads. 2. Design of deep foundation i.e., piles based on settlement & bearing capacity criteria. 3. Impart knowledge on design of drilled shafts. 4. Design of machine foundation
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes after completing this course 1. Analyze the bearing capacity of shallow foundations 2. Understand about foundation design in relation to ground movement 3. Identify a suitable foundation system for a structure. 4.Design shallow foundations, piled foundations, well foundation constructions, machine foundation and soil stability. 5. Evaluate deformations in the soil due to foundation works. 6. The knowledge of machine foundation.

Topics Covered

UNIT-I	9
Bearing capacity and settlement analysis of shallow foundation, Terzaghi, Meyerhof & Hansen and I.S. code methods, Bearing capacity of layered soil, Bearing Capacity from SPT and SCPT and Plate load Test data, Proportioning of footing based on settlement criteria. Floating foundation, allowable, total & differential settlement, soil pressure under un-symmetric foundation. Recent Advances.	
UNIT-II	9
Foundation settlement in Sand using Schmertmann and DeBeers methods. Settlement and safe load Carrying capacity of pile foundations, laterally loaded and battered piles, group action of piles, Consolidation settlement of pile group, pile cum raft foundation; Drilled piers or shaft, Type, Current construction methods, Load carrying capacity and settlement of drilled shaft in sand and clay, Foundation on difficult ground e.g. Collapsible soil, Expansive Soil etc.	
UNIT-III	9
Pile foundations, pile load tests, methods of estimating load transfer of piles, analytical estimation of load- settlement behaviour of piles. Introduction, shapes and characteristics of wells, components of well foundation, forces acting on well foundation, sinking of wells, causes and remedies of tilts and shifts.	
UNIT-IV	9
Design of Machine Foundation: Types of Machine Foundations, design criteria, Degrees of Freedom of Block foundation, Analysis of Block foundations under sliding, rocking, yawing and Coupled motions, Design Aspects and Construction details of foundations for reciprocating and Impact, vibration isolation: active and passive isolation, vibration isolation materials.	

Textbooks

1. K.R. Arora – Soil Mechanics & Foundation Engineering, Standard Publisher dist.
2. Alam Singh – Modern Geotechnical Engineering, Asia Publishing House, New, Delhi
3. Gopal Ranjan and A.S.R. Rao – Basic and Applied Soil Mechanics, New Age Intl(P) Ltd.

Reference Books

1. Brij Mohan Das – Geotechnical Engineering , CENGAGE Learning
2. I.H. Khan – Textbook of Geotechnical Engineering. Prentice-Hall of India Ltd., New Delhi
3. C. Venkataramaiah – Geotechnical Engineering, New Age Intl(P) Ltd., New Delhi
4. Shashi Gulati &Manoj Datta – Geotechnical Engineering, Tata McGraw Hill, New Delhi
5. J. E. Bowles- Foundation Analysis & Design, McGraw Hills, New Delhi
6. K. R. Arora – Soil Mechanics & Foundation Engg. Standard Publishers & Distributors, Delhi
7. V.N.S. Murthy – Soil Mechanics and Foundation Engineering, C B S Publication

BCE-427		**RIVER ENGINEERING**
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination
Course Objective	:	1. Compute incipient motion conditions of uniform and non-uniform sediments. 2. Classify flow regimes and compute resistance to flow in alluvial channels. 3. Estimation of bed loads and suspended load transports in alluvial channels. 4. Design of lined and unlined canals to carry clear and sediment laden water. 5. Identification and estimation of bed level variation in alluvial streams. 6. Computation of scours around bridge piers.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. An ability to apply knowledge of mathematics, science, and engineering 2. An ability to design a system, component, or process to meet desired needs withrealistic constraints 3. Apply the governing principles of morphological processes 4. An ability to identify, formulate and solve engineering problems 5. An ability to articulate professional ideas clearly and precisely, prepare written materials, andmake oral and written presentations 6. An ability to design the river training structures as per area-specific requirements

Topics Covered

UNIT-I	**9**

Elements of River Geomorphology: Introduction, origin, and properties of sediments classification of Rivers, Mechanics of alluvial rivers including channel and flood plain features, Sediment transport, different methods for calculation of sediment threshold, suspended, bedload and total load, River morphology, and various classification schemes.

Hydraulics of Alluvial Streams: Introduction, Incipient motion, modes of sediments transport, River Channel patterns, Straight River channels, causes, characteristics and shapes of meanders and control, cut-off, Braided Rivers, Bedforms, Instability of rivers, Hydraulic geometry, resistance to flow in alluvial rivers, Delta formation and control.

UNIT-II	**9**

River Geometry and Plan Forms: Rivers and restoration structures, Socio-cultural influences, andethics of stream restoration. Stable channels and their geometry, flow around river.

Gravel Bed Rivers: Hydraulic geometry of gravel-bed rivers, armoring, bed forms and geometry, andresistance to flow in gravel-bed rivers.

UNIT-III	**9**

Bed level variations in streams: Aggradation and Degradation, local scour at bridge pier and other hydraulic structures, reservoir sedimentation, mathematical modelling for riverbed variations.

Rivers and Environments: Environmental effects of hydraulic structures, river pollution and river actionplans.

UNIT-IV	9

River Protection and Training Works: Introduction, Classification of River Training, Types of trainingworks, Protection for Bridges with the reduced waterway, Design of Guide Bund, Embankment and spurs/dampeners and other river/flood protection works. River protection model studies.

Textbooks

1. River Behaviour Management and Training (Vol. I & II), CBI&P, New Delhi.
2. Irrigation & Water Power Engineering- B. C. Punmia and Pande B. B. Lal.
3. River Mechanics, Cambridge University Press, By P.Y. Julien

Reference Books

1. Mechanics of sediment Transportation and Alluvial Stream Problems, Wiley Eastern Ltd., R.J.Garde, and K.G. Ranga Raju.
2. Fluvial Processes in River Engineering, Wiley Interscience, By H.H. Chang.

BCE-428		**Advanced Concrete Design**
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, Two Minor tests and One Major Theory.
Course Objectives	:	Students would learn the analysis and design methods with respect to advanced special RCC structures like bunkers, silos, Industrial Structure, chimneys and tower.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Introduction to the various member components of Flat slab floor system. 2. Analyze and design a Flat slab floor system for serviceability and limit state loads. 3. Analyze and design retaining walls, counter fort retaining walls and culverts. 4. To undertake design problems on design of water tanks. 5. Explain the effects of prestress on the behavior of concrete beams and slabs and identify situations when prestress is needed. 6. To determine the combined stresses induced by prestress and applied loads using basic concepts of analysis, equivalent load method and load balancing approach.

Topics Covered

UNIT-I	9
Design of Industrial Building and RCC framed Building, Planning of Industrial Structures, and Design of Single & Multi-Bay Industrial Structures in Concrete & Steel.	
UNIT-II	9
Silos and Bunkers-Lateral Pressures in bunkers as per Rankine's and Coulomb theories, Lateral pressures in silos as per Janssen's and Airy's theories, design considerations for square, rectangular and circular shapes of silos, design of hoppers and supporting structures of bins. I. S. Code Provisions for design of Silos and Bunkers.	
UNIT-III	9

Design of R.C.C, Chimney- I.S. Code provisions, principles of design under various types of loadings, behaviour of chimneys and stack structures under wind.	
UNIT-IV	9
Design of Cooling Towers-Principles of design of various types of cooling towers. I.S. Code provisions for the design, analysis and design under wind and earthquake loads.	

Textbooks

1. IS: 456 – 2000.
2. Reinforced Concrete – Limit State Design by A. K. Jain, Nem Chand & Bros., Roorkee.

Reference books

1. Plain and Reinforced Concrete Vol. I & II by O. P. Jain & Jai Krishna, Nem Chand & Bros.
2. Reinforced Concrete Structures by R. Park and Pauley.
3. Reinforced Concrete Design by P. Dayaratnam.

BCE-429	**WATER RESOURCE SYSTEMS**	
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes, viva voce, Two Minor tests, and One Major Theory Examination
Course Objective	:	1. To introduce various aspects of systematic water resource planning and the relevant mathematical tools. 2. Modeling and simulation of water resource system 3. Quantitative methods for analyzing large scale water resource problems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course
		1. To develop a systematic approach to water resources system development. 2. To have knowledge about the application of system engineering in reservoir operation and optimal crop water allocation. 3. To have an attitude toward solving problems related to water resources. 4. To have knowledge of simulation of water resource system. 5. To have knowledge of economics of water resource system 6. To have knowledge/application of linear and dynamic programming in water resource system.
Topics Covered		
UNIT-I		**9**
Concept of system and system analysis: Definition and types of system, System Approach and		

analysis,Basic Problems in System Analysis. Planning and management. Concept of a system, Advantages, and limitations of system approach.

System Technique in Water resources: Optimization using calculus, Linear Programming, Dynamic programming and Simulation, Combination of Simulation and Optimization. Modeling of water Resources Systems.

UNIT-II	**9**

Economic Considerations in Water Resources Systems: Basics of Engineering economics, Economicanalysis, Conditions of project optimality, Benefit-cost Analysis.

UNIT-III	**9**

Multi-objective Planning: Non-inferior solutions, Plan Formulation and Plan selection.

UNIT-IV	**9**

Applications of Linear Programming: Irrigation water allocation for single and multiple crops, Multi- reservoir system for irrigation Planning Reservoir operation for Irrigation and Hydropower Optimization **Applications of Dynamic Programming:** Optimal crop water allocation, Steady State, Reservoir Operation policy for Irrigation.

Textbooks

1. Ossen bruggen, P.J.- System Analysis for Civil Engineering, John Wiley, New York.
2. Taha, H.- Operational Research- An Introduction, Vth Edn, Prentice-Hall.
3. Loucks, D. P., Stedenger, and Haith, D.A.- Water Resources system Planning & Analysis, Prentice-Hall.

Reference Books

1. Jain, S. K. and Singh, V.P.- Water Resources systems Planning & Management, Elesvier, Amsterdam.
2. Rao, S.S. "Engineering optimization, theory and Practice" New Age International, New Delhi.

Chaturvedi, M.C., "Water Resources System Planning and Management", Tata McGraw-HillIndia.

BCE-430	**PRINCIPLES OF GEOGRAPHIC INFORMATION SYSTEM**	
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture:3,Tutorial: 1,Practical:0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance home assignments, quizzes, and two Minor tests and One Major Theory Examination
Course Objectives	:	This course aims at introducing concept, principles, data models and applications of Geographic Information Systems (GIS) in the fields of environmental, geotechnical, transportation and water resources engineering.

Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course 1. Define what GIS is and know different types of spatial and non-spatial data 2. Understand the GIS and its Data models 3. Know what are the questions that GIS can answer 4. Differentiate between Raster and Vector Models 5. Create maps and overlay features/raster data for basic analyses 6. Apply and evaluate the potentials of application of GIS in the fields of environmental, geotechnical, transportation and water resources engineering.

Topics Covered

UNIT-I	9
Definition of GIS, Cartography and GIS, GIS database: spatial and attribute data; Spatial models: Semantics, spatial information, temporal information, conceptual models of spatial information, representation of geographic information: point, line and area features, topology	
UNIT-II	9
Raster and vector data, raster to vector data conversion, map projection, analytical transformation, rubber sheet transformation, manual digitizing and semi-automatic line following digitizer; Remote sensing data as an input to GIS data	
UNIT-III	9
GIS database Concepts and management systems, Types of Database management Systems, hierarchical, network, relational models, GIS functionality; data storage and data retrieval through query, generalization, classification, containment search within a spatial region	
UNIT-IV	9
Overlay: arithmetical, logical and conditional overlay, buffers, inter visibility, aggregation; Network analysis; Applications of GIS in planning and management of utility lines and in the field of environmental engineering, geotechnical engineering, transportation engineering and water resources engineering.	

Textbooks

1. Stan Arnoff Geographic Information Systems: A Management Perspective, WDL Publications.
2. C.P. Lo and Albert K. W. Yeung, Concepts and Techniques of Geographical Information Systems, Prentice- Hall India
3. Reddy, M. Anji, Remote sensing and Geographic Information System BS Publications Hyderabad
4. B. Bhatta, Remote Sensing and GIS, Oxford University Press

Reference books

1. Robert Laurini and Derek Thompson Fundamentals of Spatial Information Systems, Academic Press.
2. Tor Bernhardsen Geographic Information Systems: An Introduction, Wiley
3. Burrough P.A. and Rachel A. McDonell, Principles of Geographical Information Systems, Oxford Publication
4. Michael N. DeMers, Fundamentals of Geographic Information Systems, Wiley

BCE-431	EARTH AND EARTH RETAINING STRUCTURES	
Course category	:	Program Elective-3
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture: 3, Tutorial: 1, Practical: 0
Number of Credits	:	4
Course Assessment methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two Minor tests and One Major Theory Examination
Course Objectives	:	The course objectives are 1. To understand lateral earth pressure theories and pressure theories and design of reinforced soil retaining walls. 2. To carry out slope stability analysis of reinforced retaining wall under seismic loading 3. To understand the design of various components in soil nailing 4. To understand the bearing capacity determination of foundation on reinforced soil bed.
Course Outcomes	:	The students are expected to demonstrate the following knowledge, skills and attitudes after completing this course 1. Understand the fundamentals and classification of geosynthetics. 2. Applications of geosynthetics. 3. Different Types of Soil Retaining Structures and their deign aspects. 4. Design Codes for Reinforced Soil Retaining Walls 5. Stability and design aspects of reinforced soil retaining wall. 6. Stability analysis of soil slopes – infinite and finite slopes.

Topics Covered	
UNIT-I	9
Introduction to Geosynthetics; Types of geosynthetics and their applications; Strength of reinforced soils; Testing of Geosynthetics; Different Types of Soil Retaining Structures, Construction Aspects of Geosynthetic Reinforced Soil Retaining Walls; Design Codes for Reinforced Soil Retaining Walls	
UNIT-II	9
Internal and External Stability Analysis of Reinforced Soil Retaining Walls; Seismic Loads, Testing Requirements for Reinforced Soil Retaining Walls, Design of Reinforced Soil Retaining Walls – simple geometry; Design of reinforced soil retaining walls – sloped backfill soil.	
UNIT-III	9
Stability analysis of soil slopes – infinite and finite slopes; Stability analysis of reinforced soil slopes resting on soft foundation soils; Stability analysis of reinforced soil slopes resting on strong foundation soil, Stability analysis of reinforced soil slopes – bilinear wedge analysis	
UNIT-IV	9
Soil nailing: Analysis and Design; Design of Embankments supported on Load Transfer Platforms; Design of embankments on soft soil using geosynthetics and geocells; Reinforced soil for supporting shallow foundations, Bearing Capacity improvement of Foundation resting on soft soil using reinforcement	
Textbooks	

1. Swami Saran (2016) – Reinforced Soil and its Engineering Application, I.K. International, New Delhi.
2. GL Shivkumar Babu – Geo-environmental practices and sustainability, Springer; 1st ed. 2017 edition (5 June 2017)
3. Jie Han – Principles and Practices of Ground Improvement, Wiley; 1st edition (26 May 2015)

Reference Books

1. Almeida, M. and Marques, M.E.S. (2013) Design and Performance of Embankments on Very Soft Soils, CEC Press, London, U.K.
2. Hausmann, M.R. (1976) Engineering principles of ground modification, McGraw-Hill Publishing Co., New York, N.Y. USA.
3. Kempfert, H.G. and Gebreselassie, B. (2006) Excavations and Foundations in Soft Soils, Springer, The Netherlands.
4. Koerner, R.M. (2012) Designing with Geosynthetics. Vols. 1&2, 6th Edition, Xlibris Corporation, USA.
5. Jewell, R.A. (1996) Soil reinforcement with geotextiles, CIRIA & Thomas Telford, London, U.K.
6. John, N.W.M. (1987) Geotextiles, Blackie & Son Ltd., London, U.K.
7. Jones, C.J.F.P. (2010) Earth Reinforcement and Soil Structures, Thomas Telford, London, U.K.
8. Shukla, S.K. (2012) Handbook of Geosynthetic Engineering, 2nd Edition, ICE Publishing, London, U.K.

BCE-432		**AIR AND NOISE POLLUTION CONTROL**
Course category	:	Program Elective-3 (PE3)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and Two Minor tests and One Major Theory Examination.
Course Objectives	:	The purpose of this course is to give the students an overview of air and noise pollution including methods for prevention, control, measures and management of the pollution. Skills in the selection of technological process, analysis and calculate ventilation system and air emission; units in the industrial air pollution treatment systems.
Course Outcomes	:	The students are expected to be able to demonstrate the following knowledge, skills, and attitudes after completing this course:
		1. Knowledge about participates and air pollution treatment technologies, air emission ventilation system and noise pollution. 2. Identify the types and modes of air pollution in different areas. 3. Discuss upon the air quality standards and measurement of pollutants pertaining to air qualityas AQI.

		4. Recommend the control devices for Particulate and Gaseous emissions. 5. Understand the concepts used in air quality modelling. 6. Explain the impacts of noise on others and explain the mathematical ways to quantify same.

Topics Covered

UNIT-I	**9**

Introduction to Air Pollution: Introduction, Classification, Sources and Effects of Air Pollution, Urban Air Pollution, Industrial and Vehicular Pollution, Indoor Air Pollution. Specific group pollutants such as CFC, GHG etc. Air Pollutants from various industrial sectors. Impact of air pollution on human health and vegetation.

Introduction to noise: Difference between sound and noise, Pitch and Frequency, Sound Pressure, Sound Pressure level (Decibel), Leq, sources of noise and harmful effects of noise, noise measurement and noise control measures.

UNIT-II	**9**

Pollutant Dispersion: Concept of atmospheric stability. Adiabatic and Environmental Lapse rate. Plume behavior. Effect of topography, terrain and structure on Pollutant dispersion. Effect of wind on Pollutant dispersion. Concept of maximum mixing depth and ventilation coefficient. Plume rise and Effective stack height.

UNIT-III	**9**

Air Quality: Introduction to Air quality index and Comprehensive Environmental Pollution Index etc. and its application. Sampling and measurement of air pollutants. Introduction to National Ambient Air Quality Standards.

Dispersion modelling: Introduction to Dispersion modelling, its applications and limitations. Introduction to Gaussian Plume model and GLC determination.

UNIT-IV	**9**

Impacts of Air Pollution: Extreme air Pollution scenarios: Acid Rain, Global Warming, Smog, Ozone layer depletion etc. Various treaties and protocols: Kyoto Protocol and Montreal Protocol etc.

Control methods and equipment: Introduction to control methods and equipment for Particulate matter and gases. Design and working of scrubbers, Electrostatic Precipitator, Gravity settlers, Cyclone separator, Filter bags etc. Other mechanisms of air pollution control such as Biochemical Processes, catalytic processes etc.

Textbooks:

1. Peavy, H.S., Rowe, D.R., Tchobanoglous, G. Environmental Engineering, McGraw Hills, New York1985.
2. Patrick D. Cunniff: Environmental Noise Pollution, John Wiley & Sons Inc.

Reference books:

1. Air Pollution Control Engineering-Noel de Nevers, Waveland Press, Inc.; 3rd edition.

2. Meteorology for Scientists and Engineers- Roland & Stull, Brooks/Cole; 3rd ed. Edition.
3. R. K. Trivedi and P. K. Goel: An Introduction to Air Pollution, ABD Publishers.
4. Pandey and Carney: Environmental Engineering, McGraw Hill Education.
5. S.P. Singal: Noise pollution and Control Strategy, Alpha Science International Ltd; Second ed. Edition.
6. Environmental Pollution Control and Engineering, Rao C.S., New Age International (P) Limited, 1st Ed., 1991.
7. Air Pollution, Perkin, H.G. McGraw Hill 1974.
8. Air Pollution. Physical and Chemical Fundamentals, Sainfeld, J.H. McGraw Hill, N.Y. 1975.
9. Air Pollution: Measurement, Modeling and Mitigation, A Tiwari and J Colls, Taylor & Francis, 2010.
10. Sources and Control of Air Pollution, R J Heinsohn and R L Kabel, Prentice Hall, 1999.
11. Air Pollution Control Equipment Calulations, L Theodore, John Wiley and Sons, 2008.
12. Catalytic Air Pollution Control, Hack, Furraoto and Gulati,John Wiley and Sons, 2009.

OPEN ELECTIVES

OCE-401	**AIR POLLUTION: GLOBAL THREAT TO HEALTH**	
Course category	:	Open Electives (OE)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 0
Number of Credits	:	3
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor test and one Major Theory Examination.
Course Objectives	:	This course provides the knowledge and understanding of: 1. Air Pollution 2. Air Quality Modelling 3. environmental issues of air pollution 4. Effect of temperature and pressure on
Course Outcomes	:	Students expected to: 1. Air Pollution: Introduction and 2. Impacts of air pollution 3. Air Quality Modelling 4. Indoor air pollution: 5. sources, types and health impacts 6. Air pollution emission standards
Topics Covered		

UNIT-I	9

Air Pollution: Introduction and Impacts

Air Pollution: Introduction and Impacts of air pollution on human health, vegetation, animals, building materials, structures, and atmosphere, soil and water bodies. Sources, classification, and formation/transformation of air pollutants: Meteorology and Atmospheric Stability. Lapse Rate, Plume Behaviour, and Air Quality Monitoring, Air Quality Index (AQI)

UNIT-II	9

Air Quality Modelling

Air Quality Modelling, Gaussian dispersion models: point, line and area source models Emissions Inventory: Transport, Industrial, Agricultural, Residential and Commercial sectors

Application of remote sensing/Satellite based data in emission inventory, source apportionment using receptor modelling

UNIT-III	9

Indoor air pollution: sources, types and health impacts

Indoor air pollution: sources, types and health impacts. Sampling, assessment, and evaluation of Indoor air quality. Global and regional environmental issues of air pollution: Ozone depletion, Climate change, Global warming, Acid rain. Air pollution control devices, equipment, and their design.

UNIT-IV	9

Air pollution emission standards

Air pollution emission standards, National and international policies, acts, rules, and regulations. Emerging technologies and strategies to mitigate air pollution, Current challenges, and way forward. Lab-based measurements of air pollutants.

Reference books:

1. Wark, K., Warner, C.F., and Davis, W.T., "Air Pollution: Its Origin and Control", Addison-Wesley Longman (1998)
2. Boubel, R.W., Fox, D.L., Turner, D.B., Stern, A.C., "Fundamentals of Air Pollution", Academic Press (2005).
3. Seinfeld, J.H., Pandis, S.N., "Atmospheric Chemistry and Physics", John Wiley (2006).
4. Lodge, J.P. (Ed.), "Methods of Air Sampling and Analysis", CRC Press (1988).
5. Gurjar, B.R., Molina, L., Ojha, C.S.P. (Eds.), "Air Pollution: Health and Environmental Impacts", CRC Press. (2010).

OCE-402	SUSTAINABLE ENERGY RESOURCES	
Course category	:	Open Electives (OE)
Pre-requisite Subject	:	NIL

Contact hours/week	:	Lecture : 3, Tutorial : 0 , Practical: 0
Number of Credits	:	3
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor test and one Major Theory Examination.
Course Objectives	:	This course provides the knowledge and understanding of 1. Apply the knowledge of mathematics. 2. Apply the knowledge of science. 3. Apply the knowledge of chemical engineering and Electrical Engineering fundamentals, and Electronics and communication engineering 4. Specialization to the solution of complex problem in Geothermal and Non-Convention energy resources.
Course Outcomes	:	Students are expected to understand fundamentals of: 1. Basic of Renewable Energy Resources 2. Technology and Utilization of Non- conventional energy resources. 3. Application of Non-conventional energy resources. 4. Renewable energy and its applications 5. Fuel cell and their working. 6. Wind power it sources.

Topics Covered

UNIT-I	**9**

Introduction of various non- conventional energy resources

Introduction: Various non-conventional energy resources- Introduction, availability, classification, relative merits, and demerits. Solar Cells: Theory of solar cells. Solar cell materials, solar cell array, solar cell power plant, limitations.

UNIT-II	**9**

Solar Energy and performance

Solar Thermal Energy: Solar radiation, flat plate collectors and their materials, applications and performance, focusing of collectors and their materials, applications and performance; solar thermal power plants, thermal energy storage for solar heating and cooling, limitations**.**

UNIT-III	**9**

Geothermal energy & thermonic conversion

Geothermal Energy: Resources of geothermal energy, thermodynamics of geo- thermal energy conversion-electrical conversion, non-electrical conversion, environmental considerations. Magneto-hydrodynamics (MHD): Principle of working of MHD Power plant, performance, and

limitations. Cells: Principle of working of various types of fuel cells and their working, performance, and limitations. Thermo-electrical and thermionic Conversions: Principle of working, performance, and limitations. Wind Energy: Wind power and its sources, site selection, criterion, momentum theory, classification of rotors, concentrations and augments, wind characteristics. Performance and limitations of energy conversion systems.

UNIT-IV	**9**

Unit IV: Biomass & limitation of waste recycling plant

Bio-mass: Availability of biomass and its conversion theory. Ocean Thermal Energy Conversion (OTEC): Availability, theory and working principle, performance, and limitations. Wave and Tidal Wave: Principle of working, performance and limitations. Waste Recycling Plants.

Reference books:

1. Twideu J., Weir T., "Renewal Energy Resources" BSP Publication (2006).
2. Rao M.V.R.K., "Energy Resources: Conventional & non-conventional" BSP Publication (2006)
3. Chauhan D.S., "Non-conventional Energy Resources" New Age International (2005)
4. Solanki C.S., "Renewal Energy Technologies: A Practical Guide for Beginners" PHI Learning (2004).
5. Auer P., "Advances in Energy System and Technology", Vol. 1 & II, Academic Press (2010).
6. Boyle G., "Renewable Energy Power for A Sustainable Future", Oxford University Press (2007).

INDUSTRIAL ELECTIVES

ICE-401		**CLIMATE CHANGE & SUSTAINABILITY**
Course category	:	Industrial Elective-1 (IE1)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor test and one Major Theory Examination.
Course Objectives	:	This course provides the knowledge and understanding of 1. Concepts of climate changes 2. Causes and consequences of climate change 3. Challenges to sustainability

		4. Concept of attaining sustainability
Course Outcomes	:	Students are expected to understand: 1. Climate Change and Sustainable Development 2. Concept within the dimensions of climate changes 3. The challenges to Sustainable Development. 4. Role of climate change 5. Goals of sustainable development 6. Role of stakeholders

Topics Covered	
UNIT-I	**9**

Introduction to Climate Change and Sustainable Development:
Principles and Approaches, Global Climate System, Climate Change: Causes and Consequences, Sustainable Development: Scope and Emerging Trends, Climate and Sustainable Development: An Interface.

UNIT-II	**9**

Climate Change:
Challenges and Choices, Climate Change: Forest and Biodiversity, Climate Change: Coastal Ecosystem, Climate Change: Agriculture and Food Security.

UNIT-III	**9**

Climate Change and Sustainable Development:
An overview, Climate Change, Policies and Programs of Sustainable Development Goals, Sustainable Development: National and State Policies

UNIT-IV	**9**

Achieving Sustainable Development Goals:
Role of Various Stakeholders, Building Partnership for Climate Change and Sustainable Development.

Reference books:

1. Steyn W., Harvey J., Krishnan K. G., "Climate change, energy, sustainability and pavements", New York: Springer (2014).
2. Cunningham W.P., Cunningham M.A., "Principles of Environmental Science", Tata McGraw-Hill Publishing Company, New Delhi (2002).
3. Nathans J.A., "Basic Environmental Technology", Prentice Hall of India, New Delhi (2002).

ICE-405	POLLUTION ABATEMENT TECHNIQUES	
Course category	:	Industrial Elective-2 (IE2)
Pre-requisite Subject	:	NIL
Contact hours/week	:	Lecture : 3, Tutorial : 1 , Practical: 0
Number of Credits	:	4
Course Assessment Methods	:	Continuous assessment through tutorials, attendance, home assignments, quizzes and two minor test and one Major Theory Examination.
Course Objectives	:	This course provides the knowledge and understanding of 1. Types of emission from chemical industries 2. Air pollution and its abetment techniques 3. Water pollution and its abetment techniques 4. Industrial remediation
Course Outcomes	:	Students are expected to understand: 1. The concept of pollutions caused by chemical plants 2. Types and sources of pollutions 3. Characterization of industrial effluents 4. Ways to control air pollution 5. Ways to control water pollution 6. The industrial regulations and remediation.

Topics Covered	
UNIT-I	**9**

Introduction

Types of emission from chemical industries and effects on environment, environmental legislation, types of pollution, sources of wastewater, effluent guidelines and standards, characterization of effluent streams, oxygen demands and their determination (BOD, COD and TOC), oxygen sag curve, BOD curve, mathematical relation controlling BOD curve, self-purification of running streams.

UNIT-II	**9**

Air pollution and abatement

Air pollutants, sources and characteristics, role of meteorological factors in air pollutants dispersion (ALP and ELP), plume behavior and characteristics, chill index and equivalent ambient temperature, chimney design considerations, plume rise, effective stack height, removal of particulate matters, principles and design of settling chambers, solid traps, cyclone separators, fabric and fiber filter, scrubbers and electrostatic precipitators.

UNIT-III	**9**

Water pollution and abatement

Introduction to wastewater treatment- methods of pre-and primary treatment- screening, sedimentation floatation, neutralization. Biological treatment of wastewater, bacterial and bacterial growth curve, aerobic processes, suspended growth processes, activated aerated lagoons and stabilization ponds, attached growth processes, trickling filters, rotary drum filters, anaerobic processes, methods of tertiary treatment, a brief study of carbon adsorption, ion-exchange reverse osmosis, ultra-filtration, chlorination, zonation)

UNIT-IV	**9**

Industrial remediation

Sources and characteristic of pollutants in fertilizer, paper and pulp, petroleum and petrochemical industry and their control with possible case studies

Reference books:

1. M. N. Rao and A.K. Dutta, "Wastewater Treatment", Oxford and IHB Publ., New Delhi (2020).
2. R.S. Ramalho, "Introduction to Wastewater Treatment", Academic Press, N.Y (1984).
3. C. S. Rao, "Environmental Pollution Control Engineering", New Age International (2007).

Syllabus of Audit Courses

CONSTITUTION OF INDIA

Course Code: : **AUC 01** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

COURSE OUTCOME:

At the end of the course, learners should be able to

CO1- Student will Identify and explore the basic features and modalities about Indian constitution

CO2- Students will be able to differentiate and relate the functioning of Indian parliamentary system at the center and state level.

CO3- Student will be able to differentiate different aspects of Indian Legal System and its related bodies.

UNIT 1--Introduction and Basic Information about Indian Constitution: Historical Background of the Constituent Assembly, The Preamble of the Constitution, Fundamental Rights, Fundamental Duties, Directive Principles of State Policy, Parliamentary System, Federal System.

UNIT 2-Union Executive and State Executive: Powers of Indian Parliament Functions of Rajya Sabha, Functions of Lok Sabha, Powers and Functions of the President, Powers and Functions of the Prime Minister, Judiciary.

UNIT 3- Introduction and Basic Information about Legal System: The Court System in India and Foreign Courtiers (District Court, District Consumer Forum, Tribunals, High Courts, Supreme Court).

UNIT 4- Intellectual Property Laws and Regulation to Information: Introduction, Legal Aspects of Patents, Filing of Patent Applications, Rights from Patents, Infringement of Patents, Copyright, Information Technology Act, 2000. The Company's Act:

Reference:

1) G. Austin (2004) Working of a Democratic Constitution of India, New Delhi: Oxford University Press.
2) Basu, D.D (2005), An Introduction to the Constitution of India, New Delhi, Prentice Hall.
3) N. Chandhoke & Priyadarshini (eds) (2009) Contemporary India: Economy, Society, Politics, New Delhi: Oxford University Press.
4) N.G Jayal and P.B. Maheta, (eds) (2010) Oxford Companion to Indian Politics, New Delhi: Oxford University Press.

Indian Culture and Heritage

Course Code: : **AUC 02** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Unit-I
Indian Culture: An Introduction, Characteristics of Indian culture, Significance of Geography on Indian Culture, Society in India, Religion and Philosophy in India.

Unit-II
Indian Languages and Literature, Evolution of script and languages in India, Harappan Script and Brahmi Script, History of Buddhist and Jain Literature.

Unit-III
A Brief History of Indian Arts and Architecture, Indian Art & Architecture: Gandhara School and Mathura School of Art; Hindu Temple Architecture, Buddhist Architecture, Medieval Architecture and Colonial Architecture. Indian Painting Tradition: ancient, medieval, modern Performing Arts: Divisions of Indian classical music: Hindustani and Carnatic, Dances of India: Various Dance forms: Classical and Regional, Rise of modern theatre and Indian cinema.

Unit-IV
Spread of Indian Culture Abroad, Causes Significance and Modes of Cultural Exchange - Through Traders, Teachers, Emissaries, Missionaries and Gypsies, Indian Culture in South East Asia, India, Central Asia and Western World.

Recommended Readings:

1. Barua, B. 1934-37. Barhut Vol. I-III. Calcutta: Indian Research Institute.
2. Cunningham, Alexander 1966. The Bhilsa Topes. Varanasi: Indological Book Corporation.
3. Cunningham, Alexander 1965. The Stupa of Bharhut. Varanasi: Indological Book Corporation.
4. Dallapiccola, L.S.Z. Lallemant. 1980. The Stupa : Its Religious, Historical, and Architectural Significance. Wiesbaden: Franz Steiner Verlag.
5. Dehejia, Vidya 1972. Early Buddhist Rock Temples A Chronological Study. London: Thames and Hudson

Indian Architecture

Course Code: : **AUC 03** **Credits (0-0-0)**
Course Category : **Audit**

Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course outcome
CO1- This course will help student learn about the development of Indian architecture and its contextual and traditional aspects.
CO2- The learner will gain knowledge of the development of architectural forms with reference to technology, style and character in various aspects of Hindu architecture.
CO3- The students will comprehend and relate to the theoretical basis of Budhdhist and Jain Architectures.

UNIT 1; Indus Valley Civilization: Town planning principles, cultural ethos, economy exemplified. The Aryan civilization: With its emphasis on the Vedic town plan.
UNIT 2: Buddhist Architecture Typology of lats, eddicts, stupas, viharas, and chaityas, both in rock-cut or other wise. The Buddhist philosophy and its imprint

UNIT3; Hindu Architecture, Indo Aryan: The evolution of the temple form, evolution of the shikhara in north India. The three schools of architecture - the Gujarat, the Khajuraho, and the Orrisan styles, Introduction to Dravidian Hindu Architecture.

UNIT 4: Jain Architecture : The temple cities of Palitana, Mount Abu and Girnar. Jain Theory The Jain philosophy and its imprint in built form.

REFERNCE BOOKS

1. Stella Kramrisch, The Hindu temple, Volume 1 & 2, Motilal Banarsidass Publications, 1996.
2. Percy Brown, Indian Architecture (Buddhist and Hindu period), D.B.Taraporewala Sons & co Pvt. Ltd. 1965
3. Volwahsen, Andreas, Living Architecture
4. Satish Grover, The Architecture of India- Volume 2, Vikas, 1980.
5. Henri Stierlin, Anne Stierlin, Hindu India: from Khajuraho to the temple city of Madurai, Taschen, 1998.
6. James Fergusson, History of Indian & Eastern Architecture, 2007
7. C. Batley, Design Development of Indian Architecture, John murray, London, 1934.

Indian Festivals

Course Code: : **AUC 04** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

CO1-Students will learn about rich cultural aspects associated with Indian religions

CO2-The course will give deep insight in to understand the importance of festivals.

UNIT 1; Indian Festivals: Introduction to major Indian festivals Bihu, Raksha Bandhan , Onam, Pongal, Holi, Dipawali, Dushehra, Easter, Good Friday, Christmas , Eid-ul-fitr and Eid-ul-Azha , Cultural aspects of festivals .

UNIT 2 ; **Characteristics of Indian festivals** ; Seasonal in nature, seasonal festival are Agro based, worships of animals.

UNIT 3; festivals observed at same time but with different names in different parts of country.

UNIT3 : Artificial or non religious festivals- like Jaisalmer desert festivals, Mango festivals in Delhi, Elephant festivals in India. Etc.

REFERENCE BOOKS

1) Discover India; Festival of India by Sonia Mehta

2) Hindu Festival : Origin, sentiments and Rituals by Mukuncharan Das.

VAIDIC MATHEMEATICS

Course Code:	**:**	**AUC 05**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture : , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course outcomes:

● Vedic mathematics methods are used in coding and VLSI implementation of encryption.
● Vedic mathematics method of division, exponentiation and multiplication are used in internet security and cryptographic algorithms for making these calculations faster than before.
● Arithmetic and logic unit (ALU) is responsible for all mathematical and logical calculations in computers. Some sutras like udharvtriyakbhyam and nikhilam are used for implementing multiplication methods.
● Digital Signal Processing (DSP) includes face recognition, text speech conversion, image processing and audio -video processing and also filtering of noise. In this area VM methods are very useful to improve the performance of DSP algorithms.

UNIT-I

Introduction & history of Vedic mathematics, Arithmetic and number, Vedic Maths Formulae, Addition and Subtraction: Addition - Completing the whole , Addition from left to right , Addition of list of numbers - Shudh method , Subtraction - Base method , Subtraction - Completing the whole, Subtraction from left to right

UNIT-II

Multiplication: Ekadhikenpurven method (multiplication of two numbers of two digits), Eknunenpurven method (multiplication of two numbers of three digits), Urdhvatiragbhyam method (multiplication of two numbers of three digits), Nikhilam Navtashchramam Dashtaha (multiplication of two numbers of three digits), Combined Operations

Division and Divisibility: Division, Nikhilam Navtashchramam Dashtaha (two digits divisor), Paravartya Yojyet method (three digits divisor)

Divisibility: Ekadhikenpurven method (two digits divisor), Eknunenpurven method (two digits divisor)

UNIT-III

Least Common Multiple **(LCM)** and Highest Common Factor **(HCF)**

Power and Root Power: Square (two digit numbers), Cube (two digit numbers).

Root: Square root (four digit number), Cube root (six digit numbers)

UNIT-IV

Contribution of Indian Mathematicians (In light of Arithmetic) , Aryabhatt , Brahmagupt , Mahaveeracharya , Bharti Krishna Tirtha

Reference Books:

1. Vedic Mathematics, Motilal Banarsi Das, New Delhi.

2. Vedic Ganita: Vihangama Drishti-1, Siksha Sanskriti Uthana Nyasa, New Delhi.

3. Vedic Ganita Praneta, Siksha Sanskriti Uthana Nyasa, New Delhi.

4. Vedic Mathematics: Past, Present and Future, Siksha Sanskriti Uthana Nyasa, New Delhi.

5. Leelavati, Chokhambba Vidya Bhavan, Varanasi.

6. Bharatiya Mathematicians, Sharda Sanskrit Sansthan, Varanasi.

ASTRONOMY

Course Code: : **AUC 06** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

UNIT-I

Historical introduction: Old Indian and western – astronomy – Aryabhatta, Tycho Brahe, Copernicus, Galileo – Olbers paradox – solar system – satellites, planets, comets, meteorites, asteroids.
Practical astronomy – telescopes and observations & techniques – constellations, celestial coordinates, ephemeris.
Celestial mechanics – Kepler's laws – and derivations from Newton's laws.
Sun: Structure and various layers, sunspots, flares, faculae, granules, limb darkening, solar wind and climate.

UNIT-II

Stellar astronomy: H-R diagram, color-magnitude diagram – main sequence – stellar evolution – red giants, white dwarfs, neutron stars, black holes – accretion disc – Schwartzchild radius – stellar masses Saha–Boltzman equation – derivation and interpretation.

Variable stars: Cepheid, RR Lyrae and Mira type variables – Novae and Super novae. Binary and multiple star system – measurement of relative masses and velocities. Interstellar clouds – Nebulae.

UNIT-III

Transformations Generalized Coordinates, Canonical transformations, Conditions for canonical transformation and problem, Poisson brackets, invariance of PB under canonical transformation, Rotating frames of reference, inertial forces in rotating frames.

UNIT-IV

Relativity and Application Concept of Special Theory of Relativity, Lorentz Transformation, Length Contraction and time dilation, Relativistic addition of velocities, conservation of mass and momentum, Concept of General Theory of Relativity, Equivalence of mass and energy, Relativistic Doppler shift and aberration of light. Lagrangian and Hamiltonian of relativistic particles, Relativistic degenerate electron gas.

Reference Books:

- "Textbook of Astronomy and Astrophysics with elements of Cosmology", V. B. Bhatia, Narosa publishing 2001.
- William Marshall Smart, Robin Michael Green "On Spherical Astronomy", (Editor) Carroll, Bradley W Cambridge University Press ,1977
- Bradley W.Carroll and Dale A. Ostlie. "Introduction to modern Astrophysics" Addison-Wesley, 1996.
- Bradley W.Carroll and Dale A. Ostlie, "An Introduction to Modern Astrophysics" Addison Wesley Publishing Company,1996
- 'Stellar Astronomy' by K. D Abhayankar.
- 'Solar Physics' by K. D Abhayankar.

ARTS OF INDIA

Course Code: : **AUC 07** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

CO1- Students will be introduced to emergence and development of art traditions upto 6th century C.E. Monuments will be studied in their cultural context.

CO2-Students will able to understand the monuments in their religious, regional and stylistic context. Students will be able to prepare plans of the monuments.

Unit 1:

Introduction to traditions of Art and Architecture in India . Introduction to Art and Architecture and prelude to historical art. ii. Art of the pre-Mauryan period. iii. Art and Architecture of Mauryan Period iv. Sources of Inspiration of Mauryan Art and Architecture: Foreign and Indigenous.

Unit 2:

Emergence and Development of Structural Stupa Architecture . Origin of Stupa Architecture. ii. Stupa Architecture - Pre-Mauryan and Mauryan periods. iii. North India, Central India, Deccan and Gandhara iv. Structural monasteries and Chaityas.

Emergence and Development of Rock-cut Architecture. Origin of Rock-cut Architecture. ii. Eastern India, Western Deccan, Eastern Deccan, Central India.

Unit 3:

Unit 4: Emergence and Development of Temple Architecture (08 hrs) i. Origin of Temple Architecture- Theoretical aspects. ii. Concept and symbolism of Temple. iii. Archaeological remains of structural temples. iv. Temple Architecture during the Gupta period. v. Temple Architecture during the Vakataka period.

Unit 4:

Sculptural Art and Paintings - Emergence and Development (10 hrs) i. Sculptural Art and Paintings -Concept and Symbolism. ii. Terracottas, Ivories and Bronzes iii. Paintings iv. Stone sculptures-Gandhara, Mathura, Sarnath and Andhra schools of Art. v. Art during the Gupta-Vakataka period.

Recommended Readings:

1. Barua, B. 1934-37. Barhut Vol. I-III. Calcutta: Indian Research Institute.
2. Cunningham, Alexander 1966. The Bhilsa Topes. Varanasi: Indological Book Corporation.
3. Cunningham, Alexander 1965. The Stupa of Bharhut. Varanasi: Indological Book Corporation.
4. Dallapiccola, L.S.Z. Lallemant. 1980. The Stupa : Its Religious, Historical, and Architectural Significance. Wiesbaden: Franz Steiner Verlag.
5. Dehejia, Vidya 1972. Early Buddhist Rock Temples A Chronological Study. London: Thames and Hudson

INTELLECTUAL PROPERTY RIGHTS

Course Code:	**:**	**AUC 08**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture : , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

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

CO1: Create an understanding on Intellectual Properties and the importance of it.

CO2: Understand Trademarks and Trade secrets. To create awareness of unfair completion and methods of it.

CO3: Create awareness on the protection copyrights and patents. Understand the Ownership rights and transfer.

CO4: Create awareness of Cyber laws, Cyber Crime and get understanding of Privacy of Data.

CO5: To create awareness international aspects of IPR and the Emerging Trends in IPR.

Course Content

UNIT – I: Introduction to Intellectual property: Introduction, types of intellectual property—Patent, Trademarks, Copy rights, IPR and World Trade Organization, other international organizations,

agencies and treaties, importance of intellectual property rights. Creating Intellectual Property. Intellectual Property Management. Emerging Issues in IPR. Research and Development in India.

UNIT – II: Fundamentals of Patent: Historical Overview of Patent Law; Concept of Patent; Patentable Inventions; Procedure for Obtaining Patent; Rights and Obligations of Patent Holder; Transfer and Infringement of Patent Rights, Geographical Indications, Case Study: Apple versus Samsung Patent Dispute.

UNIT – III: Trademarks: Purpose and function of trademarks, acquisition of trademark rights, protectable matter, selecting, and evaluating trademark, trade mark registration processes.

UNIT – IV: Copy rights: Fundamental of copy right law, originality of material, rights of reproduction, rights to perform the work publicly, copy right ownership issues, copy right registration, notice of copy right, international copy right law. Law of patents: Foundation of patent law, patent searching process, ownership rights and transfer.

Textbooks

- Textbook of Intellectual Property Rights, N.K. Acharya. Asia Law House, ed. 2021.
- Intellectual property right, Deborah. E. Bouchoux, Cengage learning.
- Intellectual Property Rights–Pandey Neeraj, Dharni Khushdeep. PHI.
- Intellectual Property Rights: Text and Cases R. Radhakrishnan, S. Balasubramanian. Excel Books.

Reference Books

1) Intellectual property right – Unleashing the knowledge economy, Prabuddha Ganguli, Tate McGraw Hill ltd.

2) A short course in International Intellectual Property Rights – Karla C. Shippey, World Trade Press.

3) Intellectual Property Rights – Heritage, Science, & Society under international treaties – A. Subbian, - Deep & Deep Publications – New Delhi.

HUMAN RIGHTS

Course Code:	**:**	**AUC 09**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture : , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes:

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

1. Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
2. Strengthen the respect for human rights and fundamental freedoms.
3. Enable all persons to participate effectively in a free society.
4. Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.

UNIT-I

The Basic Concepts: Individual, Group, Civil Society, State, Equality, Justice, Human Values: Humanity, Virtues, Compassion.

UNIT-II **Human Rights and Human Duties:**

i) Philosophical and historical foundation of human rights and duties
ii) Theories of rights
iii) Concept and classifications of human rights and duties
iv) Human rights and duties

1. Correlation of rights and duties/responsibilities
2. Tensions between rights inter se, duties inter se, and rights and duties

UNIT-III

Society, Religion, Culture, and their Inter-Relationship: Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

UNIT-IV

Social Structure and Social Problems: Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged.

Books & References:

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd), 2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

LOGICAL RESEARCH

Course Code: : **AUC 10** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination

Course outcome: In this course you should develop the following competencies:

CO1: To understand about research methodology with its different aspects, about logical reasoning, and types of research.
CO2: It will also result in knowledge appraisal from data collection to data interpretation.
CO3: Mathematical reasoning will also help them to acquire several skills required for the placement.

Course Content

UNIT1- Research Methodology: meaning, characteristics, Types of research; Process of research; Research methods and Ethical issues in research.

UNIT2- Logical Reasoning: arguments, deductive and inductive research, quantitative and qualitative research, scientific research; logical approach in research - Venn diagram; Inferences; analogies.

UNIT3- Data collection, Organization of data, Data analysis and mapping, Parametric and non-parametric; Data Interpretation.

UNIT4- Mathematical Reasoning, number series, letter series, codes; relationships, classification.

References:
1. Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition
2. Business Research Methods – Alan Bryman & Emma Bell, Oxford University Press.
3. Research Methodology – C.R.Kothari
4. Marketing Research- G C Beri
5. Logical reasoning- R S Agarwal

PROFESSIONAL ETHICS

Course Code: : **AUC 11** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:

Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

Course Outcomes

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

CO1: Understand the core values that shape the ethical behaviour of a professional.

CO2: Identify the multiple ethical interests at stake in a real-world situation or practice.

CO3: Explain the role and responsibility in technological development by keeping personal ethics and legal ethics.

CO4: Solve moral and ethical problems through exploration and assessment by established experiments.

CO5: Apply the knowledge of human values and social values to contemporary ethical values and global issues.

Course Content

Unit I:

Understanding Professional Ethics and Human Values: Morals, values and Ethics – Integrity- Academic integrity-Work Ethics- Service Learning- Civic Virtue Respect for others- Living peacefully- Caring and Sharing- Honestly- courage-Cooperation commitment Empathy-Self Confidence -Social Expectations.

Unit II:

Ethics for Engineers: Ethics – its importance – code of ethics – person and virtues – habits and morals – 4 main virtues – ethical theories – Kohlberg's theory – Gilligan's theory – towards a comprehensive approach to moral behaviour – truth – approach to knowledge in technology.

Unit III:

Environmental Ethics and Sustainability: Problems of environmental ethics in engineering – engineering as profession serving people – engineer's responsibility to environment – principles of sustainability – industrial, economic, environmental, agricultural, and urban sustainability – Sustainable development. - Global Ethical Issues.

Unit IV:

Social Experimentation, Responsibility and Rights: Engineers and responsible experiments – safety and risk – confidentiality – knowledge gained confidentiality – experimental nature of engineering – Intellectual Property Rights – professional rights – employee rights – occupational crime.

Textbooks

- Mike W Martin, Roland Schinzinger, " Ethics in Engineering", Tata McGraw –Hill.
- Govindarajan M, Natarajan S, Senthil Kumar V S, "Engineering Ethics" PHI India.
- R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi.

Reference Books

- Aarne Vesblind, Alastair S Gunn, "Engineering Ethics and the Enviornment".

- Edmund G Seebauer, Robert L Barry, "Fundamentals of Ethics for scientists and engineers" Oxford University Press.
- B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.

ENVIRONMENTAL LAWS

Course Code: : AUC 12 Credits (0-0-0)
Course Category : Audit
Pre-requisite Subject : NIL
Contact Hours/Week : 1/2 Lecture : , Tutorial : , Practical:
Number of Credits :
Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.
Course Outcomes:

The course gives students the opportunity to grapple with contemporary legal debates in environment law. Therefore, the learning outcomes of this course can be encapsulated as follows:

1) The primary learning outcome is to sensitize the students towards human activities that adversely affect the environment and the need for regulation of such activities.
2) Students will develop a thorough understanding of practice and procedure followed by various environmental law enforcing agencies/bodies.
3) Students will be able to pursue environmental litigation before the National Green Tribunal and assist the Tribunal as a researcher or in any other capacity.
4) Students will be able to assist industries and projects in obtaining environmental clearance and compliances with other environmental laws.

UNIT-I

Development of Environmental Laws and Policies in India:

I. Concept of 'environment' and understanding scope of environmental law.
II. Two approaches towards environmental protection- 'Eco-centric approach' and 'Anthropocentric' approach.
III. Impact of IEL on environmental law in India.
IV. Significance of Environmental Protection in Five Year Plans.
V. Development of the 'Right to Environment' as a Fundamental Right and challenges.

UNIT-II Judicial remedies and the role of National Green Tribunal:

I. Civil Remedies i.e. Tortious remedy and Class Action

II. Criminal Law Remedies under relevant provisions of Indian Penal Code, 1860 and Criminal Procedure Code, 1973
III. Constitutional Law Remedies i.e. Writ Jurisdiction & Public Interest Litigation
IV. Statutory Remedies i.e. Remedies under Public Liability Insurance Act 1991, National Environment Tribunal Act, 1995, National Green Tribunal Act, 2010

UNIT-III

Statutory framework for Prevention of Environmental, Air and Water Pollution:

I. Water (Prevention and Control of Pollution) Act 1974 [Framework of the Act, Criminal Liability and Judicial relief under the Act, Constitutional Challenges of Restraining Orders under Section 33]
II. The Air (Prevention and Control of Pollution) Act 1981 [Framework of the Act, Criminal Liability and Judicial relief under the Act, Noise Pollution]
III. Environment (Protection) Act, 1986 [Framework of the Act, Enforcement mechanisms and Role of Pollution Control Boards, Environment Impact Assessment, Coastal zone regulations Notifications]
IV. Law on Waste Management and Handling
V. Procedural environmental rights under various environmental laws
   - Right to Information
   - Right to public consultation
   - Right of access to justice

UNIT-IV

Statutory framework governing Forest, Wildlife and Biodiversity:

II. Statutory Framework on Forest Preservation [The Indian Forest Act, 1927; Forest (Conservation) Act, 1980; National Forest Policy, 1988; The Scheduled Tribe and other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006]
III. Statutory Framework on Wildlife & Biodiversity Protection [The Wildlife (Protection) Act, 1972; Implementation and gaps and Judicial Perspective; Biological Diversity Act, 2002]

Books & References:

1) Shyam Divan & Armin Rosencranz, Environmental Law & Policy in India (2 nded, Oxford University Press, 2014)
2) P. Leelakrishnan, Environmental law in India (4th ed, LexisNexis, 2016)
3) Lavanya Rajamani and Shibani Ghosh, Indian Environmental Law: Key Concepts and Principles (Orient Blackswan, 2019)
4) Gitanjali Nain Gill, Environmental Justice in India: The National Green Tribunal (Routledge, 2017)
5) Patricia Birnie, Alan Boyle and Catherine Redgwell, International Law and the Environment (3rd ed., Oxford University Press, 2009)
6) Philippe Sands, Principles of International Environmental Law (2nd ed, Cambridge University Press, 2003)

HEALTH LAW

Course Code: : **AUC 13** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:
Number of Credits : 0 Credit

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination

Course Outcome: In this course you should develop the following competencies:
CO1: Knowledge and understanding of the values and policies underlying Health Law.
CO2: Knowledge and understanding of substantive law related to health care, health care insurance markets as well as related procedural law.
CO3: Written and oral communication in the legal context.

Course Content

UNIT-1 BASICS OF HEALTH LAW- Basic of Health and its provider, Origin & Evaluation, All Council Acts.

UNIT-2 NEED FOR HEALTH LAW -Fraudulence, Negligence and Abuse, Human Rights, Rights & Duties of Health Care Provider (Public & Private Activities).

UNIT-3 LEGAL ASPECTS OF HEALTH LAW- Role of Health Policy & Health Care Delivery, General Laws on Health Law (Medical Allied Agencies), Specific Laws on Health Law (NDT, PWD/etc.).

UNIT-4 MEDICAL INSURANCE –Introduction-Various types, Significance and Kind of Medical Insurance/Policies, Insurance & Assurance, General Principles of Law and Contract, Medical Insurance Regulations.

REFERENCES:
1)Jonathan Herring- Medical Law and Ethics
2)Mason and Mc Call Smith- Law and Medical Ethics
3)S. V. Jogarao- Current Issues in Criminal Justice and Medical Law

National Cadet Corps (NCC)

Course Code: : **AUC 14** **Credits (0-0-0)**
Course Category : **Audit**
Pre-requisite Subject : NIL
Contact Hours/Week : ½ Lecture : , Tutorial : , Practical:

Number of Credits : 0 Credit

Course Outcome: In this course you should develop the following competencies:

CO1: Imbibe the conduct of NCC cadets.
CO2: Respect the diversity of different Indian culture.
CO3: Perform his/her role in Nation Building
CO4: Do the social services on different occasions.
CO5: Practice togetherness and empathy in all walks of their life.
CO6: Do the asana and gain the physical& mental fitness

Course Content

UNIT 1
NCC General

History, Aims, Objective of NCC, NCC as Organization. Incentives of NCC, Duties of NCC Cadet, NCC Camps: Types & Conduct.

UNIT 2
National Integration & Awareness

National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security

UNIT 3
Social Service and Community Development

Celebration of Days of National & International Importance, Social Service and Community Development Activities to be conducted.

UNIT 4
Health & Hygiene:

Yoga- Introduction, Definition, Purpose, Benefits.
Asanas-Padamsana, Siddhasana, Gyan Mudra, Surya Namaskar, Shavasana, Vajrasana, Dhanurasana, Chakrasana, Sarvaangasana, Halasana etc.

Textbooks:

1. R. Gupta, "NCC: Handbook of NCC Cadets for 'A', 'B' and 'C' Certificate Examinations" 1st Edition (English, Paperback, RPH Editorial Board)

Basics of Human Health and Preventive Medicines

Course Code:	**:**	**AUC 15**	**Credits (0-0-0)**
Course Category	**:**	**Audit**	
Pre-requisite Subject	:	NIL	
Contact Hours/Week	:	1/2 Lecture: , Tutorial : , Practical:	
Number of Credits	:	0 Credit	

Course Assessment Methods: Continuous assessment through tutorials, attendance, home assignments, quizzes, practical, Tutorial class, viva voce and Minor tests and One Major Theory Examination.

UNIT- 1

Health- Definition, dimensions, concept of wellbeing, Physical quality of life index, Spectrum of health, Determinants of health.

Concept of disease- Epidemiological triad, Natural history of disease, Risk factors, risk group, Iceberg of disease, Disease control, Disease elimination, Disease eradication, **Monitoring and surveillance-** Concept of prevention, Primary, Secondary and Tertiary, Modes of Intervention.

UNIT- 2

Communicable diseases- Type of microorganisms, Mode of transmission, Prevention of infectious diseases, Vaccination/immunization**.**

Diarrheal diseases and dehydration- Prevention and role of ORS**.**

Fever- cause and how to deal with.

Respiratory problems and cough

UNIT - 3

Non communicable diseases/ Lifestyle related disorder- Risk factors, CAD, risk and prevention, Hypertension, Diabetes mellitus, Obesity, Cancer, Accidents.

UNIT – 4

Nutrition and health- Classification of food, Balance diet.

Occupational hazards

Mental health and substance abuse

Medical Emergencies- BLS and ALS.

Reference Textbook

1) K. Park – "Park's Textbook of Preventive and Social Medicine"
2) Yash Pal Bedi & Pragya Sharma– "Handbook of Preventive and Social Medicine, Seventeenth Edition, CBS Publication".
3) Sunder Lal, Adarsh, Pankaj – "Update on Textbook of Community Medicine Preventive and Social Medicine with Recent Advances" 5th Edition, Publication 2018.
4) Dr. B. Saha- "Preventive and Social Medicine Communicable Disease Hygiene".
5) Rabindra Nath Roy, Indernil Saha- "Mahajan and Gupta Textbook of Preventive and Social Medicine" 4th Edition, Japee

Detail Syllabus of Extra Curricular Activities (ECA) Courses under Council of Student Activities

Skill Development- I (ECA-151)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and IEEE:** An introduction to technical sub-council and IEEE. An overview of IEEE and the events conducted by them.

UNIT- 2

- **Robotics Classes:** Informative classes conducted on by the students of IEEE about Bot modelling and electronics as well as embedded. It is conducted for both Wired and Wireless Robotics.

UNIT- 3

- **Introduction to Workshops by IEEE:** *Workshop* is a brief intensive course for a small group which emphasizes problem solving. A number of workshops are conducted by IEEE like Ethical hacking, Soft skills, Artificial Intelligence etc.

UNIT- 4

- **Events under TechSrijan:** Techsrijan is the annual techno-management fest held every year like Enigma, Robotics, Incognito, Quizzes, World Parliament, etc.

Skill Development- II (ECA-201)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and SAE:** An introduction to technical sub-Council and SAE. An overview of SAE and the events conducted by them.

UNIT- 2

- **Aeromodelling Classes:** Informative classes and workshop conducted on by the students of SAE about Drone and remote-controlled modeling and electronics as well as embedded.

UNIT -3

- **Introduction to Workshops by SAE:** *Workshop* is a brief intensive course for a small group which emphasizes problem solving. A no. of workshops is conducted by SAE like Aeromodelling workshop, Bridge modeling etc.

UNIT- 4

- **Events under TechSrijan by SAE:** Techsrijan is the annual techno-management fest held every year. SAE conducts a number of events in TechSrijan like Junkyard Wars, Bride Kriti, El Tiro etc.

Skill Development- III (ECA-251)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and UIC:** The University Innovation Cell supports and provides opportunity for Innovation works. You will get to learn about the things they do and promote.

UNIT -2

- **Introduction to Innowizion:** Every year University Innovation Cell organizes a national level event that provides opportunities for students across all disciplines to team up and use their creativity, passion, and knowledge of technology. Events like I-Expo and I-Quiz.

UNIT- 3

- **Introduction to Spectra:** It is a special event organized by University Innovation Cell which foster an opportunity for students to showcase their creativity and talent. It comprises of three events InQUIZitive, Replica and MindBuzz**.**

UNIT- 4

- **Learnings and Innovation:** Innovation increases your chances to react to changes and discover new opportunities. It can also help foster competitive advantage as it allows you to build better products and services for your customers in the industry.

Skill Development- IV (ECA-301)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and SEB:** The Social Engineers Board (SEB) tries to achieve its goals by series of various events conducted throughout the academic year, both inside and outside the university.The members of the board are highly motivated individuals striving for noble cause, and voluntarily take initiatives which ensure betterment of the people and society in any way possible.

UNIT- 2

- **Introduction to Drishya:** A career counselling event by college final year, and an event designed to crave out the creativity inside the students and their ability to make something novel out of normality in situation

UNIT- 3

- **Introduction to Dhishan:** Bringing out the oration skill and leadership personality among the students by providing them chance to stand and represent themselves by this event.

UNIT -4

- **Introduction to Paravartan and NGOs:** Paravartan consists of a audio visual round and the second round is a skit presentation developing character of a student. They also collab with NGOs for social works.

Skill Development- Vth (ECA-351)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and E CELL:** E-Cell of Madan Mohan Malaviya University of Technology promotes entrepreneurship abilities among the students of the university and conducts events to promote these ideas.

UNIT- 2

- **Introduction to Fresher's Talk:** A creative talk with the freshers of our university in which the fresher students provide some insights of what and how are they feeling about the college and its environment.

UNIT- 3

- **Introduction to Start Up Week:** Understanding the aspects of and entrepreneurial background and train to become one, through various personality developing as well as professionally balanced events.

UNIT- 4

- **Entrepreneurship Development:** It is the process of enhancing the skillset and knowledge of entrepreneurs regarding the development, management and organization of a business venture while keeping in mind the risks associated with it. Students will learn and cultivate skills which will promote entrepreneurship.

Skill Development-VIth (ECA-401)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Participation and Training
Course Outcome	:	Students are expected to learn and develop their skill and their personality through the activities and trainings under the council and should be well versed with the listed activities and events.

UNIT- 1

- **Introduction to TSC and Robotics Club:** Robotics Club speaks a name for itself in this domain with a sheen of itself that has been set by the high standards of the club members and strict adherence to the tagline Transforming ideas into reality, Events Details

UNIT- 2

- **Introduction to Web D Classes:** Classes on web development helps students to develop skills like Front-end and Back-end development which they can use to make websites.

UNIT -3

- **Introduction to Engineers Week:** a seven-day event paying tribute to all the engineers across the globe by conducting a no. of exciting events for technical development of students.

UNIT- 4

- **Robomania:** Develop the knowledge of robotics and circuitry in the students through training of students on circuits and the conduction of Robo Wars, Electronic chess, diffusion of a bomb in a set up made by students, demonstration of live game of the virtual events of NFS and Tekken, Lazer strike, Designing of Lazer maze.

Unity and Discipline (NCC)-I (ECA-171)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to:

- Imbibe the conduct of NCC cadets.
- Do the social services on different occasions.

UNIT -1
Introduction of NCC: History, Aims, Objective of NCC.

UNIT -2
NCC as Organization. Incentives of NCC, Duties of NCC Cadet.

UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT- 4
NCC Parade on Independence Day.

Unity and Discipline (NCC)-II – (ECA- 221)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: -

- Respect the diversity of different Indian culture.
- Do the social services on different occasions.

UNIT- 1
National Integration & Awareness, Importance & Necessity

UNIT- 2
Factors Affecting National Integration, Unity in Diversity

UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT- 4
NCC Parade on Republic Day.

Unity and Discipline (NCC)-III – (ECA-271)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: - • Perform his/her role in Nation Building. • Do the social services on different occasions.

UNIT- 1
Role of NCC in Nation Building.

UNIT- 2
Threats to National Security.

UNIT -3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT- 4
NCC Parade on Independence Day.

Unity and Discipline (NCC)-IV- (ECA-321)

Course Category	:	NCC
Pre Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Lecture & Practical
Course Outcome	:	After completing this course, the students will be able to: - • Contribute to environmental awareness and conservation activities. • Develop Leadership Qualities. • Do the social services on different occasions.

UNIT -1
Environmental Awareness and Conservation.

UNIT -2
Leadership Development: Important Leadership traits, Indicators of leadership.

UNIT- 3
Celebration of Days of National & International Importance, Social Service and Community Development Activities

UNIT -4
NCC Parade on Republic Day.

National Service Scheme-I (ECA-172)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall

strive for the well-being of the society.

Introduction to National Service Scheme:

UINIT-I: History and its Objectives
UNIT-II: Organizational structure of N.S.S. at National, State, University and College Levels

UNIT-III: Advisory committee and their functions with special reference to University CSA, Program officer, N.S.S. group leader and N.S.S. volunteers in the implementation**.**

UNIT-IV: Organization/ Participation in "Tree-Plantation Drive"

National Service Scheme- II (ECA-222)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall strive for the well-being of the society.

UNIT-I: National Integration, Need and importance of National integration

UNIT-II: Various obstacles in the way of National Integration, such as caste, religion, language and provisional problems etc.

UNIT-III: NSS related Activities: Awareness to various activities under NSS.

UNIT-IV: Organization/Participation in "Cleanliness Drive" at home, hostel, Department and University

UNIT-V: Organization/Participation in "Winter cloth collection and distribution to needy people"

National Service Scheme- III (ECA-272)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0

Course Assessment Method : Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.

Course Outcome : The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers

shall strive for the well-being of the society.

UNIT-I: Special Programme in NSS-I

A) Legal awareness
B) Health awareness
C) First-aid

UNIT-II: Special Programme in NSS-II

A) Career guidance
B) Leadership training-cum-Cultural Programme
C) Globalization and its Economic Social Political and Cultural impacts.

UNIT-III: Special Camping programme in NSS-I

A) Nature and its objectives
B) Selection of campsite and physical arrangement
C) Organization of N.S.S. camp through various committees and discipline in the camp.

UNIT-IV: Special Camping programme in NSS-I

A) Activities to be undertaken during the N.S.S. camp.
B) Use of the mass media in the N.S.S. activities.

National Service Scheme- IV (ECA-322)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	NIL
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Continuous assessment through National Service Scheme related tasks, participation in different events organized, attendance, home assignments.
Course Outcome	:	The students are expected to be able to demonstrate the following knowledge, skills and attitudes in achieving NSS motto after completing this course:

- The Motto of NSS "Not Me but You", reflects the essence of democratic living and upholds the need for self-less service.
- NSS helps the students' development & appreciation to other person's point of view and also show consideration towards other living beings.
- The philosophy of the NSS is a good doctrine in this motto, which underlines on the belief that the welfare of an individual is ultimately dependent on the welfare of the society as a whole and therefore, the NSS volunteers shall strive for the well-being of the society.

UNIT-I: N.S.S. Regular Activities-I

A) Traffic regulation
B) Working with Police Commissioner's Office
C) Working with Corporation of Gorakhpur District

UNIT-II: N.S.S. Regular Activities-II

A) Working with Health Department
B) Blind assistance
C) Garments collection and distribution

UNIT-III: N.S.S. Regular Activities-III

A) Non-formal Education
B) Environmental Education Awareness and Training (EEAT)'
C) Blood donation

UNIT-IV: N.S.S. Regular Activities-IV

A) Adopted Village related works
B) Disaster/Pandemic management

GAMES & SPORTS-I (ECA-181)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills, and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track.

Track & Field-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS:**

- Starting techniques: Standing start, Crouch start and its variations, Proper use of blocks.
- Finishing Techniques: Run, Through, Forward lunging, Shoulder Shrug.

UNIT- 3

- **FUNDAMENTAL SKILLS-II:**

- Various patterns of Baton Exchange.
- Understanding of Relay Zones.
- Rules & their interpretation.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Track & Field

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-II (ECA-231)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track.

Basketball-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS- I:**

- Player stance and ball handling.
- Passing-Two Hand chest pass, Two hand Bounce Pass, One Hand Baseball pass, Side Arm Pass, Over Head pass, Hook Pass.
- Receiving-Two Hand receiving, One hand receiving, Receiving in stationary position, Receiving while jumping, Receiving while running.

UNIT- 3

- **FUNDAMENTAL SKILLS- II:**

- Dribbling-How to start dribble, how to drop dribble, High dribble, Low dribble, Reverse dribble, Rolling dribble.
- Shooting-Lay-up shot and its variations, one hand set shot, one hand jump shot, Hook shot, and Free throw.
- Individual Defensive-Guarding the man with and without the ball, pivoting.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-III (ECA-281)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track

Volleyball-

UNIT- 1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS-I:**
- Service-Under Arm Service, Tennis Service, Floating Service.
- Overhead finger pass.
- The Dig (Under Arm pass).

UNIT- 3

- **FUNDAMENTAL SKILLS –II:**
- Back court defense.
- Defensive and Offensive strategies.
- Smash
- Block–individual and team.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**
- Drills and Lead-up Games.
- Marking and Layout of Field.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS-IV (ECA-331)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track for running events.

Hockey-

UNIT-1

- **INTRODUCTION:**

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International

UNIT- 2

- **FUNDAMENTAL SKILLS-I:**

- Player stance & Grip,
- Rolling the ball, Dribbling.
- Push, Stopping.
- Hit, Flick, Scoop.
- Reverse hit.

UNIT- 3

- **FUNDAMENTAL SKILLS-II:**

- Passing–Forward pass, square pass, triangular pass, diagonal pass, return Pass.
- Goalkeeping–Hand defense, foot defense.
- Positional play in attack and defense.

UNIT- 4

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

GAMES & SPORTS- V (ECA- 381)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course. • Understand the concept of skill. • Acquire the required motor skills. • Demonstrate and assess various techniques of starts and finish. • Interpret the rules & regulations. • Acquire skill of marking track for running events.

UNIT 1

- **YOGA- HOLISTIC HEALTH:**

 Health- Concept of Health, its importance in human life.

 Components of health.

UNIT-II

- **YOGA AND ITS IMPORTANCE:**

- Definition of Yoga.
- Importance of Yoga in daily life.
- Aims and Objective of yoga.
- Misconception of yoga.

UNIT-III

- **SURYA NAMASKAR:**

- Benefits of Surya Namaskar
- Practices of Surya Namaskar

Unit- IV

- **YOGA PRACTICES:**

 Asana- Meditative
  i) Sukhasana
  ii) Padmasana
  iii) Swastikasana

 Cultural- Trikonasana, Makarasana, Bhujangasana, Sarpasana, Dhanurasana.

 Pranayama- Yogic Breathing, Anulom-Vilom.

Books & References

1. Indra Devi, “Yoga For You”, Gibbs, Smith publishers, Salt Lake City, 2002 Domen& Publishers, New Delhi-2001.
2. Yoga se Arogya, Indian Yoga Society, Sagar.

Games & Sports -VI (ECA- 431)

Course Category	:	Extra-Curricular Activities
Pre-Requisite	:	Physical Education at 12th standard
Contact/Hours of Work	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Method	:	Practical Training and Practices.
Course Outcome	:	The students are expected to be able to perform the following Knowledge, skills and attitudes after completing this course.

- Understand the concept of skill.
- Acquire the required motor skills.
- Demonstrate and assess various techniques of starts and finish.
- Interpret the rules & regulations.
- Acquire skill of marking track for running events.

UNIT- 1

- **Badminton**

INTRODUCTION:

Historical development

- National
- International

Structure and functions of Controlling Bodies

- National
- International.

UNIT-II

- **FUNDAMENTAL SKILLS-I:**

- Racket parts, Racket grips, Shuttle (dimensions).
- The basics stances.
- Basic foot movements.

UNIT-III

- **FUNDAMENTAL SKILLS-II:**

- The basic strokes-Serves.
- Forehand-overhead and underarm.
- Backhand-overhead and underarm.
- Types of games-Singles, doubles, including mixed doubles.

Unit- IV

- **FUNDAMENTAL SKILLS-III:**

- Drills and Lead-up Games.
- Marking and Layout of Court.

Books & References

1. Latest Official Rule Books of International Federation
2. Coaching Manuals of International Federation
3. Official Website

Culture, Art & Literary-I (ECA-182)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their Personality through cultural and literary activities.

UNIT-1

Workout, Warm up, Stretching, Introduction to various dance forms, Dance form – Bollywood, Footwork, Body Movement, Theatre History, Literature and Aesthetics, Introduction to Acting, Yoga(Breathing, Exercise, Voice Control and Sound Modulation).

UNIT-2

Introduction to music, Basic Terminologies related to music, Origin of sound, Historical study of musical terms, Basic Introduction to Fine Arts, Roll of FAC in cultural sub-council, Basics of Fine Arts and Types, File extension, Editing software, Resources for stock images and video.

UNIT-3

MALVIKA: Basic knowledge of designing software (I) : Adobe In Design ,Photoshop ,Notice Making, Article writing.

UNIT-4

TIRESIA: Basic knowledge of designing software (I): Adobe In Design, Photoshop, Interview skills, Vocabulary development, Knowledge about technical advancements, knowledge of campus activities.

Culture, Art & Literary-II (ECA-232)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their personality through cultural and literary activities.

UNIT-1

Intro to basics of sketching, Painting, Craft, Sculpturing.

Sketch-Tools of sketching, Types of Sketching- Pencil/ Pen/ Color Pencil/ Charcoal/ Graphite/Ink/ Chalk / Digital Sketch. History of Indian Music, About life and contributions of Indian Musician sand Musicologists.

Two forms of Indian Classical Music (Hindustani/Karnataka).

UNIT-2

Introduction to Theatre Technique and Design, Character Analysis and practical on principle of Stanislavski Method (relaxations, concentration of attention and emotion memory), Workout, Warm up, Stretching, Dance Form- Hip-Hop, Footwork, Body movement, Choreography, Equipment, Types of lenses, building web site using template.

UNIT-3

ARUNODAY: Development of thinking ability with JAM (Just a Minute), Word Building, Letter rearrangement, Knowledge of spellings, Syllables, Critical thinking skill development, Vocabulary development, Thought expressing skill development, public speaking skill development.

UNIT-4

SPELLCZAR: Word building, Vocabulary development, Decision making ability development, Coordination capabilities.

Culture, Art & Literary-III (ECA-282)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment Methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their personality through cultural and literary activities.

UNIT-1

Photo editing (Photoshop)

Ras- (Sringar Ras, Hasya Ras, Rodra Ras, Karun Ras, Vir Ras, Adbhut Ras, Vibath Ras, Bhayanak Ras, Shaant Ras)

UNIT-2

Workout, Warmup, Stretching, Pranam, Types of classical dance forms and their outfits, Dance form-Kathak, Hand movements, Choreography, Basic knowledge of Talas for Instance Teental, Dadra and Kherwa, Practice of AUM and vocal exercises of sargam (sa, re, ga, ma, pa, dha, ni) of 45. Alankaras, Styles of Sketching-Line/ Hatching/Blending/Scribbles/Tattoo/Doodling/Cartoon/Graffiti/Typography/Calligraphy/Caricat Ure

UNIT-3

ANNUAL DEBATE COMPETITION: General Knowledge & Current Affairs, Public speaking skill development, Oratory skill development, Sense of Team spirit, Knowledge of language, Social Study, Development of presentation skills.

UNIT-4

TWIST AND TWAIN: Development of imaginative power and creativity, Development of vocabulary, Development of writing skills, Thinking skill development.

Culture, Art & Literary-IV (ECA-332)

Course category	:	Cultural, Art &Literary
Pre-requisite Subject	:	NIL
Contact hours/week	:	2 Hours/Week
Number of Credits	:	0
Course Assessment methods	:	Practical Participation
Course Outcomes	:	Students are expected to develop their soft skills and their Personality through cultural and literary activities.

UNIT-1

Video editing, Basic knowledge about musical instruments (Tabla, flute, guitar etc.) about Swarmalika and two bragas-Bhupaliand Yaman.

UNIT-2

Monologue, reciting a poem, reading short stories, developing speech skill, Mime, Working on scene with partner and in a group, Painting-Tools of painting, Styles of painting-Abstract/Imagination/Expression/Cubism/Indian/Chinese/Japanese, All the theory covered upto Praveshi ka Purna, define and explain Kataaksha,Primalu, Nartan Bhedas- Nritta Nrutya and Natya, define Tandav and Lasya, Fourty pesof neck movements according to Abhinaya Darpan, Eight types of eye movements according to Abhinaya Darpan, Define and differentiate "FolkDance" and "Modern Dance" (Uday Shankar style), Life story of: Bindadin Maharaj, Kalka Prasadji, Harihar Prasadji& Hanuman Prasadji, Specialty of Jaipur and Lucknow Gharana,Definition and uses of the following Asanyukta Hasta Mudras: Sarpsheersha, Murga-sheersha, Simha-Mukha, Kangula, Alapadma, Chatura, Bhrama, Hansasya, Hansa-paksha, Sandausha, Mukula, Tamrachuda, Vyagraha, Trishula, Sanyukta HastaMudra: Anjali, Kapota, Karkata, Swastik, Dola, Pushpaputa, Utsanga, Shivalinga, Katakawardhan, Kartari-swastk, Shakata, Shankha.

UNIT-3

VAGMITA1: Development of oratory skill, Development of poetry writing skill, Alankar, Ras, Creative thinking ability development.

UNIT-4

VAGMITA 2: How to overcome camera consciousness, enhancement of the expression and presentation of the participants, development of the public speaking skill, Knowledge of tone adjustment while presenting.

Culture, Art & Literary-V (ECA-382)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their personality

UNIT-1

Types of painting-Oil painting/ Watercolor painting/ Pastel painting/ Acrylic painting/ Digital painting/Spray Painting, Basic of Contemporary Dance, Foot Position and Transference, Center Technique, Travelling Technique, Dance, Dance (A) Peter Pan, dance (B) Emergence of a Butterfly.

UNIT-2

Improvisation, Elementary knowledge of Acting, Body language, Rhythm, Clarity and fluency in dialogue delivery, Understanding the depth of character, about terms related to Hindustani music like Naad, Shuruti, Saptak, Thaat, Vaadi, Samvadi, Photography Skill.

UNIT-3

MALAVIYAN THINKER: Creative thinking, how to pen down thoughts of our mind, Development of writing skill, Development of Expression, Public Speaking skill development.

UNIT-4

ABHYUDAYA: Multidimensional skill development: Technical skill development with software like Adobe Photoshop, MS word, MS PowerPoint, MS Excel, Content Writing skill development, public addressing, public engagement, Team work Mechanism, Leadership qualities, Time management, art and craft, Pottery, Oratory skill development, Presentation skill, Event management.

Culture, Art & Literary-VI (ECA-432)

Course category	: Cultural, Art &Literary
Pre-requisite Subject	: NIL
Contact hours/week	: 2 Hours/Week
Number of Credits	: 0
Course Assessment methods	: Practical Participation
Course Outcomes	: Students are expected to develop their soft skills and their personality

UNIT-1

Cinematography, Basic knowledge of Thaat system, Raga formation rules, 5 Ragas- Bhupali, Yaman, Bihag, Kafi, Deskar.

UNIT-2

Introduction to Nukkad, Mono Act, Skit, Introduction to Comedy, Tragic Comedy, Tragedy, Melodrama, Craft- Tools of craft, Types of Craft- paperwork/ Wood work/ foam work/ Cloth work, Popping/ Introto music theory, Angles and Movement/Music Theory, Direction and Levels/Rhythms for Grooves, Twists and isolated movements/8 Count Phrasing, Footwork/Floats and Glides, Waves/Movements Dynamics, Waves 2/Musical Phrasing, Putting it all together.

UNIT-3

WRITING SKILLS: Invitation making, Notice making, Article writing.

SKILL FOR INTEVIEWER: How to take formal interview, approaching the personality, Questions preparation, management, platform selection, public engagement.

UNIT-4

INTERVIEW SKILLS FOR INTERVIEWEE: Body language, Attire, Hand gestures, voice tone, Language, General Interview Questions- How to introduce yourself.