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UNIVERSITY OF MYSORE

Estd. 1916

VishwavidyanilayaKaryasoudha
Crawford Hall, Mysuru- 570 005

No.AC2(S)/54/2024-25 Dated: 15.07.2024

Notification

Sub:- Syllabus and Scheme of Examinations of Civil Environmental Engineering programme regarding.

Ref:-1. Decision of Board of Studies in Civil Environmental Engineering meeting held on 10-06-2024.
2. Decision of the Faculty of School of Engineering meeting held on 14-06-2024.
3. Decision of the Academic Council meeting held on 28-06-2024.

*****

The Board of Studies in Civil Environmental Engineering which met on 10-06-2024 has resolved to recommend & approved the Syllabus and Scheme of examinations of Civil Environmental Engineering programme at School of Engineering.

The Faculty of School of Engineering and Academic Council at their meetings held on 14-06-2024 and 28-06-2024 respectively has also approved the above said Syllabus and Scheme of examinations, hence it is hereby notified.

The Syllabus and Scheme of Examinations content may be downloaded from the University Website i.e., www.uni-mysore.ac.in.

Registrar

Registrar
University of Mysore
Mysore

To;

1. The Registrar (Evaluation), University of Mysore, Mysuru.
2. The Chairman, BOS/DOS in Civil Environmental Engineering, Manasagangothri, Mysore.
3. The Dean, Faculty of Engineering, DOS in MGM.
4. The Deputy Registrar/Assistant Registrar/Superintendent, Administrative Branch and Examination Branch, University of Mysore, Mysuru.
5. The PA to Vice-Chancellor/ Registrar/ Registrar (Evaluation), University of Mysore, Mysuru.
6. Office Copy.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

Scheme of Teaching and Examination2021-2022 (As per NEP-2020)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

III SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	BSC	21MAT31	Engineering Mathematics-III	Basic Science	Basic Science	2	2	0	03	50	50	100	3
2	IPCC	21CV32	Surveying and Geomatics	CEE	CEE	3	0	2	03	50	50	100	4
3	IPCC	21CV33	Earth Resources Engineering	CEE	CEE	3	0	2	03	50	50	100	4
4	PCC	21CV34	Building Materials & Construction	CEE	CEE	3	0	0	03	50	50	100	3
5	IPCC	21CV35	Strength of Materials	CEE	CEE	3	0	2	03	50	50	100	4
6	PCC	21CVL36	Computer Aided Building Drawing	CEE	CEE	1	0	2	04	50	50	100	2
7	BSC	21CIV37	Environmental Studies	CEE	CEE	1	0	0	0	50	-	50	1
8	UHV	21UHV38	Universal Human Values and Professional Ethics	Basic Science	Basic Science	1	0	0	NA	50	-	50	1
Total						**17**	**02**	**08**	**19**	**400**	**300**	**700**	**22**

Note: BSC: Basic Science Courses, ESC: Engineering Science Courses, PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses UHV: Universal Human Values, HSMC: Humanity, Social Science and Management Courses. NCMC: Non-credit mandatory course, INT: Internship, Pro

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

9	NCMC	21MATDIP31	Additional Mathematics-1	Basic Science	Basic Science	2	1	0	03	50	-	50	0
10	NCMC	21KANDIP32	Technical Kannada	Basic Science	Basic Science	0	2	0	-	50	-	50	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE programs, shall attend the classes during the respective semesters to complete all the formalities of the course and need not to appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade.

(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree

Credit Definition:

- 1-hour lecture**(L)** per week per semester = **1 Credit**
- 2-hour tutorial **(T)** per week per semester = **1 Credit**
- 2-hour Practical/Drawing **(P)** per week per semester = **1 Credit**

- **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process.
- **Three credit** courses are to be designed for **40** hours of Teaching-Learning process.
- **Two credit** courses are to be designed for **25** hours of Teaching-Learning process.
- **One credit** courses is to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points to be earned by students admitted to BE/B.Tech., day college programme (For more details refer to Chapter 6, AICTE Activity Point Programme, Model Internship Guidelines): Over and above the academic grades, every Day College regular student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to the fifth semester are required to earn 50 Activity Points from the year of entry to UoM. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, the minimum hours' requirement should be fulfilled. Activity Points (non-credit) do not affect SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

Scheme of Teaching and Examination 2021-2022 (As per NEP-2020)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

IV SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Duration in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	BSC	21MAT41	Engineering Mathematics-IV	Basic Science	Basic Science	2	2	0	03	50	50	100	3
2	IPCC	21CV42	Fluid Mechanics & Hydraulics	CEE	CEE	3	0	2	03	50	50	100	4
3	IPCC	21CV43	Environmental Engineering I	CEE	CEE	3	0	2	03	50	50	100	4
4	PCC	21CV44	Analysis of Structures	CEE	CEE	3	0	0	03	50	50	100	3
5	IPCC	21CV45	Transportation Engineering	CEE	CEE	3	0	2	03	50	50	100	4
6	PCC	21CV46	Geographic Information System	CEE	CEE	1	0	2	03	50	50	100	2
7	HSMC	21CPH47	Constitution of India, Professional Ethics and Cyber Law	Basic Science	Basic Science	1	0	0	NA	50	-	50	1
8	AEC	21AEC48	Ability Enhance Course-II	CEE	CEE	1	0	0	NA	50	-	50	1
9	INT	21INT49	Summer Internship-I	(To be carried out during the intervening vacations of IV and V semesters)					-	-	-	-	-
Total						**17**	**02**	**08**	**18**	**400**	**300**	**700**	**22**

Note: BSC: Basic Science Courses, ESC: Engineering Science Courses, PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses HSMC: Humanity, Social Science and Management Courses. NCMC: Non-credit mandatory course, AEC: Ability Enhancement Course, INT: Internship.

Summer Internship-I (21INT59): shall be carried out at industrial (State and Central Government /Non-government organizations (NGOs)/Micro, Small and Medium Enterprise (MSME)/Innovation centers/ Incubation centers. The internship can also be Rural internship. All the students admitted shall have to undergo a mandatory internship of 04 weeks during the intervening vacation of IV and V semesters. A University Viva-Voce examination (Presentation followed by Question & Answer session) shall be conducted during V semester and the prescribed credit shall be included in the V semester. The internshipshallbeconsideredasaheadofpassingandshallbeconsideredforthe award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)
Summer Internship-I: SEE shall be through seminar and viva-voce.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs

10	NCMC	21MATDIP41	Additional Mathematics-II	Basic Science	Basic Science	02	01	-	03	50	-	50	0
11	NCMC	21ENGDIP42	Technical English	Basic Science	Basic Science	-	2	-	-	50	-	50	0

(a)The mandatory non – credit courses Additional Mathematics I and II prescribed for III and IV semesters respectively, to the lateral entry Diploma holders admitted to III semester of BE programs, shall attend the classes during the respective semesters to complete all the formalities of the course and need not appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40 % of the prescribed CIE marks, he/she shall be deemed to have secured F grade.
(b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree

Credit Definition:
- 1-hour lecture**(L)** per week per semester = **1 Credit**
- 2-hour tutorial **(T)** per week per semester = **1 Credit**
- 2-hour Practical/Drawing **(P)** per week per semester = **1 Credit**

- **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process.
- **Three credit** courses are to be designed for **40** hours of Teaching-Learning process.
- **Two credit** courses are to be designed for **25** hours of Teaching-Learning process.
- **One credit** courses is to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

V-SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	PCC	21CV51	Hydrology & Water Resources Engineering	CEE	CEE	3	0	0	03	50	50	100	3
2	PCC	21CV52	Design of RC Structural Elements	CEE	CEE	3	0	0	03	50	50	100	3
3	IPCC	21CV53	Concrete Technology	CEE	CEE	3	0	2	03	50	50	100	4
4	PCC	21CV54	Environmental Engineering - II	CEE	CEE	3	0	0	03	50	50	100	3
5	PCC	21CV55	Environmental Impact Assessment	CEE	CEE	3	0	0	03	50	50	100	3
6	OEC	21CV56X	Open Elective A	Inter Dept	Inter Dept	3	0	0	03	50	50	100	3
7	PEC	21CV57X	Professional Elective – I	CEE	CEE	2	0	0	03	50	50	100	2
8	PEC	21CV58X	Professional Elective – II	CEE	CEE	2	0	0	03	50	50	100	2
9	INT	21INT59	Summer Internship-I	Completed during the vacation of IV and V semesters					NA	50	-	50	1
Total						**22**	**0**	**02**	**24**	**450**	**400**	**850**	**24**

Note: PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses, PEC: Professional Elective Course ESC: Engineering Science Courses, HSMC: Humanity, Social Science and Management Courses, INT: Internship.

Open Elective-A

21CV561	Occupational Health and Safety
21CV562	Intelligent Transport System
21CV563	Smart Cities & Planning
21CV564	Neighbourhood Planning

Professional Elective-I

Course Code	Course Title	Course Code	Course Title
21CV571	Finite Element Methods	21CV574	Quality control & Assurance
21CV572	Alternative Building Materials	21CV575	Offshore Structures
21CV573	Sustainable Technologies	21CV576	Bridge Engineering

Professional Elective-II

21CV581	Environmental Chemistry and Microbiology		
21CV582	Environmental Facility Management		
21CV583	Industrial Waste Management & Engineering		
21CV584	Climate Change and Emission Trade		

Credit Definition:

- 1-hour lecture**(L)** per week per semester = **1 Credit**
- 2-hour tutorial **(T)** per week per semester = **1 Credit**
- 2-hour Practical/Drawing **(P)** per week per semester = **1 Credit**

- **Four-credit** courses are to be designed for **50** hours of Teaching-Learning process.
- **Three credit** courses are to be designed for **40** hours of Teaching-Learning process.
- **Two credit** courses are to be designed for **25** hours of Teaching-Learning process.
- **One credit** courses are to be designed for **15** hours of Teaching-Learning process.

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

Scheme of Teaching and Examination 2021-2022(As per NEP-2020)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

VI-SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	PCC	21CV61	Construction Management and Entrepreneurship	CEE	CEE	3	0	0	03	50	50	100	3
2	IPCC	21CV62	Geotechnical Engineering	CEE	CEE	3	0	2	03	50	50	100	4
3	PCC	21CV63	Design of Steel Structure Elements	CEE	CEE	2	2	0	03	50	50	100	3
4	PCC	21CVL64	Advanced Technologies and Computer Aided Designs	CEE	CEE	2	0	2	04	50	50	100	3
5	PEC	21CV65X	Professional Elective -III	CEE	CEE	3	0	0	03	50	50	100	3
6	OEC	21CV66X	Open Elective –B	Inter Dept	Inter Dept	3	0	0	03	50	50	100	3
7	AEC	21CV67	Research Methodology and Intellectual Property Rights	CEE	CEE	2	0	0	03	50	50	100	2
8	MP	21CVP68	Mini Project	CEE	CEE	0	0	2	NA	50	-	50	1
9	INT	21INT69	Summer Internship-II	(To be carried out during the intervening vacations of VI and VII semesters)					-	-	-	-	-
Total						**17**	**0**	**06**	**22**	**400**	**350**	**750**	**22**

Note: ESC: Engineering Science Courses, PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses, PEC: Professional Elective Course, OEC: Open Elective Course, , MP: Mini Project, INT: Internship AEC-Ability Enhancement Course

Professional Elective-III

Course Code	Course Title
21CV651	Design of Prestressed Concrete Structures
21CV652	Applied Geotechnical Engineering
21CV653	Railways, Harbors, Tunneling & airports
21CV654	Traffic Engineering

Open Elective-B

21CV661	Urban Transport Planning
21CV662	Construction Materials
21CV663	Green Buildings
21CV664	Solid waste Management

Students can select any one of the open electives offered by any Department (Please refer to the list of open electives under 18AI65X).
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Mini-project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the Mini-project work, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all the guides of the college. The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Summer Internship-II: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

Scheme of Teaching and Examination 2021-2022 (As per NEP-2020)
Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

VII-SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	PCC	21CV71	Quantity Survey and Contract Management	CEE	CEE	2	0	0	03	50	50	100	2
2	PCC	21CV72	Disaster Management	CEE	CEE	2	0	0	03	50	50	100	2
3	PEC	21CV73X	Professional Elective – IV	CEE	CEE	3	0	0	03	50	50	100	3
4	PEC	21CV74X	Professional Elective – V	CEE	CEE	3	0	0	03	50	50	100	3
5	PEC	21CV75X	Professional Elective – VI	CEE	CEE	3	0	0	03	50	50	100	3
7	Project	21CVP76	Project Work Phase – 1	CEE	CEE	0	0	2	00	100	-	100	2
8	AEC	21AEC77	Ability Enhancement Course-III	CEE	CEE	1	0	0	NA	50	-	50	1
9	INT	21INT78	Summer Internship-II	(If not completed during the vacation of VI and VII semesters, it has to be carried out during the intervening vacations of VII and VIII semesters)									
Total						**16**	**00**	**02**	**15**	**400**	**250**	**650**	**16**

Note: ESC: Engineering Science Courses, PCC: Professional Core Courses, IPCC: Integrated Professional Core Courses, PEC: Professional Elective Course, OEC: Open Elective Course,, AEC: Ability Enhancement Course, INT: Internship.

Professional Elective – IV (Civil)

Course Code	Course Title
21CV731	Pavement Materials and Construction
21CV732	Repair and Rehabilitation of Structures
21CV733	Advanced Design of RCC and Steel Structures
21CV734	Advanced Foundation Engineering

Professional Elective – V (Environmental)

21CV741	Air Pollution Control
21CV742	Environmental Biotechnology
21CV743	Environmental Protection and Management
21CV744	Urban Flood Management

Professional Elective-VI

Course Code	Course Title
21CV751	Pavement Design
21CV752	Earthquake Engineering
21CV753	Ground Improvement Techniques
21CV754	Design of Masonry Structures

Students can select any one of the open electives offered by any Department.
Selection of an open elective is not allowed provided,

- The candidate has studied the same course during the previous semesters of the programme.
- The syllabus content of open elective is similar to that of Departmental core courses or professional electives.
- A similar course, under any category, is prescribed in the higher semesters of the programme.

Registration to electives shall be documented under the guidance of Programme Coordinator/ Adviser/Mentor.

Project work: Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary project can be assigned to an individual student or to a group having not more than 4 students. In extraordinary cases, like the funded projects requiring students from different disciplines, the project student strength can be 5 or 6.

CIE procedure for Project Work Phase - 1:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of the project work phase -1 Report (covering Literature Survey, Problem identification, Objectives and Methodology), project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the Project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -1, shall be based on the evaluation of project work phase -1 Report, project presentation skill and question and answer session in the ratio 50:25:25. The marks awarded for the project report shall be the same for all the batch mates.

Internship: All the students admitted to III year of BE/B.Tech shall have to undergo mandatory internship of 4 weeks during the vacation of VI and VII semesters and /or VII and VIII semesters. A University examination shall be conducted during VIII semester and the prescribed credit shall be included in VIII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not takeup/complete the internship shall be declared fail and shall have to complete during subsequent University examination after satisfying the internship requirements

AICTE Activity Points: In case students fail to earn the prescribed activity Points, an Eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of the degree only after the release of the Eighth semester Grade Card.

MYSORE UNIVERSITY SCHOOL OF ENGINEERING

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Outcome Based Education (OBE) and Choice Based Credit System (CBCS)
(Effective from the academic year 2021–2022)

B.E in CIVIL ENVIRONMENTAL ENGINEERING [CEE]

VIII-SEMESTER

Sl No.	Course & Course Code		Course Title	Teaching Dept.	Paper Setting Board	Teaching Hours/week			Examination				Credits
						Theory lectures	Tutorial	Practical/ Drawing	Examination in Hours	CIE Marks	SEE Marks	Total Marks	
						L	T	P					
1	Project	21CVP81	Project Work Phase-2	CEE	CEE	Two contact hours /week for interaction between the faculty and students.			03	100	100	200	8
2	Seminar	21CVS82	Technical Seminar	CEE	CEE	One contact hour /week for interaction between the faculty and students.			03	100	-	100	2
3	INT	21INT83	Summer Internship-II	VII semester End to VIII Semester End						100	-	100	4
Total						**00**	**-**	**-**	**06**	**300**	**100**	**400**	**14**

Note: INT: Internship

Project Work CIE procedure for Project Work Phase - 2:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two senior faculty members of the Department, one of whom shall be the Guide. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group wise at the college level with the participation of all guides of the college. Participation of external guide/s, if any, is desirable. The CIE marks awarded for the project work phase -2, shall be based on the evaluation of project work phase -2 Report, project presentation skill and question and answer session in the ratio 50:25:25.The marks awarded for the project report shall be the same for all the batch mates.

SEE for Project Work Phase - 2:

(i) Single discipline: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted at the department.

(ii) Interdisciplinary: Contribution to the project and the performance of each group member shall be assessed individually in semester end examination (SEE) conducted separately at the departments to which the student/s belong to.

Internship: Those, who have not pursued /completed the internship shall be declared as fail and have to complete during subsequent University examination after satisfying the internship requirements.

AICTE activity Points: In case students fail to earn the prescribed activity Points, eighth semester Grade Card shall be issued only after earning the required activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card. Activity points of the students who have earned the prescribed AICTE activity Points shall be sent the University along with the CIE marks of 8th semester. In case of students who have not satisfied the AICTE activity Points at the end of eighth semester, the column under activity Points shall be marked NSAP (Not Satisfied Activity Points).

ENGINEERING MATHEMATICS-III (21MAT31)

Semester III			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Tutorial hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	2:1:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Fourier Series:** Periodic functions, Dirichlet's condition. Fourier series of periodic functions period 2π and arbitrary period. Half range Fourier series. Application of Practical harmonic analysis.	**08 Hours**
Module 2	**Fourier Transforms:** Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Problems.	**08 Hours**
Module 3	**Difference Equations and Z-Transforms:** Difference equations, basic definition, z-transform-definition, Standard z-transforms, Damping and shifting rules, initial value and final value theorems (without proof) and problems, Inverse z-transform and applications to solve difference equations.	**08 Hours**
Module 4	**Partial Differential Equations (PDE's):** Formation of PDE's by elimination of arbitrary constants and functions. Solution of non-homogeneous PDE by direct integration. Homogeneous PDEs involving derivative with respect to one independent variable only. Solution of Lagrange's linear PDE. Derivation of one-dimensional heat equation and wave equation. Solution of one-dimensional heat equation and wave equation by the method of separation of variables.	**08 Hours**
Module 5	**Statistical Methods:** Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation-problems. Regression analysis- lines of regression –problems. **Curve Fitting:** Curve fitting by the method of least squares-fitting the curves of the form- $y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$.	**08 Hours**

Course outcomes:

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

• Explain the basic concepts of Fourier Series, Fourier Transforms, Z-Transforms, Partial Differential Equations, Some concepts of statistical analysis and curve fitting.

• Apply the above concepts of the syllabus in their respective branches of engineering.

• Analyse the solutions of engineering problems using these concepts.

Text and Reference Books:

1. E. Kreyszig: Advanced Engineering Mathematics, John Wiley & Sons, 10th Ed.(Reprint), 2017.
2. B.S. Grewal: Higher Engineering Mathematics, Khanna Publishers, 44th Ed., 2017.
3. Srimanta Pal &Subobh C Bhunia: "Engineering Mathematics", Oxford University Press, 3rd Reprint, 2016.
4. C.Ray Wylie, Louis C.Barrett : "Advanced Engineering Mathematics", 6th Edition, 2. McGrawHill Book Co., New York, 1995.

5. S.S.Sastry: “Introductory Methods of Numerical Analysis”, 11th Edition, Tata McGraw-Hill, 2010
6. B.V.Ramana: "Higher Engineering Mathematics" 11th Edition, Tata McGraw-Hill, 2010.
7. N.P.Bali and Manish Goyal, “A Text Book of Engineering Mathematics”, Laxmi Publications. Latest edition, 2014.
8. Chandrika Prasad and Reena Garg “Advanced Engineering Mathematics”, Latest edition, Khanna Publishing, 2018.

ADDITIONAL MATHEMATICS-I (21MATDIP31)

Semester III			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Tutorial hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	2:1:0	**Credits**	00

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Complex Variables:** Definitions and properties. Modulus and amplitude of a complex number, Argand's diagram, De-Moivre's theorem (without proof). **Vector Algebra:** Scalar and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.	**08 Hours**
Module 2	**Differential Calculus**: Review of successive differentiation-illustrative examples. Maclaurin's series expansions-Illustrative examples. Partial Differentiation: Euler's theorem-problems on first order derivatives only. Total derivatives-differentiation of composite functions. Jacobians of order two-Problems.	**08 Hours**
Module 3	**Vector Differentiation**: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl-simple problems. Solenoidal and irrotational vectorfields-Problems.	**08 Hours**
Module 4	**Numerical Methods:** Finite differences. Interpolation/extrapolation using Newton's forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae)-Illustrative examples. Numerical integration: Simpson's one third rule and Weddle's rule (without proof) Problems.	**08 Hours**
Module 5	**Ordinary differential equations (ODE's)**. Introduction-solutions of first order and first-degree differential equations: exact, linear differential equations. Equations reducible to exact and Bernoulli's equation.	**08 Hours**

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

1. Explain the basic concepts of complex trigonometry, differential calculus and vector differentiation, Numerical methods, Ordinary Differential Equations of first order.
2. Apply the above concepts of the syllabus in their respective branches of engineering.
3. Analyse the solutions of engineering problems using these concepts

Text and Reference Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd Edition, 2015
2. E. Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons, 10th Edition, 2016
3. N.P.Bali and Manish Goyal, A Text Book of Engineering Mathematics, Laxmi Publications, 6thEdition, 2014
4. RohitKhurana , Engineering Mathematics Vol.I, Cengage Learning, 1st Edition, 2015.

SURVEYING AND GEOMATICS (21CV32)

Semester III			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture/Practical hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Module 1:** ***Introduction to Surveying*** *Fundamentals of Maps:* Maps - types; scales-types; measuring distance; finding direction and use of symbols. Map projection - Latitude, Longitude and time, Topographical survey – Toposheets and Principles of topo sheet numbering, Analysis of landforms using maps. *History of Surveying:* Definition of Surveying, Uses of Surveying, Basic principles of surveying, Classification of Surveys. Introduction to Chain surveying, Compass surveying, Plane table surveying and Theodolite surveying. **Levelling:** Principles of levelling- booking and reducing levels; Types of levelling- differential, reciprocal levelling, profile levelling and cross sectioning. Numerical problems. **Contouring:** Contours and their characteristics, Uses of contours. Introduction to areas and volumes	**6 hours**
Module 2	**Curve Surveying:** Elements of simple and compound curves – Method of setting out of simple and compound curves, Elements of Reverse and Transition curve.	**8 hours**
Module 3	***Modern Field Survey Systems*** *(8 Hours)*: Principle of Electronic Distance Measurement, Modulation, Types of EDM instruments, Total Station – Parts of a Total Station – Accessories –Advantages and Applications, **Global Positioning Systems-** Segments, GPS measurements, errors and biases, Surveying with GPS, Co-ordinate transformation, accuracy considerations. Introduction to DGPS, Drone surveying and LiDAR	**8 hours**
Module 4	***Photogrammetry Surveying***: Introduction, Basic concepts, perspective geometry of aerial photograph, relief and tilt displacements, terrestrial photogrammetry, flight planning; Stereoscopy; photographic mapping- mapping using paper prints, mapping using stereo plotting instruments, mosaics, map substitutes.	**6 hours**
Module 5	***Remote Sensing and GIS***: Introduction –Electromagnetic Spectrum, interaction of electromagnetic radiation with the atmosphere and earth surface, remote sensing data acquisition: platforms and sensors; visual image interpretation. Introduction to GIS, Digital Elevation Model (DEM),	**10 hours**

LABORATORY EXPERIMENTS

I. Chain Surveying

1. Measure distance between two points using direct ranging and setting out perpendiculars.
2. Marking central line of a building using grid plan using chain and its accessories.

II. Levelling

3. Determine difference in elevation between two points using differential levelling technique, using height of the instrument method and rise and fall methods.
4. Perform profile levelling and to draw the longitudinal section and cross section to determine the depth of cut and height of filling for a given formation level.

III Total station

5. Contour surveying using total station.
6. Determine the elevation, Distance and gradient between two inaccessible points using total station.
7. Traversing using total station.

IV Curves

8. Set out simple curves using linear methods-perpendicular offsets from long chord and offsets from chord produced methods.
9. Set out simple curve using Rankine's deflection angles method.
10. Set out compound curve by angular method.

V. GIS

11. Generate thematic map using GIS Software

Course outcomes:

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

1. Apply fundamental concepts of Surveying, Levelling, Total station, Remote Sensing and GIS to engineering and surveying activities
2. Evaluate principles and components of all types of surveying
3. Interpret the concepts of measurements in engineering problems
4. Demonstrate the application of Surveying in , Electronic Distance Measurement, Global Positioning System, Photogrammetry and Remote Sensing, and
5. Adopt GIS & remote sensing techniques for field measurements and other applications in Civil Engineering.

Text/Reference Books:

1. Punmia B.C, "Surveying Vol.I and Vol.II", Laxmi Publications, (P) Ltd, New Delhi 16th Edition, 2016, ISBN-10: 9788170088530 ISBN-10: 8170088836.
2. George Joseph, "Fundamentals of Remote Sensing", Universities press 3rd Edition, 2018, ISBN10: 9386235463, ISBN-13: 978-9386235466.
3. Duggal S.K, "Surveying Vol. I & II" , Tata Mc Graw Hill Publishing Co., 8th Edition, 2017, ISBN10: 9781259028991 ISBN-10: 978125902899.
4. Anji Reddy M, "Remote sensing and Geographical information system", B.S. Publications, 2001.
5. Madhu, N, Sathikumar, R and Satheesh Gobi, "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson India, 2006.
6. Manoj, K. Arora and Badjatia, "Geomatics Engineering", Nem Chand & Bros, 2011

EARTH RESOURCES ENGINEERING (21CV33)

Semester III			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture/Practical hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Introduction, scope of earth science in Engineering** Geohazards and disasters, Mitigation and management Earths internal dynamics ,Plate tectonics, Earth quakes types, causes iso-seismal line, seismic zonation map, seismic proof structures, volcanic eruption, landslides, tsunamis, cyclones – Causes & management.	**10 Hours**
Module 2	**Earth Resources** Minerals -Industrial, rock forming and ore minerals. Physical properties, composition and uses Rocks as a construction materials- physical properties, texture, composition, applications for aggregate, decorative (facing/polishing), railway ballast, rocks for masonry work, monumental/architecture, rocks as aquifers, water bearing properties igneous, sedimentary.	**10 Hours**
Module 3	**Surface investigation for Civil Engineering projects** Weathering, type, causes, soil in-situ, drifted soil, soil profile, soil mineralogy , structure, types of soil, Black cotton soil v/s Lateritic soil; effects of weathering on monumental rocks, River morphology and basin investigation for engineering Projects like earthen dam, gravity dam, arch dam, features of river erosion, deposition and their influences on river valley projects, morphometric analysis of river basin, selection of site for artificial recharge,, interlinking of river basins, coastal process and landforms, sedimentation /siltation, erosion.	**10 Hours**
Module 4	**Subsurface investigation for deep foundation** Borehole data(and problems), Dip and strike, and outcrop problems(numerical problem geometrical/ simple trigonometry based), Electrical Resistivity meter, depth of water table, (numerical problems) seismic studies, faults, folds, unconformity, joints types, recognition and their significance in Civil engineering projects like tunnel project, dam project, , Ground improvements like rock bolting, rock jointing, grouting.	**10 Hours**
Module 5	**Introduction to Mining and Its Impact** Mining – definition and economic importance; Mine – definition, different types and classification; Mine life cycle; Mineral deposit – different types and their classification; Mineral resources of India; Modes of entry to a mine – shaft, incline, decline, adit and box-cut. Overview of surface mining: Types of surface mines, unit operations, basic bench geometry, applicability & limitations and advantages & disadvantages. Granite mining and Mining Impacts	**10 Hours**

LABORATORY EXPERIMENTS

1. Evaluation of minerals based on physical properties for basic raw material for construction, industrial application (2 classes)
2. Investigation of rock based on physical, textural, and mineralogical properties for construction (2 classes)
3. Geologic maps studies (6 classes) Cross-section studies of Geological maps for suitability evaluation and subsurface investigation of geological conditions for Dams, tunnels water harvesting, aqua duct, bridges under conditions of Horizontal strata, inclined strata, Folded and Faulted beds, Unconformity, Intrusion relevant–; construction/ generation of Geological maps based on borehole data
4. Geospatial data analysis (3 classes)
    - Interpretation of topo sheets
    - Visual interpretation of FCCs (Geomorphology and Land use/land cover mapping) and TCCs,
5. Geophysical exploration – (2 classes)
    - Electrical resistivity methods for subsurface investigation – and its Interpretation, lateral and vertical sounding

Course outcomes:

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

- Comprehend the relations between minerals and rocks based on their physical properties
- Assess the suitability of materials used in building construction
- Differentiate geological investigations necessary for the construction of dams, bridges, and tunnels and mining
- Demonstrate the groundwater investigation using resistivity methods
- Appraise the applications of Geospatial technology in Civil and Environmental Engineering.

Text and Reference Books:

1. Parthasarathy, “Engineering Geology”, Wiley publications, Latest edition.
2. ChennaKesavulu, “A textbook of Engineering Geology”, Mac Millan India Ltd, Latest edition.
3. K.M. Bangar, “Principle of Engineering Geology”, Standard publishers, Latest edition.
4. S.K. Garg, “Physical and Engineering Geology”, Khanna publishers, Latest edition.
5. KVGK Gokhale, “Principles of Engineering Geology”, BS Publications, Latest edition.
6. Hartmann, “Introduction to Mining Engineering”, Wiley publications, 2nd edition. 2007.

BUILDING MATERIALS & CONSTRUCTION (21CV34)

Semester III			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Building materials** Aggregates, Bricks, concrete blocks, Cement, Mortar, Concrete, Timber, steel, Glass, MDF, Ply wood. **Painting**: Characteristics of an ideal paint, classification & types of paints, painting on different surfaces, defects in painting, varnishing, distempering, white washing &colour washing. **Green and Smart Materials***:* Passive Products & Materials include glazing, insulation, paints & coatings, adhesives & sealants, fly-ash blocks, cement, concrete, composite wood, filler slabs, certified new wood, housekeeping chemicals, false ceiling materials, flooring materials, furniture, gypsum-based products, high reflective materials & coatings, glass etc.	**08 Hours**
Module 2	**Foundations** Introduction, Depth of footings, Strip footing, Isolated footing, Eccentrically loaded footings, Grillage foundations, Combined footings, Strap footing, Raft foundation, Foundations for black cotton soils, stepped footings, Adjacent footings.	**08 Hours**
Module 3	**Masonry, Doors & Windows** Stone masonry: Definition of terms, Classification of stone masonry, dressing of stones, joints in stone masonry. Brick Masonry: Terminologies, types of bonds: stretcher bond, header bond, English bond, Flemish bond, brick laying, defects in brick masonry, Thickness of a brick wall, buttresses, thresholds, window sills, corbels, copings, jambs. Concrete masonry, Hollow clay block masonry. Doors& windows: Terminologies, Location of doors & windows, size of doors, door frames, types of doors & windows.	**08 Hours**
Module 4	**Formwork & scaffolding, Plastering & pointing** Formwork: requirements, IS standards on form work, Loads on form work, shuttering for: columns-beam & slab floor-stairs-walls. Shoring, under pinning, scaffolding. Plastering & pointing: plastering, terminologies, tools for plastering, number of coats of plaster, methods of plastering, types of plaster finishes, defects in plastering, pointing.	**08 Hours**
Module 5	**Green Building:** Concept of Green building, Principles of green buildings, Eco-friendly materials, Certification systems – Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED).	**08 Hours**

Course outcomes:

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

- Assess the suitability of building and construction materials and green materials used construction
- Differentiate types of footings used for buildings.
- Describe the erection of masonry work along with doors & windows.
- Appreciate the process involved in formwork & scaffolding work and plastering, painting, plumbing & sanitary works.
- Gain Knowledge on Green Buildings

Text and Reference Books:

1. W B McKay, “Building Construction”, Pearson Publications, 2013.
2. Dr. B C Punmia, “Building Construction”, Lakshmi Publications, 11 th edition, 2016.
3. Rangwala, “Building Construction”, Charotar Publications, 2016.
4. Sushil Kumar, “Building Construction”, Standard publications, 20th edition.
5. Gurucharan Singh, “Building Construction & Material”, Standard Book House, 2019.
6. IGBC and NBC Codes & Specifications.

STRENGTH OF MATERIALS (21CV35)

Semester III			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture/Practical hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Simple Stresses and Strains:** Introduction, Properties of Materials, Stress, Strain, Hook's law, Poisson's Ratio, Stress – Strain Diagram for structural steel, Principles of superposition, Total elongation of tapering bars of circular and rectangular cross sections. Composite section, Volumetric strain, expression for volumetric strain, Elastic constants, relationship among elastic constants, Thermal stress and strains **Compound stresses:** Introduction, Stress components on inclined planes, General two-dimensional stress system, Principal planes and stresses, maximum shear stresses and their planes (shear planes). Compound stress using Mohr's circle method.	**10 Hours**
Module 2	**Bending moment and shear force diagrams in beams**: Definition of shear force and bending moment, Sign convention, Relationship between loading, shear force and bending moment, Shear force and bending moment equations, development of Shear Force Diagram (SFD) and Bending Moment Diagram (BMD) with salient values for cantilever, simply supported and overhanging beams for point loads, UDL (Uniformly Distributed Load), UVL (Uniformly Varying Load) and Couple.	**10 Hours**
Module 3	**Bending stress in beams:** Introduction – Bending stress in beam, Pure bending, Assumptions in simple bending theory, derivation of Simple bending equation (Bernoulli's equation), modulus of rupture, section modulus, Flexural rigidity, Problems **Shear stress in beams:** Derivation of Shear stress intensity equations, Derivation of Expressions of the shear stress intensity for rectangular, triangular and circular cross sections of the beams. Problems on calculation of the shear stress intensities at various critical levels of T, I and Hollow rectangular cross sections of the beam.	**10 Hours**
Module 4	**Torsion:** Twisting moment in shafts, simple torque theory, derivation of torsion equation, tensional rigidity, polar modulus, shear stress variation across solid circular and hollow circular sections, Problems **Thin cylinders:** Introduction: Longitudinal, circumferential (hoop) stress in thin cylinders. Expressions for longitudinal and circumferential stresses. Efficiency of longitudinal and circumferential joints. Problems on estimation of change in length, diameter and volume when the thin cylinder subjected to internal fluid pressure. **Thick cylinders:** Concept of Thick cylinders Lame's equations applicable to thick cylinders with usual notations, calculation of longitudinal, circumferential and radial stresses – simple	**10 Hours**

	numerical examples. Sketching the variation of radial stress (pressure) and circumferential stress across the wall of thick cylinder.	
Module 5	**Elastic stability of columns:** Introduction – Short and long columns, Euler's theory on columns, Effective length, slenderness ratio, radii of gyration, buckling load, Assumptions, derivations of Euler's Buckling load for different boundary conditions, Limitations of Euler's theory, Rankine's formula and related problems. **Deflection of determinate Beams:** Introduction, Elastic curve –Derivation of differential equation of flexure, Sign convention, Slope and deflection using Macaulay's method for statically determinate beams subjected to various vertical loads, moment, couple and their combinations. Numerical problems.	**10 Hours**

LABORATORY EXPERIMENTS

1. Dimensionality of bricks, Water absorption, Initial rate of absorption
2. Specific gravity of coarse and fine aggregate
3. Fineness modulus of Fine and Coarse aggregate
4. Compressive strength tests on building blocks (brick, solid blocks and hollow blocks)
5. Tension test on Mild steel and HYSD bars
6. Compression test on HYSD, Cast iron
7. Bending Test on Wood under two-point loading.
8. Shear Test on Mild steel – single and double shear
9. Impact test on Mild Steel (Charpy & Izod)

Course outcomes:

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

- Evaluate the behaviour when a solid material is subjected to various types of forces (namely Compressive, Tensile, Thermal, Shear, flexure, Torque, internal fluid pressure) and estimate stresses and corresponding strain developed. (L3)
- Estimate the forces developed and draw schematic diagram for stresses, forces, moments for simple beams with different types of support and are subjected to various types of loads (L3).
- Evaluate the behaviour when a solid material is subjected to Torque and internal fluid pressure and estimate stresses and corresponding strain developed. (L3)
- Distinguish the behaviour of short and long column and calculate load at failure & explain the behaviour of spring to estimate deflection and stiffness (L3)
- Examine and evaluate the mechanical properties of various materials under different loading conditions.

Text and Reference Books:

1. Timoshenko and Young, "Elements of Strength of Material", East West Press, 5t edition 2003.
2. R. Subramanyam, "Strength of Materials", Oxford University Press, 3rd Edition -2016.
3. B.C Punmia Ashok Jain, Arun Jain, "Strength of Materials", Laxmi Publications, 10th Edition-2018.
4. S. Ramamrutham, "Strength of Materials", Dhanpath Rai Publications, 20th edition, 2020.
5. S. S Rattan, "Strength of Materials", Mc Graw Hill Publications, 3rd edition, 2017.

COMPUTER AIDED BUILDING DRAWINGS (21CVL36)

Semester III			
No. of Lecture hour/Week	02	**CIE Marks**	50
No. of Practical hours/week	02	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	1:0:2	**Credits**	02

Sl No.	Course Content	
Module 1	**Drawing Basics:** Selection of scales for various drawings, thickness of lines, dimensioning, abbreviations and conventional representations as per IS: 962. **Simple Engineering Drawings with CAD** Drawing Tools**:** Lines Circle, Arc, Poly line, Multiline, Polygon, Rectangle, Spline, Ellipse. Modify tools: Erase, Copy, Mirror, Offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet. Using Text: Single line text, Multiline text, Spelling, Edit text. Special Features: View tools, Layers concept, Dimension tools, Hatching, Customizing Toolbars, Working with multiple drawings.	**8 hours**
Module 2	**Drawings of Different Building Elements:** Following drawings are to be prepared for the data given using CAD Software a) Cross section of Foundation, masonry wall, RCC columns with isolated & combined footings. b) Different types of staircases – Dog legged, Open well, c) Lintel and chajja. d) RCC Slabs and beams.	**7 hours**
Module 3	**Building Drawings :**Principles of planning, Planning regulations and building bye-laws, factors affecting site selection, Functional planning of residential and public buildings, design aspects for different public buildings. Recommendations of NBC. Drawing of plan, elevation and sectional elevation including electrical, plumbing and sanitary services using CAD software for 1. Single and double story residential building. 2. Hostel building. 3. Hospital building. 4. School building. Submission drawing (sanction drawing) of two storied residential building with access to terrace including all details and statements as per the local bye-laws Industry Applications : 3D Modelling and Rendering, 2D Animation, Construction site Simulation **Environmental Engineering Drawings** e) Septic Tank and sedimentation Tank. f) Layout plan of Rainwater recharging and harvesting system. g) Layout of Typical Water Supply System. f) Drawing of Hydraulic Profile for Water Treatment Unit. **Note:** Students shall sketch to dimension the above in a sketch book before doing the computer drawing and undertake one compulsory field visit/exercise. (Single line diagrams are given in the examination).	**10 hours**

Course Outcomes

At the end of the course the student will able to

- Understand the basics of CAD Drawing and
- Prepare, read and interpret the drawings in a professional set up.
- Know the procedures of submission of drawings and Develop working and submission drawings for building.
- Build the skills on elements of building Plan and design of residential or public building as per the given requirements including 2D and 3D Animation.
- Prepare layout plans of environmental engineering using CAD

Text Books:

1. MG Shah, CM Kale, SY Patki, "Building drawing with an integrated approach to Built Environment Drawing", Tata McGraw Hill Publishing co. Ltd, New Delhi.
2. Gurucharan Singh, "Building Construction", Standard Publishers, & distributors, New Delhi.
3. Malik RS and a Meo GS, "Civil Engineering Drawing", Asian Publishers/Computech Publication Pvt Ltd.
4. IS: 962-1989 (Code of practice for architectural and building drawing).
5. National Building Code, BIS, New Delhi.

ENVIRONMENTAL STUDIES [21CIV37]

Semester III			
No. of Teaching hour/Week	1	**CIE Marks**	50
No. of Tutorial hours/week	-	**SEE Marks**	-
Total No. of Lecture hours	16	**Exam Hours**	-
L: T:P	1:0:0	**Credits**	01

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Environment - Components of Environment **Ecosystem**: Types & Structure of Ecosystem, Balanced ecosystem Human Activities – Food, Shelter, And Economic & Social Security. **Impacts**: Impacts of Agriculture & Housing Impacts of Industry, Mining & Transportation Environmental Impact Assessment, Sustainable Development.	**03 Hours**
Module 2	**Natural Resources, Water resources –** Availability & Quality aspects, Water borne diseases & water induced diseases, Fluoride problem in drinking water Mineral resources, Forest Wealth Material Cycles – Carbon Cycle, Nitrogen Cycle & Sulphur Cycle. **Energy** – Different types of energy, Conventional sources &Non-Conventional sources of energy Solar energy, Hydro electric energy, Wind Energy, Nuclear energy, Biomass & Biogas Fossil Fuels, Hydrogen as an alternative energy.	**04 Hours**
Module 3	**Environmental Pollution** – Water Pollution, Noise pollution, Land Pollution, Public Health Aspects. **Global Environmental Issues:** Population Growth, Urbanization, Land Management, Water & Waste Water Management	**03 Hours**
Module 4	**Air Pollution & Automobile Pollution:** Definition, Effects – Global Warming, Acid rain & Ozone layer depletion, controlling measures. **Solid Waste Management**, E –Source, Segregation, Transportation, and Waste Treatment and Management &**Biomedical Waste Management** - Sources, Characteristics & Disposal methods.	**03 Hours**
Module 5	Applications of GIS & Remote Sensing and Smart Technologies in Environmental Engineering Practices. **Environmental Legislations:** Acts, Rules& Regulations, Role of government, Legal aspects, Role of Nongovernmental Organizations (NGOs), Environmental Education & Women Education.	**03 Hours**

Course outcomes:

After Studying this course, students will be able to

1. Understand the principles of ecology and environmental issues that apply to air, land, and water issues on a global scale.
2. Develop critical thinking and/or observation skills, and apply them to the analysis of a problem or question related to the environment.
3. Demonstrate Solid Waste Management.
4. Apply knowledge and technology in environmental practices
5. Build inquisitiveness to protect environment through societal interventions

Text Books:

1. Benny Joseph (2005), “Environmental Studies”, Tata McGraw – Hill Publishing Company Limited.
2. R.J.Ranjit Daniels and Jagadish Krishnaswamy, (2009), “Environmental Studies”, Wiley India Private Ltd., New Delhi.
3. R Rajagopalan, “Environmental Studies – From Crisis to Cure”, Oxford University Press, 2005.
4. Aloka Debi, “Environmental Science and Engineering”, Universities Press (India) Pvt. Ltd. 2012.

UNIVERSAL HUMAN VALUE & PROFESSIONAL ETHICS [21UHV38]

Semester III			
No. of Teaching hour/Week	1	**CIE Marks**	50
No. of Tutorial hours/week	-	**SEE Marks**	-
Total No. of Lecture hours	16	**Exam Hours**	-
L: T:P	1:0:0	**Credits**	01

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Value Education:** Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education) Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfil the Basic Human Aspirations	**03 Hours**
Module 2	**Harmony in the Human Being:** Understanding Human being as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self, Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health	**03 Hours**
Module 3	**Harmony in the Family and Society:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order	**03 Hours**
Module 4	**Harmony in the Nature/Existence:** Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence	**03 Hours**
Module 5	**Implications of the Holistic Understanding – a Look at Professional Ethics:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession	**04 Hours**

Course outcomes:

The course and further follow up is expected to positively impact common graduate attributes like:

- Holistic vision of life
- Socially responsible behaviour and Environmentally responsible work
- Ethical human conduct
- Having Competence and Capabilities for Maintaining Health and Hygiene
- Appreciation and aspiration for excellence (merit) and gratitude for all

Textbook/ Reference Books

1. ", R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", Excel Books, New Delhi, 2nd Revised Edition, 2019. ISBN 978-93-87034- 447-1 b.
2. The Teacher's Manual for "A Foundation Course in Human Values and Professional Ethics", R R Gaur, R Asthana.

ENGINEERING MATHEMATICS-IV [21MAT41]

Semester IV			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Tutorial hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L:T:P	2:1:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Calculus of complex functions:** Review of function of a complex variables, limits, continuity, and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. **Construction of analytic functions:** Milne-Thomson method-Problems.	**08 Hours**
Module 2	**Conformal transformations:** Introduction. Discussion of transformations:$w = z^2,\ w = e^z,\ w = z + \frac{1}{z}, (z \neq 0)$. Bilinear transformations- Problems. **Complex integration:** Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems.	**08 Hours**
Module 3	**Numerical Solutions of Ordinary Differential Equations (ODE's):** Numerical solution of ODE's of first order and first degree- Taylor's series method, Modified Euler's method. Runge -Kutta method of fourth order, Milne's predictor and corrector method (No derivations of formulae)-Problems. Numerical Solution of Second Order ODE's - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).	**08 Hours**
Module 3	**Probability Distributions:** Review of basic probability theory. Random variables (discrete and continuous), probability mass/density functions. Binomial, Poisson, exponential and normal distributions- problems (No derivation for mean and standard deviation)-Illustrative examples.	**08 Hours**
Module 5	**Joint probability distribution:** Joint Probability distribution for two discrete random variables, expectation and covariance. **Sampling Theory:** Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.	**08 Hours**

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

• Explain the concepts of integral calculus, Higher order differential equations, Laplace transforms, Probability and Linear Algebra.
• Apply the above concepts of the syllabus in their respective branches of engineering.
• Analyse the solutions of engineering problems using these concepts.

Text and Reference Books:

Text Books:

1. Erwin Kreyszig, “Advanced Engineering Mathematics”, Wiley Publications, Latest edition.
2. B.S. Grewal, “Higher Engineering Mathematics”, Khanna Publishers, Latest edition.
3. B.V. Ramana, “Higher Engineering Mathematics”, Tata McGraw Hill, Latest edition.

Reference Books:

1. Srimanta Pal & Subodh C. Bhunia: “Engineering Mathematics” Oxford University Press, 3rd Reprint, 2016.
2. N.P Bali and Manish Goyal: “A textbook of Engineering Mathematics” Laxmi Publications, Latest edition.
3. H.K.Dass and Er. Rajnish Verma: “Higher Engineering Mathematics”, S.Chand Publication (2014).

ADDITIONAL MATHEMATICS-II (21MATDIP41)

Semester IV			
No. of Lecture hour/Week	2	**CIE Marks**	50
No. of Tutorial hours/week	1	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	2:1:0	**Credits**	00

Modules	Course Content	Teaching Hours
Module 1	**Integral Calculus**: Review of elementary integral calculus. Reduction formulae for $sin^n x, cos^n x$ (with proof) and $sin^m x cos^n x$(without proof) and evaluation of these with standard limits-Examples. Double integrals-Simple examples. Beta and Gamma functions- Simple problems	**08 Hours**
Module 2	**Higher order ODE's:** Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. [Particular Integral restricted to$R(x) = e^{ax}, \sin ax / \cos axforf(D)y = R(x)$].	**08 Hours**
Module 3	**Laplace Transform:** Definition and Laplace transforms of elementary functions (statements only)-problems. Inverse Laplace Transform: Inverse Laplace transforms by method of partial fractions, Convolution theorem to find the inverse Laplace transforms. Solution of linear differential equations using Laplace transforms.	**08 Hours**
Module 4	**Introduction to Probability:** Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability, Bayes's theorem, problems.	**08 Hours**
Module 5	**Linear Algebra:** Introduction - rank of matrix by elementary row operations - Echelon form. Consistency of system of linear equations - Gauss elimination method. Eigen values and Eigen vectors of a square matrix. Problems.	**08 Hours**

Course outcomes: At the end of the course the students will be able to:
• Explain the concepts of integral calculus, Higher order differential equations, Laplace transforms, Probability and Linear Algebra.
• Apply the above concepts of the syllabus in their respective branches of engineering.
• Analyse the solutions of engineering problems using these concepts.

Text Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, Latest edition.
2. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, Latest edition.
3. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill, Latest edition.

4. Srimanta Pal & Subodh C. Bhunia: “Engineering Mathematics” Oxford University Press, 3rd Reprint, 2016.

Reference Books:

1. N.P Bali and Manish Goyal: “A textbook of Engineering Mathematics” Laxmi Publications, Latest edition.
2. H.K.Dass and Er. Rajnish Verma: “Higher Engineering Mathematics” S.Chand Publication (2014).

FLUID MECHANICS & HYDRAULICS (21CV42)

Semester IV			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture/Practical hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	Fluids and their properties, Fluid pressure measurements, Pascal's law, Measurement of pressure using manometer, Total pressure and centre of pressure on vertical and inclined plane surfaces.	**10 Hours**
Module 2	Kinematics- Types of fluid flow, continuity equation in Cartesian coordinates, flow nets, Dynamics- Euler's equation of motion, Bernoulli's equation, Application-Venturimeter, Orificemeter, Pitot tube	**10 Hours**
Module 3	Classification of orifice and mouth piece, Hydraulic coefficients, Discharge over Rectangular, Triangular and Cipoletti notch. Flow through pipes-Major and minor losses, pipes in series and parallel, concepts of water hammer and surge tanks	**10 Hours**
Module 4	Open Channel Hydraulics- Classification of Flow through channels, Most economical channel sections: Rectangular, Triangular and Circular. Uniform flow, Specific energy. Non-Uniform flow- Hydraulic jump, Analysis of GVF equation.	**10 Hours**
Module 5	Impact of jet on curved vanes, momentum equation, Impact of jet on stationary and moving curved vanes. Turbines- Pelton wheel and components, Velocity triangle Reaction turbine-Francis turbine, Working proportions. Centrifugal Pumps-Work done and efficiency, Multi stage pumps	**10 Hours**

LABORATORY EXPERIMENTS

1. Determination of Cd for Venturimeter or Orificemeter
2. Determination of Hydraulic coefficients of small vertical orifice
3. Calibration of Triangular notch
4. Determination of Major & Minor losses in pipes
5. Determination of Cd for ogee or broad crested weir
6. Determination of force exerted by a jet on flat and curved vanes
7. Determination of efficiency of centrifugal pump
8. Determination of efficiency of Kaplan or Francis turbine
9. Determination of efficiency of Pelton wheel turbine

Course outcomes:

After studying this course, students will able to:

1. Understand fundamental properties of fluids and solve problems on Hydrostatics.
2. Apply Principles of Mathematics to represent Kinematics and Bernoulli's principles.
3. Compute discharge through pipes, notches and weirs.
4. Design of open channels of various cross sections.
5. Design of turbines for the given data and understand their operation characteristics.

Text and Reference Books:

1. P.N.Modi and S.M.Seth, “Hydraulics and Fluid Mechanics”, including Hydraulic machines, standard Book House, New Delhi
2. K Subramanya, “Fluid Mechanics and Hydraulic Machines”, Tata Mc Graw hill, New Delhi.
3. R.K. Bansal, “A text book of Fluid Mechanics and Hydraulic Machines”, Laxmi Publications, New Delhi.
4. Victor L. Streeter, Benjamin Wyile E and Keith W. Bedford, “Fluid Mechanics” ,Tata McGraw Hill publishing Co Ltd, New Delhi.

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ENVIRONMENTAL ENGINEERING – I (21CV43)

Semester IV			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture/Practical hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Introduction**: Water: Need for protected water supply, Demand of Water: Types of water demands -domestic demand, industrial, institutional and commercial demand, public use and fire demand estimation, factors affecting per capita demand, Variations in demand of water, Peak factor. Design period and factors governing design period. Methods of population forecasting and numerical problems. Physico-chemical characteristics of water (Analysis to be conducted in laboratory session). Sampling.	**10 Hours**
Module 2	**Water Treatment:** Objectives, Unit flow diagrams – significance of each unit, Aeration process- Limitations and types. **Sedimentation -** Theory, settling tanks, types and design, Coagulation and flocculation, types of coagulants, (Optimization of coagulant to be carried out in the laboratory), Clari-flocculator. **Filtration:** mechanism, theory of filtration, types of filters: slow sand, rapid sand and pressure filters. Operation and cleaning. Design of slow and rapid sand filter without under drainage system	**10 Hours**
Module 3	**Disinfection:** Methods of disinfection with merits and demerits. Breakpoint of chlorination (Analysis to be conducted in laboratory session). **Water softening:** Introduction, types of hardness and methods of their removal, Lime-soda process, Lime-soda softening plant, Water softening accelerator, zeolite process, Demineralization or Deionization process. **Miscellaneous Treatment methods:** Activated carbon Treatment, Defluoridation, Desalination.	**10 Hours**
Module 4	**Pumps & Pumping:** Necessity of pumping, types of pumps and their choice, displacement pumps, centrifugal pumps, jet pump, air lift pumps, well pumps, power requirement of pumps, economical diameter of pumping mains. **Conveyance of water:** Introduction, types of pipes (based on material), stresses in pipes, corrosion in pipes, Pipe appurtenances.	**10 Hours**
Module 5	**Distribution of water:** Introduction, methods of distribution, Pressure in distribution mains, systems of water supply, storage and distribution reservoirs, types of storage and storage and distribution reservoirs. **Water supply for buildings:** materials for service pipes, service connection, size of service pipes, water meters, valves.	**10 Hours**

LIST OF DRAWINGS

1. Drawing of Distribution Systems for simple network.
2. Drawing of Flocculator and Sedimentation Units (Circular and Rectangular)
3. Plan and Sectional Elevation, Clariflocculator.
4. Drawing of Rapid Sand Filters (Plan and Section).
5. Layout showing hydrants, valves, bends and chlorination point in water treatment plant.

LABORATORY EXPERIMENTS

1. Determination of Acidity and Alkalinity
2. Determination of Calcium, Magnesium and Total Hardness.
3. Determination of Dissolved Oxygen / BOD / COD.
4. Determination of Chlorides.
5. Determination of percentage of available chlorine in bleaching powder sample, Determination of Residual Chlorine and chlorine demand.
6. Determination of Solids in Sewage: (i) Total Solids, (ii) Suspended Solids, (iii) Dissolved Solids, (iv)Volatile Solids, Fixed Solids (v) Settleable Solids.
7. Determination of optimum coagulant dosage using Jar test apparatus.
8. Determination Nitrates and Iron by spectrophotometer

Course outcomes:

- After studying this course, students will able to:
- Estimate average and peak water demand for a community.
- Evaluate water quality and environmental significance of various parameters and plan suitable treatment system.
- Design the different units of water treatment plant
- Understand and design the various units of wastewater treatment plant
- Acquire capability to conduct experiments and estimate the concentration of different parameters and compare the obtained results with the concerned guidelines and regulations.

Text and Reference Books:

1. Howard S. Peavy, Donald R. Rowe, George T, “Environmental Engineering”, Tata Mc Graw Hill, New York, Indian Edition, 2013.
2. S. K. Garg, “Environmental Engineering vol-I”, Khanna Publishers, New Delhi 2010.
3. B.C. Punmia and Ashok Jain, “Environmental Engineering-I”, Laxmi Publications (P) Ltd., New Delhi.

ANALYSIS OF STRUCTURES (21CV44)

Semester IV			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Tutorial hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Deflection of Beams:** ***Moment area method***– Derivation, Mohr's theorems, Sign convention; Application of moment area method to determinate prismatic beams, beams of varying cross section; Use of moment diagram by parts; ***Conjugate beam method***– Real beam and conjugate beam, conjugate beam theorems; Application of conjugate beam method to determinate beams of varying cross sections.	**10 Hours**
Module 2	**Energy Principles and Energy Theorems:** ***Principle of virtual displacements***; *Principle of virtual forces*, Strain energy and complementary energy; Strain energy due to axial force, bending shear and torsion; Deflection of determinate beams and trusses using total strain energy; Deflection at the point of application of single point load; ***Castigliano's theorems***, application of Castigliano's theorems to calculate deflection of trusses, frames; Special application – Dummy unit load method.	**10 Hours**
Module 3	**Arches and Cables:** Three-hinged circular and parabolic arches with supports at the same and different levels; Determination of normal thrust, radial shear and bending moment; Analysis of cables under point loads and UDL; Length of cables with supports at the same and different levels; Stiffening trusses for suspension cables.	**10 Hours**
Module 4	**Slope Deflection Method:** Introduction, sign convention, development of slope deflection equation; Analysis of continuous beams including settlement of supports; Analysis of orthogonal rigid plane frames including sway frames with kinematic indeterminacy up to 3	**10 Hours**
Module 5	**Matrix Methods of Structural Analysis:** Definition of stiffness and flexibility methods, comparison to classical methods. **Stiffness Method:** Stiffness matrix, Analysis of continuous beams and plane trusses using system approach; Analysis of simple orthogonal plane frames using system approach with kinematic indeterminacy up to 3.	**10 Hours**

Course outcomes:

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

1. Evaluate slope and deflections in beams using geometrical methods.
2. Determine deflections in trusses and frames using energy principles.
3. Analyze arches and cables for stress resultants.
4. Apply slope defection method in analyzing indeterminate structures and construct bending

moment diagram.
5. Analyze continuous beams, frames and trusses using stiffness matrix method of analysis.

Reference Books:

1. Reddy, C.S., "Basic Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd., 3rd ed., New Delhi, 2011.
2. Hibbeler, R.C., "Structural Analysis", Pearson publications, 9th edition, New Delhi, 2012.
3. Thandavamoorthy, T.S., "Structural Analysis", Oxford University press.,New Delhi, 6th edition., 2015.
4. Charles Head Norris, John Benson Wilbur and Senol Utku., "Elementary Structural Analysis", Tata McGraw-Hill Education Pvt. Ltd., 4th edition, New Delhi, 2003.
5. Hall, A. and Kabaila, A.P., "Basic Concepts of Structural Analysis", Pitman Publishing, London, John Wiley & Sons, New York, 1977.
6. Wang, C.K., "Intermediate Structural Analysis", McGraw-Hill International Book Co., 1985.

TRANSPORTATION ENGINEERING (21CV45)

Semester IV			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Principles of Transportation Engineering**: Importance of transportation, Different modes of transportation. Characteristics of road transport, Importance of Roads in India, Current Road development Programmes in India. Highway Development and Planning: Highway Development in India, Highway Planning, Planning Surveys and Interpretation, Highway Planning in India. Highway Alignment and Project preparation: Highway Alignment, Engineering Surveys for Highway Alignment, Drawings and Reports, Highway Projects, Preparation of Detailed Project Report	**08 Hours**
Module 2	**Highway Geometric Design of horizontal alignment elements**: Cross sectional elements, Sight distance, Design of Horizontal alignment, Design of vertical alignment. Pavement Design: Pavement types, component parts of flexible and rigid pavements and their functions, ESWL and its determination (Graphical method only)-Examples.	**08 Hours**
Module 3	**Pavement Materials**: Sub grade soil-grade soil -desirable properties-HRB soil classification, determination of CBR and modulus of sub grade reaction with Problems. Aggregates-Desirable properties. Bituminous Binders & Mixes- Types, desirable properties. Pavement Quality concrete- Materials, Requirements. Pavement Construction: General features, Embankment and Subgrade, Construction of Flexible pavements, Construction of CC pavements	**08 Hours**
Module 4	**Highway Drainage:** Significance and requirements, Surface drainage system and Design-Examples, sub surface drainage system, design of filter materials, Types of cross drainage structures, their choice and location. Highway Economics: Highway user benefits, VOC using charts only-Examples, Economic analysis - annual Cost method-Benefit Cost Ratio method-NPV-IRR methods- Examples, Highway financing-BOT-BOOT concepts	**08 Hours**
Module 5	**Elements of Traffic Engineering** – Traffic characteristics, Traffic Engineering Studies and Analysis, Traffic Regulation and Control. Elements of Railways and Airport Engineering - Railways: Introduction, classification of routes; railway gauge, coning of wheels and canting of rails, train resistance and hauling power; track components: rails, sleepers, fastenings, ballast and formation. Airports: Introduction, Layout of an airport with component parts and functions of each, Aircraft Characteristics – Airport Classifications, - Site selection-regional Planning. Orientation of runway by using wind rose diagram with examples	**08 Hours**

Lab Experiments

1. Tests on Aggregates a. Aggregate Crushing value b. Los Angeles abrasion test c. Aggregate impact test d. Aggregate shape tests (combined index and angularity number)
2. Tests on Bituminous Materials a. Penetration test b. Ductility test c. Softening point test d. Specific gravity test
3. Tests on Soil a. Wet sieve analysis b. CBR test
4. Tests on Bituminous Mixes a. Marshall Method (Demo Experiment)

Course outcomes:

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

- Acquire the capability of proposing a new alignment or re-alignment of existing roads, conduct necessary field investigation for generation of required data.
- Evaluate the engineering properties of the materials and suggest the suitability of the same for pavement construction.
- Design road geometrics, structural components of pavement and drainage.
- Evaluate the highway economics by few select methods and also will have a basic knowledge of various highway financing concepts.

Text Books/Reference Books:

1. S K Khanna and C E G Justo, “Highway Engineering”, Nem Chand Bros, Roorkee.
2. L R Kadiyali, “Highway Engineering”, Khanna Publishers, New Delhi.
3. R Srinivasa Kumar, “Highway Engineering”, University Press.
4. K. Subramaniam, “Transportation Engineering”, SciTech Publications, Chennai.
5. Saxena Subhash C and Satyapal Arora, “A Course in Railway Engineering”, Dhanpat Rai and Sons, Delhi.
6. Chandra S. and Agarwal M.M. “Railway Engineering”, Oxford University Press India.
7. Khanna S K, Arora M G and Jain S S, “Airport Planning and Design”, Nem Chand and Bros.
8. Khanna S.K. and Justo C.E.G. “Highway Material Testing”, Nem Chand & Bros.

GEOGRAPHIC INFORMATION SYSTEM (21CV46)

Semester IV			
No. of Lecture hour/Week	02	**CIE Marks**	50
No. of Practical hours/week	02	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	1:0:2	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Geographic Information System-** Introduction, Functions and advantages, sources of data for GIS. Database – Types, advantages and disadvantages. Data Analysis.-overlay operations, network analysis, spatial analysis. Outputs and map generation. GPS- components and working principles.	**03 Hours**
Module 2	**Applications of GIS**, Remote Sensing and GPS: Water Resources engineering and management (prioritization of river basins, water perspective zones and its mapping), Highway and transportation (highway alignment, Optimization of routes, accident analysis), Environmental Engineering 2 (Geostatistical analysis of water quality, rainfall).	**05 Hours**
Module 3	**Applications of GIS, Remote Sensing and GPS:** Urban Planning & Management, urban sprawl, Change detection studies, forests and urban area, floods, drainage system agriculture, Disaster Management.	**03 Hours**
Module 4	**QGIS** **Introduction:** Definition of GIS and its use. Introduction to a free and open source desktop geographic information system software. Types of data (vector and raster formats), web services, useful commands and utilities for geo-processing, extending its capabilities to digital satellite image processing and analysis. **About QGIS:** Characteristics of QGIS Start using QGIS. QGIS TOOLS QGIS Configuration, General tools, Working with projections QGIS Browser. WORKING WITH RASTER DATA Introduction, Display raster data, Raster calculator, Working with images, Practical exercises: Working with raster data and operations with images.	**07 Hours**
Module 5	**Create maps and related products**: Creation tools, Graphic elements, Atlases generation, and Graphic output creations. Practical exercises: Map creation with QGIS. Teaching-Learning Process Chalk and talk, PowerPoint Presentation & PBL **Relational database management systems and spatial data**. Database design, Database connections, Table joins Spatial joins, generate new statistics and new data using table and spatial data information. Practical exercises: Creation of thematic maps like population data of taluk, Watershed map with drainage and water bodies, Highway with other 2 road intersection details	**07 Hours**

Course Outcomes:

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

1. Understand principles Geographical Information Systems (GIS) data acquisition and its applications.
2. Apply GIS technologies in various fields of engineering and social needs for creating a feasible solution in the different fields of application of GIS
3. Use open source software for civil environmental engineering applications of various tools in QGIS software
4. Create thematic layers with attribute data and generate maps using QGIS for decision making

Reference Books:

1. Tor Bernharadsen, "Geographic Information System-An Introduction", Wiley India Pvt. Ltd. New Delhi, 3rd Edition, 2009, ISBN - 9788126511389.
2. Principles of Remote sensing and Image Interpretation, Lillesand and Kiefer, John Wiley Publishers, New Delhi, 6th Edition, 2011, ISBN – 8126532238.
3. Web links and Video Lectures (e-Resources): https://docs.qgis.org/3.16/pdf/en/QGIS-3.16-DesktopUserGuide-en.pdf for QGIS manual
4. NPTEL Lectures.

CONSTITUTION OF INDIA, PROFESSIONAL ETHICS & CYBER LAW (21CPH47)

Semester IV			
No. of Lecture hour/Week	1	**CIE Marks**	50
No. of Tutorial hours/week	-	**SEE Marks**	-
Total No. of Lecture hours	16	**Exam Hours**	-
L: T:P	1:0:0	**Credits**	01

Modules	Course Content	Teaching Hours
Module 1	**Introduction to Indian Constitution:** Definition of Constitution, Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution, Role of the Constituent Assembly. Preamble of Indian Constitution & Key concepts of the Preamble. Salient features of India Constitution.	**03 Hours**
Module 2	**Fundamental Rights (FR's), Directive Principles of State Policy (DPSP's) and Fundamental Duties (FD's):** Fundamental Rights and its Restriction and limitations in different Complex Situations. DPSP's and its present relevance in Indian society. Fundamental Duties and its Scope and significance in Nation building.	**03 Hours**
Moule 3	**Union Executive:** Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism.	**03 Hours**
Module 4	**State Executive & Elections, Amendments and Emergency Provisions:** State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (Why and How) and Important Constitutional Amendments till today. Emergency Provisions.	**03 Hours**
Module 5	**Professional Ethics:** Definition of Ethics & Values. Professional & Engineering Ethics. Positive and Negative aspects of Engineering Ethics. **Cyber Laws:** Salient features of the IT Act, 2000, various authorities under IT Act and their powers. ; Penalties & Offences, amendments. **Computer & Cyber Security:** (a) Types of Attacks, (b) Network Security (c) Overview of Security threats, (d) Hacking Techniques, (e) Password cracking (f) Insecure Network connections, (g) Malicious code (h) Concept of Fire wall Security	**04 Hours**

Course outcomes:

After studying this course, students will able to:

- Have constitutional knowledge and legal literacy.
- Understand Engineering and Professional ethics and responsibilities of Engineers.
- Understand cyber threats & cyber laws, acts and their powers.

Textbook/ Reference Books

1. Shubham Singla, “Constitution of India, Professional Ethics & Human Rights”, CENGAGE Publications, 2018

2. Advocate Prashant Mali, “Cyber Law & Cyber Crimes”, Snow White publications, Mumbai.

3. Farooq Ahmad, “Cyber Law in India”, Pioneer Books.

ABILITY ENHANCEMENT COURSE II (21AEC48)

Semester IV			
No. of Lecture hour/Week	1	**CIE Marks**	50
No. of Tutorial hours/week	-	**SEE Marks**	-
Total No. of Lecture hours	16	**Exam Hours**	-
L: T:P	1:0:0	**Credits**	01

Modules	Course Content	Teaching Hours
Module 1	**Technical Report Writing:** Introduction to Technical writing process, Understanding of writing process, Introduction to various Technical Report writing.	**03 Hours**
Module 2	**Art of condensation and Paragraph Writing:** Introduction and importance, Types and principles of condensation. Importance of paragraph writing, Features and its construction styles.	**03 Hours**
Module 3	**Business Report Writing:** Introduction, Definition and Salient features of Business reports. Significance and types of report writing. (Formal and Informal). Resume building and Types of resumes. (samples of resumes)	**03 Hours**
Module 4	**Technical Articles and Proposals:** Nature and significance, Types of technical Articles Journal articles and conference papers. Elements of technical articles .Introduction to technical proposal writing, Purpose, importance, structure and types of technical proposals.	**04 Hours**
Module 5	**Social media posts and Blog Writing:** Ethics and practices of social media posts, Principles and fundamentals, Guiding principles for composition of articles, some common pitfalls. Maintaining common etiquette. Blogs and Blog writings strategies.	**03 Hours**

Course outcomes

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

1. Effectively communicate in technical matters.
2. Practice preparation of gist, abstract and notes from a technical article.
3. Prepare a business proposals and reports.
4. Write and respond in social media and write blogs.

Textbook/ Reference Books

1. Sanjay Kumar and Pushpalata, “Communication Skills”, Oxford University Press. 2018.
2. M. Ashraf Rizvi, “Effective Technical Communication”, McGraw Hill, 2018.
3. Gajendra Singh Chauhan and et.al. “Technical Communication”, Cengage Publication, 2018.
4. Meenakshi Raman and Sangeeta Sharma, “Technical Communication Principles and Practice”, Oxford University Press, 2018.

HYDROLOGY & WATER RESOURCES ENGINEERING (21CV51)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Hydrology:** Introduction, Global distribution of water and Indian water availability. Hydrologic cycle (Horton's) qualitative and engineering representation. **Precipitation:** Forms and types, measurement of rain fall using Syphon type of rain gauges, optimum number of rain gauge stations, consistency of rainfall data (double mass curve method), computation of mean rainfall, estimation of missing data, presentation of precipitation data, moving average curve, mass curve, rainfall hyetographs. **Losses from Precipitation:** Evaporation process, factors affecting evaporation, measurement using IS class-A Pan, reservoir evaporation and control. Factors affecting Evapo-transpiration. Infiltration, Factors affecting infiltration capacity, measurement by double ring infiltrometer, Horton's infiltration equation, infiltration indices.	**08 Hours**
Module 2	**Runoff:** Definition, concept of catchment, factors affecting runoff, rainfall – runoff relationship using regression analysis. **Hydrographs:** Definition, components of hydrograph, base flow separation, unit hydrograph, assumption, application and limitations, derivation from simple storm hydrographs, S curve and its computations, Conversion of UH of different durations.	**08 Hours**
Module 3	**Irrigation:** System of irrigation: surface and ground water, flow irrigation, lift irrigation. Methods of irrigation: surface, sprinkler and drip/micro irrigation. **Water Requirements of Crops:** Duty, delta and base period, relationship between them, factors affecting duty of water crops and crop seasons in India, irrigation efficiency, frequency of irrigation.	**08 Hours**
Module 4	**Reservoirs:** Definition, investigation for reservoir site, storage zones determination of storage capacity using mass curves, economical height of dam. **Canals:** Types of canals. Alignment of canals. Definition of gross command area, cultural command area, intensity of irrigation, time factor, crop factor. Unlined and lined canals. Standard sections. Regime channels, Design of canals by Lacey's and Kennedy's method.	**08 Hours**
Module 5	**Flood Management:** rivers and floods, Causes of floods, Alleviation, Flood control:Levees and floodwalls, Flood ways, Channel improvement, Flood damage analysis. **Drought Management:** Definition of drought, Causes of drought, measures for water conservation and augmentation, drought contingency planning.	**08 Hours**

	Water harvesting: rainwater collection, small dams, runoff enhancement, runoff collection, Restoration and rejuvenation of water bodies (ponds and lakes)	

Course outcomes:

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

- Provide a background in the theory of hydrological processes and their measurement
- Estimate runoff and develop unit hydrographs.
- Find the water requirement and frequency of irrigation for various crops.
- Find the canal capacity and compute the reservoir capacity.
- Analyze floods and droughts. Emphasize on the importance of conservation of water and water bodies.

Text and Reference Books:

1. Subramanya. K, "Engineering Hydrology", Tata McGraw Hill New Delhi, Latest Ed.
2. Madan Mohan Das, Mim Mohan Das , "Hydrology", PHI Learning private Ltd, New Delhi-Latest Ed.
3. Jayarami Reddy, "A Text Book of Hydrology", Lakshmi Publications, New Delhi, Latest Ed.
4. P.N. Modi, "Irrigation, water Resources and water power Engineering", standard book house, New Delhi.
5. Ralph A Wurbs, Wesley P. James, "Water resources engineering", PHI Learning pvt. Ltd. New Delhi, Latest Ed.
6. Chin D.A., "Water resources engineering", Prentice Hall, Latest Ed.
7. Larry W. Mays,"Water resources engineering", John Wiley & sons, Latest Ed.
8. B.C Punmia & Pande B.B Lal, "Irrigation & water power engineering", Laxmi Publications, 17 th edition.

DESIGN OF RC STRUCTURAL ELEMENTS (21CV52)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to working stress and limit State Design:** Introduction to working stress method, Difference between Working stress and Limit State Method of design. Philosophy and principle of limit state design with assumptions. Partial Safety factors, Characteristic load and strength. Stress block parameters, concept of balanced section, under reinforced and over reinforced section. Limiting deflection, short term deflection, long term deflection, Calculation of deflection of singly reinforced beam only.	**08 Hours**
Module 2	**Limit State Analysis of Beams:** Analysis of singly reinforced, doubly reinforced and flanged beams for flexure and shear.	**08 Hours**
Module 3	**Limit State Design of Beams:** Design of singly reinforced beams with check for shear, check for development length and other checks. Design of doubly reinforced beams and flanged sections without checks.	**08 Hours**
Module 4	**Limit State Design of Slabs and Stairs:** Introduction to one way and two way slabs, Design of cantilever, simply supported and one way continuous slab. Design of two way slabs for different boundary conditions. Design of dog legged and open well staircases.	**08 Hours**
Module 5	**Limit State Design of Columns and Footings:** Analysis and design of short axially loaded RC column. Design of columns with uniaxial and biaxial moments, Design concepts of the footings. Design of Rectangular and square column footings with axial load.	**08 Hours**

Course outcomes:

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

- Understand the design philosophy and principles.
- Distinguish between Working stress and Limit State Method of design.
- Demonstrate the procedural knowledge in designs of RC structural elements such as slabs, columns, stairs and footings.
- Solve engineering problems of RC elements subjected to flexure, shear and torsion.
- Analyze and design a complete structural system through a comprehensive design project.

Text and Reference Books:

1. Unnikrishnan Pillai and Devdas Menon, “Reinforced Concrete Design”, McGraw Hill, New Delhi
2. N Subramanian, “Design of Concrete Structures”, Oxford University Press

3. H J Shah, “Reinforced Concrete Vol. 1 (Elementary Reinforced Concrete)”, Charotar Publishing House Pvt. Ltd.

Reference Books:

1. P C Varghese, “Limit State design of reinforced concrete”, PHI, New Delhi.
2. Robert Park and Thomas Paulay, “Reinforced Concrete Structures”, John Wiley & Sons, Inc.
3. IS 456:2000, Plain and reinforced concrete - Code of practice.

CONCRETE TECHNOLOGY (21CV53)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Cement and aggregates** Cement, Chemical composition, Physical and chemical properties, Other Cementitious materials and composition - GGBS, Fly ash rice Husk ash, Silica fume, Hydration of cement, Factors influencing and affecting Hydration of cement, Types of cement. Fine aggregate - grading, analysis, Specify gravity, bulking, moisture content, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests. Codal Provisions.	**08 Hours**
Module 2	**Properties of fresh concrete** Workability - Process of manufactures of concrete: Batching, Mixing, Assessment of Workability of Concrete, Factors affecting workability, Measurement of workability – slump test, flow test, Compaction factor test and Vee-Bee Consistometer tests, Segregation and bleeding, Transporting, Placing, Compaction, Curing, need and Types of curing, accelerated curing.	**08 Hours**
Module 3	**Admixtures:** Classification, effect on fresh and hardened concrete, retention time, Dosage ant their effects, Influence on properties of paste, mortar, and concrete. Types of concrete (in brief). **Mix design procedure**: Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262-2019, Numerical examples of Mix Design.	**08 Hours**
Module 4	**Hardened concrete:** Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, assessment of compressive strength, flexural strength, tensile strength, bond strength and modulus of elasticity, aggregate - cement bond strength, factors influencing strength and codal provisions, Relation between modulus of elasticity and strength, factors affecting modulus of elasticity, Poisson Ratio.	**08 Hours**
Module 5	**Durability** - definition, significance, short term and long-term durability. Shrinkage-plastic shrinkage and drying shrinkage, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, Factors affecting shrinkage, Effect of creep. Measurement of creep, factors influencing creep. Permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Construction joints and Expansion joints, Thermal effect of concrete. Codal Provisions.	**08 Hours**

Lab Experiments

1. Testing of cement: Consistency, fineness, setting time, Specific Gravity, Soundness and Strength.
2. Testing of fine aggregate: Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.
3. Testing of coarse aggregate: Specific Gravity, sieve analysis, bulk density, flakiness index, Elongation index, water absorption & moisture content, soundness of aggregate.
4. Concrete Mix design by ACI 211.1-91 method, IS code method as per 10262- 2019 & 456-2000, DOE method.
5. Tests on Concrete- Workability tests – Slump cone test, compaction factor test, Vee-bee Consistometer test, flow table test, strength tests- compressive strength, flexural strength, split tensile strength.
6. Effects of Admixture - Accelerator, Retarder, Super Plasticizer
7. Non-destructive Testing - Rebound Hammer test, Ultrasonic Pulse Velocity test

Course outcomes

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

- Assess and infer various properties of cement, cementitious materials, Fine and coarse aggregate as per codal provision and specifications.
- Design the concrete mix for the given materials as per IS: 10262-2019 provisions.
- Understand the manufacturing process and asses the quality of cement.
- Describe the properties of fresh and hardened concrete – Strength and Durability aspects.
- Examine and Evaluate properties of Cement and Concrete.

Text Books/Reference Books

1. M.S.Shetty, "Concrete Technology-Theory and Practice", S. Chand and Company, New Delhi, 2002.
2. A.R. Santa kumar, "Concrete Technology", Oxford University Press, 2007.
3. Gambhir, Dhanpat Rai & Sons, "Concrete Manual", New Delhi.
4. IS: 10262-2016, "Recommended guidelines for concrete mix design", Bureau of Indian Standards, New Delhi.

ENVIRONMENTAL ENGINEERING - II (21CV54)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Wastewater:** **Introduction:** Need for sanitation, methods of sewage disposal, and types of sewerage systems. **Treatment of municipal waste water:** Waste water characteristics (Analysis to be conducted in laboratory session): sampling, significance and techniques, physical, chemical and biological characteristics, Numericals on BOD.	**08 Hours**
Module 2	**Treatment Process:** flow diagram for municipal waste water Treatment unit operations and process, Screens: types, disposal. Grit chamber, oil and grease removal. Primary and secondary settling tanks.	**08 Hours**
Module 3	**Suspended & Attached growth system** – trickling filter, Trickling filters, bio-towers and rotating biological contactors. SBBR, SBR, MBR. Activated sludge process and its modifications.	**08 Hours**
Module 4	**Fundamentals of sanitary engineering:** Methods of sewage disposal, types of sewerage systems, dry weather flow, wet weather flow, factors affecting dry and wet weather flow, estimation of storm water flow, time of concentration flow, Numericals. Sewer appurtenances: Manholes, catch basins, oil and grease traps. P, Q, S traps. Material of sewers, shape of sewers, laying and testing of sewers, ventilation of sewers, basics of house drainage. **Hydraulic design of sewers:** Determination of velocity and discharge. Self-cleansing and non-scouring velocity. Design of hydraulic elements for circular sewers for full flow and half flow conditions.	**08 Hours**
Module 5	**Rural sanitation:** Collection and disposal of dry refuse, collection and disposal of sullage, disposal of excretal waste, night soil disposal without water carriage: previes. **Solid waste disposal**: Introduction, quantity and composition of refuse, transport of refuse, disposal of refuse, composting, methods of composting. **Air Pollution:** Composition of atmospheric air, classification and sources of air pollutants, characteristics of air pollutants, air pollution control methods and equipment's.	**08 Hours**

Course outcomes:

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

- Identify and solve problems arising from hard water using various treatment methods.
- Choose appropriate suitable systems and connection services for supply and distribution of water.

- Design sewers for various conditions flow and demonstrate house drainage appurtenances.
- Articulate the principles of rural sanitation and pollution control.

Text and Reference Books:

1. B.C. Punmia and Ashok Jain, “Environmental Engineering - II”, Laxmi Publications (P) Ltd., New Delhi.
2. Howard S. Peavy, Donald R. Rowe, George T, “Environmental Engineering”, Tata McGrawHill, New York, Indian Edition, 2013.
3. S. K. Garg, “Environmental engineering vol-II”, Khanna Publishers, New Delhi.

ENVIRONMENTAL IMPACT ASSESMENT (21CV55)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Development; Sustainable Development – Logic of sustainable development; methods to achieve sustainable development. EIA- As An Integral Part of The Planning Process. The need for EIA, Indian Policies requiring EIA, The EIA cycle and procedures, Screening, Scoping, Baseline Data, impact prediction, Assessment of Alternatives, Delineation of mitigation measure and EIA report, Public Hearing, decision making, monitoring the clearance conditions. Government of India Ministry of Environment and Forest Notification (2000) and its amendments, List of projects requiring environmental clearance, categorization of projects, Procedure for getting environmental clearance, application form, Composition of expert committee, ecological sensitive places, international agreements.	**08 Hours**
Module 2	**Environmental Impact Assessment:** Carrying capacity concept, Evolution, Objectives, Types - Rapid and Comprehensive EIA, FONSI, NDS, EIS, NABET Accreditation to EIA Consultants. Scope and contents of EIA, Step-by-step process in EIA & its Frame work, Components of EIA, Roles in the EIA Process, EIA process limitations, TOR.	**08 Hours**
Module 3	**EIA Methodologies:** Environmental Attributes-Criteria for the selection of EIA methodology, impact identification, impact measurement, impact interpretation & Evaluation, impact communication, Methods - Adhoc methods, Checklists methods, Matrices methods, Networks methods, Overlays methods. EIA review- Baseline Conditions -Construction Stage Impacts, post project impacts. Attributes – air, water, land, noise, biotic, socio-economic - Standards and value functions, Application of various models for the Prediction of impact on Air Environment, Water Environment, Noise Environment and Land Environment.	**08 Hours**
Module 4	**Environmental Management Plan:** EMP preparation, Monitoring Environmental Management Plan, Identification of Significant or Unacceptable Impacts Requiring Mitigation, Mitigation Plans and Relief & Rehabilitation, Stipulating the Conditions, Monitoring Methods, Pre- Appraisal and Appraisal.	**08 Hours**
Module 5	**Case Studies:** Preparation of EIA for developmental projects- Factors to be considered in making assessment decisions, Water Resources Project, Construction and Infrastructure projects, Pharmaceutical industry, Thermal power plant, Nuclear fuel complex, Highway project, Sewage treatment plant, Municipal Solid waste processing plant, Air Ports.	**08 Hours**

Course outcomes:

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

- Make decisions on Sustainable Development.
- Provide comprehensive information, on Environment (physical and biological), its degradation due to developmental activities
- Choose appropriate methods of determining consequences or impacts and possible methods of mitigation.
- Assess consequences of developmental projects being planned and executed in the vicinity.

Text and Reference Books:

1. Jain, R.K., Urban, L.V. and Stacey, G.S., "Environment Impact Analysis", Von Nostrand Reinhold Company.
2. Lawrence, David P., "Environmental Impact Assessment (Practical Solutions to Recurrent Problems)", Wiley International, New Jersey.
3. MoEF, GoI, "Environment Impact Assessment", Impact Assessment Division, January 2001 (Manual).
4. Trivedi, P.R., "Natural Resources Conservation", APH Publishing Corporation, New Delhi.
5. Westman, Walter E., "Ecology, Impact Assessment and Environment Planning", John Wiley and Sons, Canada, 1985.
6. Canter L., "Environmental Impact Assessment", McGraw Hill, 1995.
7. Clark B.C. Bisett and Tomlinsan P, "Perspective on Environmental Impact Assessment", Allied Publishers, 1985.
8. CPR Environmental Education Centre, "Environmental Laws of India – An Introduction", 2006.
9. Indian Acts related to Environmental Pollution Prevention and Control.
10. Anjaneyulu and Valli Manickam, "Environmental Impact AssessmentMethodologies", BS Publications, 2010.

OCCUPATIONAL HEALTH & SAFETY (21CV561)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation.	**08 Hours**
Module 2	Ergonomics at Work Place: Ergonomics Task analysis, Preventing Ergonomic Hazards, Work space Envelops, Visual Ergonomics, Ergonomic Standards, Ergonomic Programs. Hazard cognition and Analysis, Human Error Analysis, Fault Tree Analysis – Emergency Response - Decision for action – purpose and considerations.	**08 Hours**
Module 3	Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers. Electrical Safety, Product Safety: Technical Requirements of Product safety.	**08 Hours**
Module 4	Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and Sustainability.	**08 Hours**
Module 5	Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors.	**08 Hours**

Course outcomes:

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

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Present a coherent analysis of a potential safety or health hazard both verbally and in writing,
4. Citing the occupational Health and Safety Regulations as well as supported legislation.
5. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.

6. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Text and Reference Books:

1. Goetsch D.L., "Occupational Safety and Health for Technologists, Engineers and Managers", Pren tice Hall, 1999.
2. Heinrich H.W., (2007), "Industrial Accident Prevention - A Scientific Approach", McGraw-Hill Publ.
3. National Safety Council and Associate (Data) Publishers Pvt. Ltd., (1991), "Industrial Safety and Pollution Control" Handbook.
4. Colling D.A., (1990), "Industrial Safety Management and Technology", Prentice Hall, New Delhi.
5. Della D.E., and Giustina, (1996), "Safety and Environmental Management", Van Nostrand Reinhold International Thomson Publishing Inc.

INTELLIGENT TRANSPORT SYSTEM (21CV562)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	Basic elements of intelligent transportation systems (ITS), focusing on technological, systems and institutional aspects. Benefits of ITS -ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection.	**08 Hours**
Module 2	Advanced traveler information systems; transportation network operations; commercial vehicle operations and intermodal freight.	**08 Hours**
Module 3	Public transportation applications, ITS and regional strategic transportation planning, including regional architectures.	**08 Hours**
Module 4	ITS and changing transportation institutions, ITS and safety, ITS and security, ITS as a technology deployment program, research, development and business models, ITS and sustainable mobility.	**08 Hours**
Module 5	Travel demand management, electronic toll collection, and ITS and road-pricing. Automated Highway Systems- Vehicles in Platoons –ITS in World – Overview of ITS Implementations in developed countries, ITS in developing countries.	**08 Hours**

Course outcomes:

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

1. Suggest the appropriate system/s in various functional areas of transportation.
2. Amalgamate the various systems, plan and implement the applications of ITS.
3. Apply of information technology and telecommunication to control traffic.
4. Provide advance information to the travellers, automatic handling of emergencies and to improve safety.

Text and Reference Books:

1. Choudury M A and Sadek A, “Fundamentals of Intelligent Transportation Systems Planning” Artech House.
2. Pradip Kumar Sarkar, Amit Kumar Jain, “Intelligent Transport Systems”, PHI Learning Publishers.
3. Kan Paul Chen, John Miles, “Recommendations for World Road Association (PIARC)” ITS Hand Book, 2000.
4. Sussman, J. M., “Perspective on ITS”, Artech House Publishers, 2005.
5. US Department of Transportation, “National ITS Architecture Documentation”, 2007 (CDROM).
6. Turban. E and Aronson. J. E, “Decision Support Systems and Intelligent Systems”.

SMART CITIES & PLANNING (21CV563)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Fundamental of smart city & Infrastructure:** Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment.	**08 Hours**
Module 2	**Planning and development of Smart city Infrastructure**: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.	**08 Hours**
Module 3	**Intelligent transport systems** Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	**08 Hours**
Module 4	**Management of water resources and related infrastructure**: Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system	**08 Hours**
Module 5	**Infrastructure Management system & Policy for Smart city** Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city. Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	**08 Hours**

Course outcomes:

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

- Understand the necessity of infrastructural development for smart cities.
- Identify components of infrastructure and Prepare infrastructure plan for smart city.
- Formulate smart transport system for smart cities and its application.
- Plan of water resources systems for smart city and its application.
- Understand National and Global policies to implement for smart city development.

Text and Reference Books:

1. Xianyi Li, “Smart City on Future Life - Scientific Planning and Construction”.
2. Nicos Komninos, “The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities)”.
3. Anthony Townsend, “Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia”.
4. Grig N.S., “Infrastructure engineering and management”, Wiley-Interscience, 1988.
5. Hudson W.R., Haas R., Uddin W., “Infrastructure Management”, McGraw-Hill, 1997.

6. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler-Milanovic; Evert Meijers, "Smart cities – Ranking of European medium-sized cities" , Vienna: Centre of Regional Science, (2007).
7. Government of India - Ministry of Urban Development, “Mission statement & guidelines on Smart City Scheme”. http://smartcities.gov.in/upload/uploadfiles/files/Smart City Guidelines.

NEIGHBOURHOOD PLANNING (21CV564)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Types of Data and Sources of Data for Planning** Understanding difference between data, information and knowledge; Distinction between facts and opinions; Reliable sources of data and information; Data requirements for urban and regional planning; Sources of primary and secondary data; Overview of data availability from different sources including Census of India, NSSO, etc.	**08 Hours**
Module 2	**Data Collection Methods - Socio-Economic Surveys** Questionnaire design, design of sample surveys, types of sampling, measurement scales, data coding and data verification; Qualitative data collection methods: focus group surveys, individual interviews, observations, ethnographic methods; Validity and reliability of data.	**08 Hours**
Module 3	**Data Collection Methods - Physical Surveys and Mapping** Physical surveys for the preparation of base maps at different scales, contents of base maps; Land use classifications; Techniques for conducting field surveys for land use, building use, density and other surveys needed for planning; Use of information, communication and technology (ICT) based data collection methods.	**08 Hours**
Module 4	**Urban land use planning:** Objectives and Principles of Urban planning; Different Land use planning norms, Environmental aspects of land use planning, Role of URDPFI guidelines in Town planning, Land use Structures, demand and supply of land relationship, Government policies of urban development, Role of Professional bodies.	**08 Hours**
Module 5	**Planning of residential areas:** Household and housing, housing requirement for different sections of society, building byelaws, development controls, housing projects layouts, Neighbourhood planning, design standards and their significance in housing process, socio-economic and aesthetic, environmental factors affecting layouts, various concepts of layout planning, row and multi storied housing, layout optimization techniques, appropriate DU design.	**08 Hours**

Course outcomes:

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

- Develop the skills for preparing a base map at different scales and representation of relevant planning information on it.

- Assess data requirements for planning and to demonstrate skills for undertaking surveys.
- Understand the concepts for different area planning.
- Plan residential areas considering socio economic factors.

Text and Reference Books:

1. William M Rohe and Lauren B Gates, “Planning with Neighbourhoods”, University of North Carolina Press, 1985.
2. William Peterman, “Neighbourhood Planning and Community Based Development”, Sage Publications India Pvt Ltd, GoKI , New Delhi, 2000.
3. Berke, P.R. and Goodschalk, D.R., Kaiser, E.J. and Rodriguez, D.AUrban, “Land Use Planning”, University of Illinois Press, Champaign, Illinois. Fifth Edition, 2006.
4. Dandekar, H.C, “The Planner’s Use of Information, Routledge”, New York. Third Edition, 2019.
5. Brownill, S, “Localism and Neighbourhood Planning”, Policy Press, Bristol, 2017.
6. Parker, G., Salter, K. and Wargent, M. “Neighbourhood Planning in Practice”, Lund Humphries Publishers, London, 2019.

Reference Books:

1. Jain, A.K, “Town Planning”, Khanna Book Publishing Co., New Delhi, 2019.
2. A.B. Gillion and Simon Eisner, “The Urban Pattern”, CBS Publishers and Distributors, Delhi.
3. Rishma A., “Town Planning in Hot Cities”, Mir Publishers, Moscow.
4. Ward S, “Planning the 20th Century City” John Wiler & Sons, 2002.
5. R. Ramachandran, “Urbanisation and Urban Systems in India”, Oxford Publications.
6. K. C. Shivrama Krishnan, “Revisioning Indian Cities”, Sage Publications.

FINITE ELEMENT METHOD (21CV571)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	Theory of elasticity concepts, Energy principles, Rayleigh - Ritz Method, Galerkin method and finite element method, steps in finite element analysis, displacement approach, stiffness matrix and boundary conditions.	**05 Hours**
Module 2	Discritisation; finite representation of infinite bodies and discritisation of very large bodies, Natural Coordinates, Shape functions; polynomial, LaGrange and Serendipity , one dimensional formulations; beam and truss with numerical examples.	**05 Hours**
Module 3	2D formulations; Constant Strain Triangle, Linear Strain Triangle, 4 and 8 noded quadrilateral elements, Numerical Evaluation of Element Stiffness -Computation of Stresses, Static Condensation of nodes, degradation technique, Axisym metric Element.	**05 Hours**
Module 4	Isopara metric concepts; is opera metric, sub parametric and super parametric elements, Jacobian transformation matrix, Stiffness Matrix of Isopara metric Elements, Numerical integration by Gaussian quadrature rule for one, two and three dimensional problems.	**05 Hours**
Module 5	Techniques to solve nonlinearities in structural systems; material, geometric and combined non linearity, incremental and iterative techniques. Structure of computer program for FEM analysis, description of different modules, exposure to FEM software's.	**05 Hours**

Course outcomes:

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

- Understand the concepts behind formulation methods in FEM.
- Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements.
- Develop element characteristic equation and generation of global equation.
- Able to apply suitable boundary conditions to a global equation for bars, trusses, beams, circular shafts, heat transfer, fluid flow, axi symmetric and dynamic problems and solve them displacements, stress and strains induced.

Text and Reference Books:

1. Krishnamoorthy C.S., "Finite Element analysis" -Tata McGraw Hill.
2. Desai C &Abel J F.," Introduction to Finite element Method" , East West Press Pvt. Ltd.
3. Cook R D et.al., "Concepts and applications of Finite Element analysis", John Wiley.
4. Daryl L Logan, "A first course on Finite element Method", Cengage Learning.
5. Bathe K J - "Finite Element Procedures in Engineering analysis"- Prentice Hall.

ALTERNATIVE BUILDING MATERIALS (21CV572)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Environmental Implications of Buildings** Energy use, carbon emissions, water use, waste disposal; Building materials: sources, methods of production and environmental Implications. Embodied Energy in Building Materials: Transportation Energy for Building Materials; Maintenance Energy for Buildings. Framed Construction, Masonry Construction. Resources for Building Materials, Alternative concepts. Recycling of Industrial and Buildings Wastes. Biomass Resources for buildings.	**05 Hours**
Module 2	**Elements of Structural Masonry:** Elements of Structural Masonry, Masonry materials, requirements of masonry units' characteristics of bricks, stones, clay blocks, concrete blocks, stone boulders, laterite Blocks, Fal- G blocks and Stabilized mud block. Manufacture of stabilized blocks. **Structural Masonry Mortars:** Mortars, cementations materials, sand, natural & manufactured, types of mortars, classification of mortars as per BIS, characteristics and requirements of mortar, selection of mortar. Uses of masonry, masonry bonding, Compressive strength of masonry elements, Factors affecting compressive strength, Strength of Prisms/wallets and walls, Effect of brick bond on strength, Bond strength of masonry: Flexure and shear, Elastic properties of masonry materials and masonry, Design of masonry compression elements subjected to axial load.	**05 Hours**
Module 3	**Alternate Building Materials:** Lime, Pozzolana cements, Raw materials, Manufacturing process, Properties and uses. Fibers- metal and synthetic, Properties and applications. Fiber reinforced plastics, Matrix materials, Fibers organic and synthetic, Properties and applications. Building materials from agro and industrial wastes, Types of agro wastes, Types of industrial and mine wastes, Properties and applications. Masonry blocks using industrial wastes. Construction and demolition wastes.	**05 Hours**
Module 4	**Alternate Building Technologies:** Use of arches in foundation, alternatives for wall constructions, composite masonry, confined masonry, cavity walls, rammed earth, Ferro cement and ferroconcrete building components, Materials and specifications, Properties, Construction methods, Applications. Top down Construction, Mivan Construction Technique. **Alternate Roofing Systems:** Concepts, Filler slabs, Composite beam panel roofs, Masonry vaults and domes.	**05 Hours**
Module 5	**Equipment for Production of Alternate Materials:** Machines for manufacture of concrete, Equipment's for	**05 Hours**

	production of stabilized blocks, Moulds and methods of production of precast elements, Cost concepts in buildings, Cost saving techniques in planning, design and construction, Cost analysis: Case studies using alternatives.	

Course outcomes:

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

- Solve the problems of Environmental issues concerned to building materials and cost effective building technologies;
- Select appropriate type of masonry unit and mortar for civil engineering constructions; also they are able to Design Structural Masonry Elements under Axial Compression.
- Analyze different alternative building materials which will be suitable for specific climate and in an environmentally sustainable manner. Also capable of suggesting suitable agro and industrial wastes as a building material.
- Recommend various types of alternative building materials and technologies and design energy efficient building by considering local climatic condition and building material.

Text and Reference Books:

1. K S Jagadish, B V Venkatarama Reddy and K S Nanjunda Rao, “Alternative Building Materials and Technologies”, New Age International pub.
2. Arnold W Hendry, “Structural Masonry”, Macmillan Publishers.
3. RJS Spence and DJ Cook, “Building Materials in Developing Countries”, Wiley pub.
4. LEED India, Green Building Rating System, IGBC pub.
5. IGBC Green Homes Rating System, CII pub.
6. Relevant IS Codes.

SUSTAINABLE TECHNOLOGIES (21CV573)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Introduction to the concept of cost effective construction** - Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime Puzzolona Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials-Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.	**05 Hours**
Module 2	**Environment friendly and cost effective Building Technologies** - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams – columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products – steel and plastic - Contributions of agencies - Costford - Nirmithi Kendra - Habitat	**05 Hours**
Module 3	**Global Warming** – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.	**05 Hours**
Module 4	**Green Building rating Systems**- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weightage. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)	**05 Hours**
Module 5	**Utility of Solar Energy in Buildings** Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. **Green Concepts for Buildings** Concepts of Green Composites. Water balancing in Buildings, Low Energy Approaches. Management of Solid Wastes. Management of	**05 Hours**

	Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.HVAC.	

Course outcomes:

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

- Adopt cost effective technologies in construction.
- Harness renewable energy from the sources efficiently to reduce cost of construction.
- Make use of alternative materials to observe cost efficiency.
- Practice environment friendly and cost effective methods in constructional aspects.

Text and Reference Books:

1. Harhara Iyer G, “Green Building Fundamentals”, Notion Press, 2022.
2. Dr. Adv. Harshul Savla, “Green Building: Principles & Practices”, Notion Press, 2021.

QUALITY CONTROL & ASSURANCE (21CV574)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Overview of Quality:** Quality History, Quality Definition, Quality Inspection, Quality Control, Quality Assurance, Quality Engineering, Quality Management, Quality Gurus: Philip B. Crosby, W. Edwards Deming etc, PDCA Cycle, Costs associated with Quality, Reasons for Poor Quality.	**05 Hours**
Module 2	**Quality Management:** Management Practices: TQM, Vision and Quality policy, Quality Function Deployment, Bench marking and performance evaluation, ISO 9000 Quality Management System, ISO 14000 Environmental Management System.	**05 Hours**
Module 3	**Statistical Quality Control:** Importance of SQC in construction, Statistical parameters: sampling, population and sampling, measure of variability, measure of central tendency & dispersion, Recommendations of IS 456:2000 on sampling, testing and acceptance criteria for concrete.	**05 Hours**
Module 4	**QA and QC in Construction:** Errors in concrete construction; Frequency of material testing and reporting of basic construction materials (cement, sand, coarse aggregate, bricks, steel), Norms for accepting and rejecting criteria of basic construction materials as per relevant IS codes.	**05 Hours**
Module 5	**On-Site Quality:** Achieving quality at different stages of construction: Conceptual Design, Preliminary Design, Detailed Design, Construction, Testing, Commissioning, and Handover. Quality assessment of concrete through NDT: rebound hammer and USPV tests and guidelines for accepting and rejecting.	**05 Hours**

Course outcomes:

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

1. Realize the importance of quality in construction.
2. Apply SQC techniques in different aspects of construction.
3. Implement QMS programs at different levels of construction.
4. Frame criteria's for acceptance/rejection during execution of works.

Text and Reference Books:

1. Juran J M and Gryna F M, "Quality Planning and Analysis", McGraw Hill Publications, 3rd edition, 1993.
2. Hutchins G, John L Ashford, "The Management of Quality in Construction", Taylor & Francis group, 1 st edition, 1989.
3. Mohamed A. El-Reedy, "Concrete and Steel Construction, Quality Control and Assurance", CRC Press, Taylor and Francis Group.
4. Amitava Mitra, "Fundamentals of Quality Control and Improvement", WILEY Publications, 4th Edition.
5. Abdul Razzak Rumane, "Quality Management in Construction Projects", CRC Press, Taylor and Francis Group Publications.
6. Relevant IS Codes.

OFFSHORE STRUCTURES (21CV575)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	Types of offshore structures and their conceptual development- Fixed, Compliant, Floating- Analytical models for offshore structures- Behaviour under static and dynamic loads- Materials and construction of jacket and gravity platforms- Statutory regulations- Allowable stresses- Design methods and Code Provisions- Design specification of API, DNV, Lloyd's and other Classification Societies.	**05 Hours**
Module 2	Environmental loads- Wind, wave, current and ice loads- Calculation based on maximum base shear and overturning moments- Design wave height and spectral definition- Morison's Equation- Maximum wave force on offshore structure.	**05 Hours**
Module 3	Concept of return waves- Principles of static and dynamic analyses of fixed platforms-Use of approximate methods- Principles of WSD and LRFD- Allowable stresses and partial safety factors- Design of structural elements.	**05 Hours**
Module 4	Design against accidental loads- Fire, Blast and Collision- Behaviour of steel at elevated temperature. Fire rating for Hydrocarbon fire- Design of structures for high temperature- Blast mitigation-Blast walls- Collision of boats and energy absorption.	**05 Hours**
Module 5	Corrosion- Corrosion mechanism- Types of corrosion- Offshore structure corrosion zones- Biological corrosion- Preventive measures of corrosion- Principles of cathode protection systems- Sacrificial anode method and impressed current method- Online corrosion monitoring- Corrosion fatigue.	**05 Hours**

Course outcomes:

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

- Acquire knowledge and skills to carry out basic tasks regarding dimensioning and structural design of offshore structures.
- Estimation of maximum forces on an offshore structure due to operational loads and conduct static and dynamic analyses of fixed platforms.
- Acquire training in the design of jacket platforms, gravity platforms.
- Estimate the resistance of platforms against fatigue and accidental loads.
- Attain knowledge in the physics of corrosion and methods to monitor and prevent corrosion.

Text and Reference Books:

1. Srinivasan Chandrasekaran, “Dynamic Analysis and Design of Ocean Structures”, Springer, 2015.
2. DNV-RP-C203- fatigue Design of Offshore Steel Structures, 2011.
3. DNV-RP-C204- Design against Accidental Loads, 2010.
4. DNV-RP-B101-Corrosion Protection of Floating Protection and Storage Units, 2007.
5. API RP 2A, “Planning, Designing and Constructing Fixed Offshore Platforms”, API. 2000.
6. B.C Gerwick, Jr, “Construction of Marine and Offshore Structures”, CRC Press, Florida, 2000.
7. Clauss, G, Lehmann, E & Ostergaard, C, “Offshore Structures, Vol. 1 & 2”, Springer-Verlag, 1992.
8. Reddy, D. V and Arockiasamy, M., “Offshore Structures Vol.1 & 2”, Kreiger Publ. Co, 1991.
9. Morgan, N., “Marine Technology Reference Book”, Butterworths, 1990.
10. McClelland, B and Reifel, M. D., “Planning and Design of fixed Offshore Platforms”, Van Nostrand, 1986.
11. Dawson, T. H., “Offshore Structural Engineering”, Prentice Hall, 1983.
12. Graff, W. J., “Introduction to Offshore Structures”, Gulf Publ. Co.1981.

BRIDGE ENGINEERING (21CV576)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	Introduction to bridges, classification, selection of bridge site and preliminary and detailed survey work computation of discharge, linear waterway, economic span, afflux, scour depth. Design loads for bridges, introduction to I.R.C. loading standards, Load Distribution Theory, Bridge slabs, Effective width, Introduction to methods as per I.R.C.	**05 Hours**
Module 2	Design of Slab Bridges: Straight and skew slab bridges.	**05 Hours**
Module 3	Design of T beam bridges (up to three girder only) Proportioning of components, analysis of slab using IRC Class AA tracked vehicle, structural design of slab, analysis of cross girder for dead load & IRC Class AA tracked vehicle, structural design of cross girder, analysis of main girder using Courbon's method, calculation of dead load BM and SF, calculation of live load B M & S F using IRC Class AA Tracked vehicle. Structural design of main girder.	**05 Hours**
Module 4	Other Bridges: Design of Box culvert (Single vent only). Design of Pipe culverts.	**05 Hours**
Module 5	Substructures - Design of Piers and abutments, Introduction to Bridge bearings, Hinges and Expansion joints (No design).	**05 Hours**

Course outcomes:

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

- Understand the load distribution and IRC standards.
- Design the slab and T beam bridges.
- Design Box culvert, pipe culvert.
- Elucidate the prominence of bearings, hinges and expansion joints.
- Design Piers and abutments.

Text and Reference Books:

1. Johnson Victor. D, "Essentials of Bridge Engineering", Oxford Publishing Company.
2. N Krishna Raju, "Design of Bridges, Oxford and IBH publishing company.
3. T R Jagadeesh and M A Jayaram, "Design of bridge structures", Prentice Hall of India.
4. Jain and Jaikrishna, "Plain and Reinforced Concrete", Vol.2, Nem Chand Brothers.
5. Standard specifications and code of practice for road bridges, IRC section I, II, III and IV.
6. "Concrete Bridges", The Concrete Association of India.

ENVIRONMENTAL CHEMISTRY & MICROBIOLOGY (21CV581)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Environmental Chemistry** Introduction: Importance of Environmental Chemistry as applied to Environmental Engineering, types of reactions, acid/base, precipitation, reversible and irreversible reactions. Concepts of equivalent mass in relation to acids, bases, salts and oxidizing and reducing agents. Chemical equilibrium – redox and ionic equations. Modes of expression for molarity, normality, molality, ppm.	**05 Hours**
Module 2	**Electrochemistry** Electrolytes, types of conductance. Method of determining the specific conductance of water/wastewater and its correlation with dissolved salts. Electrode, types of electrodes, electrode potential, etc. Measurement of emf and pH and their applications in Environmental Engineering, electrode potential. Buffers and buffer index.	**05 Hours**
Module 3	**Colloidal and Surface chemistry** Colloids – Types, properties and environmental significance. Colloidal dispersions in water, air and emulsions. Theory of colloids – double layer theory, zeta potential, destabilization of colloids (Schulze – Hardy rule) as applied to coagulation process. Absorption and adsorption process, adsorption isotherms.	**05 Hours**
Module 4	**Applied Microbiology** Microscopic flora and fauna and their importance in environmental protection, microorganisms of importance in air, water and soil environment. Microbial enumeration techniques. **Microbial Metabolism:** Metabolic activity, anabolism and catabolism, influencing parameters, microbial metabolism of toxic chemicals and trace organics, bio concentration and bio magnification.	**05 Hours**
Module 5	**Bacteria:** Morphology, spore formation, typical bacterial growth curve, Nutritional requirements, Growth Models specific growth rate and generation time, numerical problems. **Algae, Fungi, Virus:** Classification, characteristics and environmental applications. **Enzymes:** Classification, kinetics of enzymatic reactions, Michaelis - Menton equation, factors influencing enzyme reactions, problems. Recent trends - Use of microbial consortia in water and wastewater treatment, Emerging Microbial Contaminants-chemical and antibiotic resistant microbes	**05 Hours**

Course outcomes:

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

- Identify types of chemical reactions and evaluate the feasibility of given reaction based on thermodynamics properties.
- Classify colloids, discuss their properties and their environmental significance.
- Discuss the need for microbiology and identify different flora and fauna of importance in water, air and soil media.
- Distinguish bacterial metabolic processes as applied to aerobic, anaerobic and facultative modes.
- Distinguish between algae, fungi and virus. Classify and characterize using different methods.

Text and Reference Books:

1. McKinney R.E. "Microbiology for Sanitary Engineers", McGraw Hill.
2. Pelzer, Chan and Ried, "Microbiology", Tata McGraw Hill Publishers, 1998.
3. Sawyer C.N. and McCarty, P.L., (2003), "Chemistry for Environmental Engineering and Science", TATA McGraw Hill Publishing Co. Ltd., 5th Edition, New Delhi.
4. Gaudy and Gaudy (1980), "Microbiology for Environmental Scientists and Engineers", McGraw Hill. Mall C.A.S & Day J.W., "Ecosystem Modelling in Theory and Practice: An Introduction with Case Histories", John Wiley Publications.
5. APHA, "Standard Methods for Examination of Water and Wastewater"; latest Edition, (2002).
6. Chakraborthy P, (2005), "Textbook of Microbiology", New Central Book Agency Pvt. Ltd., 2 nd Edition.

ENVIRONMENTAL FACILITY MANAGEMENT (21CV582)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Operation Maintenance & Management of Environmental Facilities** Scope, Significance, Importance, Basic Principles, Objectives, Requirements, limitations. Operation, maintenance and Management. Organizational Structure, Work Planning, Preparation and Scheduling, Cost Estimates.	**05 Hours**
Module 2	**Data Base of Facilities** Plan, Drawing, Map, Operation Manual, Record keeping, standard operating procedure. **Water Treatment and Supply Facilities** – Operation, maintenance and management problems and their respective remedial and control measures of Different Units of water Treatment and Water Supply Facilities.	**05 Hours**
Module 3	**Wastewater Collection and Treatment Facilities:** Operation, maintenance and management problems and their respective remedial and control measures of wastewater collection and treatment facilities	**05 Hours**
Module 4	**Industrial wastewater collection and treatment facilities:** Operation, maintenance and management problems and their respective remedial and control measures of Industrial Wastewater collection and treatment facility.	**05 Hours**
Module 5	**Air Pollution Control Facilities:** Operation, maintenance and management problems and their respective remedial and control measures of air pollution control facility. Computer Applications in O&M and SCADA.	**05 Hours**

Course outcomes:

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

- Elaborate the scope, types, basic principles, organizational structure, work planning and scheduling and cost estimates of O&M.
- Demonstrate the importance of plans, drawing, map, record keeping. Recognize the need for operational manual and SOP.
- Identify and list the operational problems in water treatment and supply facilities. Apply preventive and corrective maintenance measures.
- Describe the operational problems in wastewater (Domestic and Industrial) collection and treatment facilities. Enumerate the remedial measures.
- Identify and discuss the troubles in air pollution control systems and suggest the preventive and control measures.

Text and Reference Books:

1. Hammer M.J., and Hammer Jr. M.J.," Water and Wastewater Technology", Prentice Hall of India Pvt. Ltd., New Delhi, 2008.
2. Metcalf and Eddy Inc., "Wastewater Engineering - Treatment and Reuse", 4th Edition, Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2003.
3. Peavy, H.S., Rowe and Tchobonoglous, G., "Environmental Engineering", McGraw Hill, 1985.
4. Santhosh Kumar Garg, "Water Supply Engineerng", Khanna Publishers (Recent Edition).
5. B. S. N. Raju, "Water Supply and Wastewater Engineering", McGraw Hill, 1994.

Reference Books:

1. Training Manual on O & M for Municipal Staff, Asian Development Bank Project, Government of Karnataka.
2. CPHEEO Manual, (1999) "Water Supply & Treatment", GOI Publication.
3. CPHEEO Manual, (1999) on "Sewerage & Sewerage Treatment", GOI Publication.
4. National Safety Council and Associate (Data) Publishers Pvt. Ltd., "Industrial Safety and Pollution Control Handbook", 1991.

INDUSTRIAL WASTE MANAGEMENT & ENGINEERING (21CV583)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** General Characteristics of Industrial effluents, Effects on Environment – ISI tolerance limits for discharging industrial effluents into surface water, into public sewers and on to land for irrigation.	**05 Hours**
Module 2	**Treatment of industrial waste water:** Necessity of treatment –Segregation – Process changes – Salvaging– Byproduct Recovery –Ion Exchange, Electro dialysis, Solvent Extraction, Floatation – Removal of Nitrogen and Phosphorus – Boiler water treatment methods and cooling water treatment methods.	**05 Hours**
Module 3	**Food industries:** Sources, characteristics treatment and recycling of waste water from Sugar, Dairy, and Distilleries.	**05 Hours**
Module 4	**Major industrial effluents**: Sources, characteristics, treatment and recycling of waste water from Power plants, Oil refineries, Cement and Steel factories.	**05 Hours**
Module 5	**Chemical industries:** Sources, characteristics, treatment and recycling of waste water from Paper and pulp, Tanneries, Textiles, Fertilizers and Pharmaceutical industries.	**05 Hours**

Course outcomes:

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

- Assess the characteristics of industrial effluents and their effects on environment including their tolerance limits.
- Describe the basic principles of industrial waste water treatment by physical methods.
- Discuss the sources, characteristics and treatment of food industrial wastes.
- Identify the sources, characteristics and treatment of major industrial waste of Thermal Power Plants, Oil Refineries, Steel mills and Cement industries.
- Identify the sources, characteristics and treatment of Chemical industrial wastes.

Text and Reference Books:

1. Nemerow. N.L., “Liquid Waste from industry – Theories, Practice and Treatment” Addison wisely, 1996.
2. Benefield L.D. and Randall C.D, “Biological Process Designs for Wastewater Advanced Waste Treatment Methods “Removal Suspended solids – Dissolved solid Treatment”, Prentice Hall Pub. Co., 1980.
3. Metcalf and Eddy. “Waste water Engineering – Collection, Treatment, Disposal and Reuse”, McGraw Hill Pub. Co., 1995.
4. C. Fred Gurnham, “Industrial Waste Water Control”, Academic Press, 1965.
5. Gurnham, C.F., “Principles of Industrial Waste Water: Wiley; New York, 1955.

CLIMATE CHANGE & EMISSION TRADE (21CV584)

Semester V			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Global warming aggravations, Earth's climate, climate change, drivers of climate change, Kyoto, Montreal and New Delhi Protocols. **Climate models:** Models for climate change, GCMs, RCMs, climate change scenarios; Sector models – water resources, Agricultural, forestry, energy, GHG prediction models.	**05 Hours**
Module 2	**Climate change impacts:** Impacts of climate change on water sector, agriculture sector, infrastructure and energy systems with case studies. **Vulnerability/adaptation:** Need for vulnerability assessment; generic steps, approaches and tools of assessment; adaptation to climate change by various sectors.	**05 Hours**
Module 3	**Mitigation:** Mitigation measures for climate change, CDM and case studies. Climate change and India, impacts, sectoral and regional vulnerability in India, Evaluation of model simulation over India.	**05 Hours**
Module 4	**Emission trading** Evolution of emission trading and design features, trading mechanisms Cost-effective permit markets, the role of transaction costs, the role of technical change, Consequences of emission trading.	**05 Hours**
Module 5	**Monitoring and enforcement:** Domestic enforcement process, nature of international enforcement process, economic enforcement, current enforcement practice, program Effectiveness, global responsibilities for controlling climatic change.	**05 Hours**

Course outcomes:

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

- Review earth's climate change, identifies the causes for climate change and introduce the climate change models and their application.
- Describe impacts of climate change on various environmental compartments and Stress the need for vulnerability assessment and its approach.
- Explain the Indian scenario of climate change and its impact and review various impact predictive models.
- Define & describes emission trading, distinguishes different types of emission trading, understands the consequences of emission trading.
- Highlight the need for emission trading, Describe emission trading mechanisms; suggest monitoring and enforcing agencies, their role and responsibilities in emission trading.

Text and Reference Books:

1. Shukla, P.R., et al., “Climate Change and India: Vulnerability Assessment and Adaptation” - Universities Press, 2004.
2. Konrad Soyez, and Hartmut Grabl, “Basic Facts, Evaluation and Technological Options”, Springer Publications, 2008.

References:

1. Thomas H. Tietenberg, “Emissions trading: principles and practice”, REF Press book, 2006.
2. Noel D Nevers, “Air Pollution Control Engineering”, McGraw Hill International Editions, Civil Engineering Series, McGraw Hill, 2000.
3. Wark K., Warner C.F., and Davis W.T., “Air Pollution – Its Origin and Control”, Third Edition, Prentice Hall of India Publishers, 1997.

CONSTRUCTION MANAGEMENT & ENTREPRENEURSHIP (21CV61)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Construction Planning and Scheduling:** Introduction, types of project plans, work breakdown structure, Grant Chart, preparation of network diagram- event and activity based and its critical path critical path method, PERT method, concept of activity on arrow and activity on node. **Resource Management:** Basic concepts of resource management, class of lab our, Wages & statutory requirement, Labour Production rate or Productivity, Factors affecting labour output or productivity.	**08 Hours**
Module 2	**Construction Equipment's:** classification of construction equipment, estimation of productivity for: excavator, dozer, compactors, graders and dumpers. Estimation of ownership cost, operational and maintenance cost of construction equipment's. Selection of construction equipment and basic concept on equipment maintenance **Materials:** material management functions, inventory management. **Construction Quality, safety and Human Values:** Construction quality process, inspection, quality control and quality assurance, cost of quality, ISO standards. Introduction to concept of Total Quality Management	**08 Hours**
Module 3	**HSE: Introduction** to concepts of HSE as applicable to Construction. Importance of safety in construction , Safety measures to be taken during Excavation , Explosives , drilling and blasting , hot bituminous works , scaffolds / platforms / ladder , form work and equipment operation. Storage of materials. Safety through legislation, safety campaign. Insurances. **Ethics :** Morals, values and ethics, integrity, trustworthiness , work ethics, need of engineering ethics, Professional Duties, Professional and Individual Rights, Confidential and Proprietary Information, Conflict of Interest Confidentiality, Gifts and Bribes, Price Fixing, Whistle Blowing.	**08 Hours**
Module 4	**Introduction: Principles of Engineering Economy**, Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy. Interest and Interest Factors: Interest rate, Simple interest, Compound interest, Cash- flow diagrams, Exercises and Discussion. **Comparison of alternatives:** Present worth, annual equivalent, capitalized and rate of return methods, Minimum Cost analysis and break even analysis.	**08 Hours**

	Replacement Analysis: Replacement studies, replacement due to deterioration, obsolescence, inadequacy, economic life for cyclic replacements, Exercises, Problems. Break- Even Analysis: Basic concepts, Linear Break- Even analysis, Exercises, Problems. **Depreciation:** Causes of Depreciation, Basic methods of computing depreciation charges, Exercises, Problems.	
Module 5	**Introduction to Entrepreneurship** – Learn how entrepreneurship has changed the world. Identify six entrepreneurial myths and uncover the true facts. Explore E-cells on Campus. **Characteristics of a Successful Entrepreneur** Understand the entrepreneurial journey and learn the concept of different entrepreneurial styles. Identify your own entrepreneurship style based on your personality traits, strengths, and weaknesses. Learn about the 5M Model, each of the five entrepreneurial styles in the model, and how they differ from each other. **Business Planning Process:** Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.	**08 Hours**

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

- Use planning, organizing, scheduling, monitoring and controlling techniques for managing construction activity
- Understand importance of quality control and safety in construction.
- Understand managing data pertaining to construction project.
- Evaluate alternatives and develop capital budget for different scenarios.

Text and Reference Books:

1. P C Tripathi and P N Reddy, "Principles of Management", Tata McGraw-Hill Education.
2. Chitkara, K.K, "Construction Project Management: Planning Scheduling and Control", Tata McGraw Hill Publishing, New Delhi.
3. Poornima M. Charantimath, "Entrepreneurship Development and Small Business Enterprise", Dorling Kindersley (India) Pvt. Ltd., Licensees of Pearson Education.
4. Dr. U.K. Shrivastava, "Construction Planning and Management", Galgotia publications Pvt. Ltd. New Delhi.
5. Bureau of Indian standards – IS 7272 (Part-1) - 1974 : "Recommendations for labour output constant for building works".
6. Riggs J.L., "Engineering Economy", Tata McGraw Hill, 5th Edition, ISBN 0-07-058670-5.
7. R Panneer selvam, "Engineering Economics", PHI, Eastern Economy Edition, 2001, ISBN – 81- 203-1743-2.
8. Khan M Y, "Cost Accounting", Tata McGraw-Hill, 2nd Edition, 2000, ISBN 0070402248.
9. T.R.Banga, S.C.Sharma, "Mechanical Estimating & Costing", Khanna Publishers, 16th Edition, 2011, ISBN 8174091009.

GEOTECHNICAL ENGINEERING (21CV62)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	50	**Exam Hours**	03
L: T:P	3:0:2	**Credits**	04

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Phase Diagram, phase relationships, definitions and their inter relationships. Determination of Index properties: Specific gravity, water content, in-situ density, relative density, particle size analysis, Atterberg's Limits, consistency indices. Activity of clay, Field identification of soils, Plasticity chart, BIS soil classification.	**10 Hours**
Module 2	**Permeability:** Darcy's law- assumption, coefficient of permeability and its determination in laboratory, factors affecting permeability, permeability of stratified soils, Seepage velocity, Superficial velocity and coefficient of percolation. **Effective Stress** Geostatic stresses, Effective stress concept-total stress, effective stress and Neutral stress and impact of the effective stress in construction of structures, quick sand phenomena.	**10 Hours**
Module 3	**Compaction:** Principle of compaction, Standard and Modified proctor's compaction tests, factors affecting compaction, effect of compaction on soil properties. **Consolidation:** Definition, Mass-spring analogy, Terzaghi's one dimensional consolidation theory-assumption, Consolidation characteristics of soil (Cc, av, mv and Cv). Laboratory one dimensional consolidation test, characteristics of e-log (σ') curve, Pre-consolidation pressure and its determination by Casagrande's method. Over consolidation ratio.	**10 Hours**
Module 4	**Shear Strength:** Concept of shear strength, Mohr–Coulomb Failure Criterion, Total and effective shear strength parameters, factors affecting shear strength of soils. Thixotrophy and sensitivity, Measurement of shear strength parameters - Direct shear test, unconfined compression test, triaxial compression test, Tests under different drainage conditions.	**10 Hours**
Module 5	**Bearing Capacity of Soil:** Determination of bearing capacity by Terzaghi's and BIS method (IS: 6403), Modes of shear failure, Factors affecting Bearing capacity of soil. Effects of water table and eccentricity on bearing capacity of soil. **Foundation Settlement**: Types of settlements and importance, Computation of Immediate, consolidation and creep settlements, permissible, differential and total settlements.	**10 Hours**

LAB EXPERIMENTS

1. **Specific gravity test** (pycnometer and density bottle method).**Water content** determination by oven drying method.
2. **Grain Size Analysis:** Sieve Analysis
3. **In-situ density tests:** Core-cutter method, Sand replacement method.
4. **Consistency limits:** Liquid limit test (by Casagrande's and cone penetration method), Plastic limit test
5. Standard **compaction test** (light and heavy compaction)
6. **Co-efficient of permeability test:** Constant head test, Variable head test
7. **Shear strength tests:** Unconfined compression test, Direct shear test, Triaxial test (unconsolidated undrained test only)
8. **Consolidation test:** to determine preconsolidation pressure only (half an hour perloading-test).

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

- Determine the index properties of soil and hence classify the soil
- Assess the compaction and consolidation characteristics of soil
- Determine the permeability of soils and assess the seepage in hydraulic structures
- Evaluate shear parameters of the soil using shear tests
- Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure

Text and Reference Books:

1. Punmia B.C, "Soil Mechanics and Foundation Engineering", Laxmi Publications Co., India.
2. Braja, M. Das, "Principles of Geotechnical Engineering", Cengage Learning, India.
3. Murthy V. N. S., "Geotechnical Engineering: Principles and Practices of Soil Mechanics and Foundation Engineering", CRC Press, New York.

References:
1. Bowles J. E., "Foundation Analysis and Design", McGraw Hill Pub. Co. New York.
2. Swami Saran, "Analysis and Design of Substructures", Oxford & IBH Pub. Co.Pvt.Ltd., India.
3. R. B. Peck, W. E. Hanson & T.H. Thornburn,"Foundation Engineering", Wiley Eastern Ltd., India.
4. Donald P. Coduto, "Geotechnical Engineering Principles & Practices", Prentice-hall of India Ltd, India.
5. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.
6. SP 36: "Compendium of Indian standards on soil Engineering, Bureau Indian Standards.

DESIGN OF STEEL STRUCTURAL ELEMENTS (21CV63)

Semester VII			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Tutorial hours/week	2	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	2:2:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Advantages and Disadvantages of Steel Structures, Limit state method Limit State of Strength, Structural Stability, Serviceability Limit states, Failure Criteria of steel, Design Consideration, Loading and load combinations, IS code provisions, Specification and Section Classification. **Plastic Behavior of Structural Steel:** Introduction, Plastic theory, Plastic Hinge Concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, Plastic analysis of Continuous Beams.	**08 Hours**
Module 2	**Bolted Connections:** Introduction, Types of Bolts, Behavior of bolted joints, Design of High Strength friction Grip (HSFG) bolts, Design of Simple bolted Connections (Lap and Butt joints) and bracket connections. **Welded Connections:** Introduction, Types and properties of welds, Effective areas of welds, Weld Defects, Simple welded joints for truss member and bracket connections, Advantages and Disadvantages of Bolted and Welded Connections.	**08 Hours**
Module 3	**Design of Compression Members:** Introduction, Failure modes, Behavior of compression members, Sections used for compression members, Effective length of compression members, Design of compression members and built up Compression members, Design concept of Laced and Battened Systems.	**08 Hours**
Module 4	**Design of Tension Members:** Introduction, Types of Tension members, Slenderness ratio, Modes of Failure, Factors affecting the strength of tension members, Design of Tension members. Concept of Lug angles, Splices and Gussets. **Design of Column Bases:** Design of Simple Slab Base and Gusseted Base.	**08 Hours**
Module 5	**Design of Beams:** Introduction, Beam types, Lateral Stability of beams, factors affecting lateral stability, Behavior of Beams in Bending, Design strength of laterally supported beams in Bending, Design of Laterally unsupported Beams [No Numerical Problems], Shear Strength of Steel Beams.	**08 Hours**

Course outcomes:

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

- Possess knowledge of Steel Structures Advantages and Disadvantages of Steel structures, steel code provisions and plastic behaviour of structural steel.
- Understand the Concept of Bolted and Welded connections.
- Design of compression members, built-up columns and columns splices

- Design of tension members, simple slab base and gusseted base.
- Design of laterally supported and un-supported steel beams.

Text and Reference Books:

1. N Subramanian., “Design of Steel Structures”, Oxford University Press, New Delhi. 2016.
2. Duggal S K., “Limit State Method of Design of Steel Structures”, Tata McGraw Hill, New Delhi.
3. Dayarathnam P, “Design of Steel Structures”, Scientific International Pvt. Ltd.
4. Kazim S M A and Jindal R S, “Design of Steel Structures”, Prentice Hall of India, New Delhi.
5. IS 800-2007: “General Construction in Steel Code Practice”, Bureau of Indian Standards, New Delhi.

ADVANCED TECHNOLOGIES & COMPUTER AIDED DESIGNS (21CVL64)

Semester VI			
No. of Lecture hour/Week	02	**CIE Marks**	50
No. of Practical hours/week	02	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	2:0:2	**Credits**	03

Sl No.	Course Content	
Module 1	**SITE DESIGN USING CIVIL 3D** Create, analyse and adjust **survey** data; Create comprehensive digital models of ground **topography** for studies such as land-use feasibility, transportation system planning and water flow simulations; Create dynamic and data-rich **corridor models** for designs such as residential roads, kerbs and footpaths, swales within a subdivision and car park design; Model **storm and sanitary sewer systems**; Analyse networks to resize pipes, reset inverts, and compute energy and hydraulic gradient lines; Use **materials and sectional or profile** information to create reports for volumes along an alignment, comparing design and existing ground surfaces and quantity take-off.	**14 hours**
Module 2	**ROAD & MOTORWAY DESIGN USING CIVIL 3D** Prepare Longitudinal & Cross sections. Create dynamic, flexible **3D models of road corridors**. Simulate driving through the corridor and visually evaluate sight distance and influence analysis; Create dynamic models of 3-way (T-shaped) or 4-way **intersections**. Model roundabouts according to standards that blend with existing or planned roads; Perform storm water management tasks, including storm sewer design. Define pipeline paths, optimized with hydraulics/hydrology analysis; Use **materials** information to create reports for volumes along an alignment, comparing design and existing ground surfaces and quantity take-off; Create plan production sheets that automatically display station ranges of **alignments and profiles** that are based on predefined areas along an alignment.	**14 hours**
Module 3	**RAIL DESIGN USING CIVIL 3D** Prepare Longitudinal & Cross sections. Use rail **alignments** to create rail lines with common stationing based on specified tolerances that adjust with changes to parent rail alignment geometry, profile and cant; Design **turnouts** for branching alignments and crossover switches connecting parallel alignments based on a library of turnout and crossover types that you can edit, delete or supplement; Build 3D track **corridor models**, including alignments, profiles and assemblies. Incorporate designs for switches, turnouts, platforms and calculations for cant.	**12 hours**

Course Outcomes

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

- Create comprehensive, accurate site designs.
- Design, optimize and documentation of road and motorway projects.
- Accelerate planning, design and delivery of transit stations and rail networks.

Text Books:

1. "Autodesk Civil 3D 2023 Fundamentals", SDC Publications, 2022.
2. Cyndy Davenport, Ishka Voiculescu, "Mastering AutoCAD Civil 3D 2016", Autodesk Official Press, August 2015, ISBN: 978-1-119-05974-5.
3. Prof. Sham Tickoo, "Exploring AutoCAD Civil 3D", BPB Publications, Latest Edition.
4. Phillip J Zimmerman, "Harnessing AutoCAD Civil 3D", Delmar Cengage Learning, Latest edition.

DESIGN OF PRE-STRESSED CONCRETE STRUCTURES (21CV651)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction and Analysis of Members:** Concept of Pre stressing - Types of Pre stressing - Advantages - Limitations – Pre stressing systems - Anchoring devices - Materials – Mechanical Properties of high strength concrete - high strength steel - Stress-Strain curve for High strength concrete. Comparison between RCC & PSC. Analysis of members at transfer - Stress concept - Force concept - Load balancing concept - Kern point -Pressure line. (More problems on stress concept)	**08 Hours**
Module 2	**Losses in Pre stress:** Loss of Pre stress due to Elastic shortening, Friction, Anchorage slip, Creep of concrete, Shrinkage of concrete and Relaxation of steel - Total Loss. **Deflection**: Deflection due to gravity loads - Deflection due to prestressing force -Total deflection - Limits of deflection - Limits of span-to-effective depth ratio.	**08 Hours**
Module 3	**Design of Sections for Flexure:** Analysis of members at ultimate strength - Preliminary Design - Final Design for simply supported beams.	**08 Hours**
Module 4	**Design for Shear:** Analysis for shear - Components of shear resistance - Modes of Failure - Limit State of collapse for shear - Design of transverse reinforcement.	**08 Hours**
Module 5	Different anchorage system, design of end block and anchorages.	**08 Hours**

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

- Understand the requirement of PSC members for present scenario.
- Analyze the stresses encountered in PSC element during transfer and at working.
- Understand the effectiveness of the design of PSC after studying losses.
- Capable of analyzing the PSC element and finding its efficiency.
- Design PSC beam for different requirements.

Text and Reference Books:

1. Krishna Raju, N. “Pre stressed Concrete”, Tata McGraw Hill Publishing, New Delhi, Latest edition.
2. Rajagopalan N, “Pre - stressed Concrete”, Narosa Publishing House, New Delhi.

References:

1. P. Dayaratnam, “Pre stressed Concrete Structures”, Scientific International Pvt. Ltd.
2. Lin T Y and Burns N H, ‘Design of Pre - stressed Concrete Structures’ , John Wiley and Sons, New York.
3. IS 1343: Code of Practice for Prestressed concrete.

APPLIED GEOTECHNICAL ENGINEERING (21CV652)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Soil Exploration**: Introduction, Objectives and Importance, Stages and Methods of exploration- Test pits, Borings, stabilization of boreholes, Sampling techniques, Undisturbed, disturbed and representative samples, sample disturbance and Bore hole log.	**08 Hours**
Module 2	**Drainage and Dewatering:** Drainage and Dewatering methods, estimation of depth of GWT (Hvorslev's method) **Flownets:** Importance, properties and applications, Phreatic Lines, Seepage in earth dams (with and without filter) and sheet piles.	**08 Hours**
Module 3	**Lateral Earth Pressure:** Active, Passive and earth pressure at rest, Rankine's theory for cohesion less and cohesive soils, Factors influencing lateral earth pressure, Geotechnical design of gravity and cantilever retaining walls.	**08 Hours**
Module 4	**Stability of Slopes:** Assumptions, infinite and finite slopes, factor of safety, Swedish slip circle method for C and C-ø (Method of slices) soils, Fellineous method for critical slip circle, use of Taylor's stability charts. Causes for slope instability, Methods of stabilization of slopes	**08 Hours**
Module 5	**Stresses in Soil:** Geodesic stress and Stress due to structures, Boussinesq's Stress distribution in ground for point load, line load and uniformly distributed loads, Newmark's Chart, Contact Pressure, Pressure bulbs.	**08 Hours**

Course outcomes:

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

1. Ability to plan and execute geotechnical site investigation program for different civil engineering projects.
2. Understanding of stress distribution and resulting settlement beneath the loaded footings on sand and clayey soils.
3. Ability to estimate factor of safety against failure of slopes and to compute lateral pressure distribution behind earth retaining structures.
4. Ability to determine bearing capacity of soil and achieve proficiency in proportioning shallow isolated and combined footings for uniform bearing pressure.
5. Capable of estimating load carrying capacity of single and group of piles.

Text and Reference Books:

1. K.R. Arora, "Soil Mechanics and Foundation Engineering", Standard Publisher Distributors, New Delhi.
2. P C Varghese, "Foundation Engineering", PHI India Learning Private Limited, New Delhi.

3. Punmia B C, “Soil Mechanics and Foundation Engineering”, Laxmi Publications co., New Delhi, 16th Edition, 2017.
4. Bureau of Indian Standards: IS-1904, IS-6403, IS-8009, IS-2950, IS-2911 and all other relevant codes.

RAILWAYS, HARBOUR, TUNNELING & AIRPORTS (21CV653)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Railway Planning:** Significance of Road, Rail, Air and Water transports – Coordination of all modes to achieve sustainability – Elements of permanent way, - Rails, Sleepers, Ballast, rail fixtures and fastenings, – Track Stress, coning of wheels, creep in rails, defects in rails. Route alignment surveys, conventional and modern methods- – Soil suitability analysis – Geometric design of railways, gradient, super elevation, widening of gauge on curves- Points and Crossings (Explanation & Sketches of Right- and Left-hand turnouts only).	**08 Hours**
Module 2	**Railway Construction and Maintenance:** Earthwork – Stabilization of track on poor soil, Calculation of Materials required for track laying – Construction and maintenance of tracks – Modern methods of construction & maintenance – Railway stations and yards and passenger amenities- Urban rail – Infrastructure for Metro, Mono and underground railways.	**08 Hours**
Module 3	**Harbour and Tunnel Engineering:** Definition of Basic Terms: Planning and Design of Harbours: Requirements, Classification, Location and Design Principles – Harbour Layout and Terminal Facilities, Coastal Structures, Inland Water Transport – Wave action on Coastal Structures and Coastal Protection Works. **Tunneling:** Introduction, size and shape of the tunnel, tunneling methods in soils, tunnel lining, tunnel drainage and ventilation.	**08 Hours**
Module 4	**Airport Planning:** Air transport characteristics, airport classification, airport planning: objectives, components, layout characteristics, and socio-economic characteristics of the catchment area, criteria for airport site selection a nd ICAO stipulations, typical airport layouts, Parking and circulation area.	**08 Hours**
Module 5	**Airport Design:** Runway Design: Orientation, Wind Rose Diagram, Runway length, Problems on basic and Actual Length, Geometric design of runways, Configuration and Pavement Design Principles, Elements of Taxiway Design, Airport Zones, Passenger Facilities and Services, Runway and Taxiway Markings and lighting.	**08 Hours**

Course outcomes:

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

1. Acquires capability of choosing alignment and also design geometric aspects of railway system, runway and taxiway.
2. Suggest and estimate the material quantity required for laying a railway track and also will be able to determine the hauling capacity of a locomotive.
3. Develop layout plan of airport, harbour, dock and will be able relate the gained knowledge to identify required type of visual and/or navigational aids for the same.
4. Apply the knowledge gained to conduct surveying, understand the tunneling activities.

Text and Reference Books:

1. Saxena Subhash C and Satyapal Arora, "A Course in Railway Engineering", Dhanpat Rai and Sons, Delhi.
2. Satish Chandra and Agarwal M. M, "Railway Engineering", Oxford University Press, New Delhi, 2nd Edition.
3. Saxena Subhash C, "Airport Engineering-Planning and Design", CBS Publishers, 2020.
4. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nem chand and Brothers, Roorkee.
5. C Venkatramaiah, "Transportation Engineering- Volume II: Railways, Airports, Docks and Harbours, Bridges and Tunnels", Universities Press.
6. Bindra S P, "A Course in Docks and Harbour Engineering", Dhanpat Rai and Sons, New Delhi.

TRAFFIC ENGINEERING (21CV654)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Traffic Planning and Characteristics**: Road Characteristics- Road user characteristics, PIEV theory, Vehicle Performance characteristics, Fundamentals of Traffic Flow, Urban Traffic problems in India, Integrated planning of town, country, regional and all urban infrastructures, Sustainable approach- land use & transport and modal integration.	**08 Hours**
Module 2	**Traffic Surveys:** Traffic Surveys- Speed, journey time and delay surveys, Vehicles Volume Survey including non-motorized transports, Methods and interpretation, Origin Destination Survey, Methods and presentation, Parking Survey, Accident Analyses-Methods, interpretation and presentation, Statistical applications in traffic studies and traffic forecasting, Level of Service-Concept, applications and significance.	**08 Hours**
Module 3	**Traffic Design and Visual Aids:** Intersection Design- channelization, Rotary intersection design, Signal design, Coordination of signals, Grade separation, Traffic signs including VMS and road markings, Significant roles of traffic control personnel, Networking pedestrian facilities & cycle tracks.	**08 Hours**
Module 4	**Traffic Safety and Environment**: Road accidents, Causes, effect, prevention, and cost, Street lighting, Traffic and environment hazards, Air and Noise Pollution, causes, abatement measures, Promotion and integration of public transportation, Promotion of non-motorized transport.	**08 Hours**
Module 5	**Traffic Management:** Area Traffic Management System, Traffic System Management (TSM) with IRC standards, Traffic Regulatory Measures, Travel Demand Management (TDM), Direct and indirect methods, Congestion and parking pricing, All segregation methods- Coordination among different agencies, Intelligent Transport System for traffic management, enforcement and education.	**08 Hours**

Course outcomes:

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

1. Understand the human factors and vehicular factors in traffic engineering design.
2. Conduct different types of traffic survey sand analysis of collected data using statistical concepts.
3. Use an appropriate traffic flow theory and to comprehend the capacity & signalized inter-section analysis.
4. Understand the basic knowledge of Intelligent Transportation System.

Text and Reference Books:

1. Kadiyali. L.R. “Traffic Engineering and Transport Planning”, Khanna Publishers, Delhi, 2013.
2. S K Khanna and CEG Justo and A. Veeraragavan, “Highway Engineering”, Nem Chand and Bros.
3. Salter. R.I and Hounsell N.B, “Highway Traffic Analysis and design”, Macmillan Press Ltd, 1996.

References:

1. Indian Roads Congress (IRC) Specifications: “Guidelines and Special Publications on Traffic Planning and Management”.
2. Fred L. Mannering, Scott S. Washburn and Walter P. Kilareski, “Principles of Highway Engineering and Traffic Analysis”, Wiley India Pvt. Ltd., New Delhi, 2011.
3. Garber and Hoel, “Principles of Traffic and Highway Engineering”, CENGAGE Learning, New Delhi, 2010.
4. SP: 43-1994, IRC Specification, “Guidelines on Low-cost Traffic Management Techniques for Urban Areas”, 1994.
5. John E Tyworth, “Traffic Management Planning, Operations and control”, Addison Wesly Publishing Company, 1996.
6. Hobbs. F. D. “Traffic Planning and Engineering”, University of Brimingham, Peragamon Press Ltd, 2005.

URBAN TRANSPORT PLANNING (21CV661)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Urban transport planning:** Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning. Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.	**08 Hours**
Module 2	**Data Collection And Inventories:** Collection of data – Organisation of surveys and Analysis, Study Area, Zoning, Types and Sources of Data, Road Side Interviews, Home Interview Surveys, Commercial Vehicle Surveys, Sampling Techniques, Expansion Factors, Accuracy Checks, Use of Secondary Sources, Economic data – Income – Population – Employment – Vehicle Owner Ship.	**08 Hours**
Module 3	**Trip Generation & Distribution**: UTPS Approach, Trip Generation Analysis: Zonal Models, Category Analysis, Household Models, Trip Attraction models, Commercial Trip Rates; Trip Distribution by Growth Factor Methods. Problems on above.	**08 Hours**
Module 4	**Trip Distribution**: Gravity Models, Opportunity Models, Time Function Iteration Models. Travel demand modeling: gravity model, opportunity models, Desire line diagram. Modal split analysis. Problems on above.	**08 Hours**
Module 5	**Traffic Assignment:** Diversion Curves; Basic Elements of Transport Networks, Coding, Route Properties, Path Building Criteria, Skimming Tree, All-or-Nothing Assignment, Capacity Restraint Techniques, Reallocation of Assigned Volumes, Equilibrium Assignment. Numerical problems on Traffic Assignment. Introduction to land use planning models, land use and transportation interaction.	**08 Hours**

Course outcomes:

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

- Design, conduct and administer surveys to provide the data required for transportation planning.
- Supervise the process of data collection about travel behavior and analyze the data for use in transport planning.
- Develop and calibrate modal split, trip generation rates for specific types of land use developments.
- Adopt the steps that are necessary to complete a long-term transportation plan.

Text and Reference Books:

1. Kadiyali. L. R., “Traffic Engineering and Transportation Planning”, Khanna Publishers, New Delhi, Latest edition.
2. Hutchinson, B.G, “Introduction to Urban System Planning”, McGraw Hill, Latest edition.
3. Khisty C.J., “Transportation Engineering – An Introduction”, Prentice Hall, Latest edition.
4. Papacostas, “Fundamentals of Transportation Planning”, Tata McGraw Hill, Latest edition.
5. Mayer M and Miller E, “Urban Transportation Planning: A decision oriented Approach”, McGraw Hill, Latest edition.

CONSTRUCTION MATERIALS (21CV662)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Aggregates:** Origin & Classification of rocks, classification of aggregates, uses of aggregates, characteristics requirements of aggregates, tests on coarse and fine aggregates, IS Specifications.	**08 Hours**
Module 2	**Cement:** Definition, characteristics, types of cement, manufacturing of cement, composition of cement, functions of cement ingredients, field and lab tests, IS specifications. **Concrete:** tests on fresh and hardened concrete, applications.	**08 Hours**
Module 3	**Soil:** Origin of soils, formation of soils, clay mineralogy and soil structure, basic terminology and their relations, index properties of soils. Soil classification: Particle size distribution, use of particle size distribution curve, classification of soil, Tests on soil.	**08 Hours**
Module 4	**Bricks**: Manufacturing, composition, classification, variety, Dimensions, tests for bricks, Quality requirements, dimensions. **Concrete blocks**: requirements, Tests, Dimensions.	**08 Hours**
Module 5	**Bitumen:** Definition, Production of bitumen, different forms of bitumen, requirements, tests on bitumen, IS Specifications, applications. Other Civil Engineering materials: Steel, Timber, paints & varnishes, flooring materials, materials for interiors etc.	**08 Hours**

Course outcomes:

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

- Choose appropriate building material as per requirement.
- Measure the quality of materials to be used in construction.
- Identify the characteristics of civil engineering materials.
- Conduct suitable tests on various materials.

Text and Reference Books:

1. Rangwala P.C., “Engineering Materials”, Charotar Publishing House, Anand, India.
2. Sushil Kumar, “Engineering Materials”, Standard Publication and Distributors, New Delhi.
3. M.S. Shetty, “Concrete technology – Theory and practice”, S. Chand and Co, New Delhi, 2002.
4. P.G. Varghese, “A Text Book Building Materials”, Prentice-Hall of India Pvt. Ltd., Publication.
5. Mohan Rai and M.P. Jain Singh, “Advances in Building Materials and Construction”, Publication by CBRI, Roorkee.
6. S. K. Khanna, C. E. G. Justo, A. Veeraragavan, “Highway Materials and Pavement Testing”, Nem Chand & Bros, 2013.

GREEN BUILDINGS (21CV663)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction to the concept of cost effective construction** - Uses of different types of materials and their availability -Stone and Laterite blocks- Burned Bricks- Concrete Blocks- Stabilized Mud Blocks- Lime-puzzolona Cement- Gypsum Board- Light Weight Beams- Fiber Reinforced Cement Components- Fiber Reinforced Polymer Composite- Bamboo- Availability of different materials-Recycling of building materials – Brick- Concrete- Steel- Plastics - Environmental issues related to quarrying of building materials.	**08 Hours**
Module 2	**Environment friendly and cost effective Building Technologies** - Different substitute for wall construction Flemish Bond - Rat Trap Bond – Arches – Panels - Cavity Wall - Ferro Cement and Ferro Concrete constructions – different pre cast members using these materials - Wall and Roof Panels – Beams –columns - Door and Window frames - Water tanks - Septic Tanks - Alternate roofing systems - Filler Slab - Composite Beam and Panel Roof -Pre-engineered and ready to use building elements - wood products - steel and plastic - Contributions of agencies - Costford - Nirmithi Kendra - Habitat	**08 Hours**
Module 3	**Global Warming** – Definition - Causes and Effects - Contribution of Buildings towards Global Warming - Carbon Footprint – Global Efforts to reduce carbon Emissions Green Buildings – Definition - Features- Necessity – Environmental benefit - Economical benefits - Health and Social benefits - Major Energy efficient areas for buildings – Embodied Energy in Materials Green Materials - Comparison of Initial cost of Green V/s Conventional Building - Life cycle cost of Buildings.	**08 Hours**
Module 4	**Green Building rating Systems**- BREEAM – LEED - GREEN STAR -GRIHA (Green Rating for Integrated Habitat Assessment) for new buildings – Purpose - Key highlights - Point System with Differential weight age. Green Design – Definition - Principles of sustainable development in Building Design - Characteristics of Sustainable Buildings – Sustainably managed Materials - Integrated Lifecycle design of Materials and Structures (Concepts only)	**08Hours**
Module 5	**Utility of Solar Energy in Buildings** Utility of Solar energy in buildings concepts of Solar Passive Cooling and Heating of Buildings. Low Energy Cooling. Case studies of Solar Passive Cooled and Heated Buildings. **Green Composites for Buildings** Concepts of Green Composites. Water Utilisation in Buildings, Low Energy Approaches to Water Management. Management of Solid	**08 Hours**

	Wastes. Management of Sullage Water and Sewage. Urban Environment and Green Buildings. Green Cover and Built Environment.	

Course outcomes:

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

- Apply cost effective techniques in construction.
- Apply cost effective Technologies and Methods in Construction.
- Understand the Problems due to Global Warming.
- Comprehend the Concept of Green Building.

Text and Reference Books:

1. Harhara Iyer G, “Green Building Fundamentals”, Notion Press, 2022.
2. Dr. Adv. Harshul Savla, “Green Building: Principles & Practices”, Notion Press, 2021.

SOLID WASTE MANAGEMENT (21CV664)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction :** Functional elements of municipal solid waste (MSW) management system, Sources: Sources of Solid waste, Types of solid waste, Physical and Chemical composition of municipal solid waste. Generation rate, Numerical Problems. Environmental implications of open dumping of MSW, Construction debris – management & handling. Rag pickers and their role, Solid waste management 2000 rules with 2016 amendments.	**08Hours**
Module 2	Collection: Collection of solid waste- services and systems Haul and stationary container system-numericals, equipments, Transportation: Need of transfer operation, transfer station, transport means and methods, route optimization.	**08 Hours**
Module 3	**Treatment / processing techniques:** Components separation, volume reduction, size reduction, chemical reduction and biological processing problems. **Composting:** Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermicomposting.	**08 Hours**
Module 4	**Sanitary land filling:** Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geosynthetic fabrics in sanitary landfills. **Incineration:** Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, pyrolysis, design criteria for incineration.	**08 Hours**
Module 5	**Sources, collection, treatment and disposal:-** Biomedical waste and E-waste, **Recycle and reuse:** Material and energy recovery operations, reuse in other industries, plastic wastes, environmental significance and reuse.	**08 Hours**

Course outcomes:

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

- Identify improper practices of solid waste disposal and their environmental implications.
- Describe the need for economics in collection and transportation of solid waste and clearly discuss various types of collection systems and analyse system dynamics.
- Understand the management concepts, define 4 R approach, apply PPP model and community involvement for effective management of solid waste.

- Develop a concise idea on various conventional and advanced treatment options for solid waste.
- Conceive the design aspects of engineered disposal options and apply the gained knowledge.

Text and Reference Books:

1. Tchobanoglous G., Theissen H., and EIiassen R., "Solid Waste Engineering Principles and Management Issues", McGraw Hill, New York.
2. Pavoni J.L., "Handbook of Solid Waste Disposal", Krieger Pub Co, 1st edition, 1975.
3. Peavy, Rowe and Tchobanoglous, "Environmental Engineering", McGraw Hill.
4. Mantell C.L., "Solid Waste Management", John Wiley, 1975.

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS (21CV67)

Semester VI			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Meaning, Types of research, approaches, significance, research methods versus methodology, research and scientific method, research process, criteria of good research. **Defining a research problem**: definition, selecting the problem, Technique involved in defining a problem.	**05 Hours**
Module 2	**Research Design:** meaning, Need for research design, features of a good design, variables, Hypothesis and testing, control groups, treatments, different research designs, principles of experimental designs, types of experimental designs. **Design of sample surveys:** Introduction, sample design, sampling & non sampling errors, types of sampling designs.	**05 Hours**
Module 3	**Measurement & scaling:** quantitative & qualitative data, classifications of measurement scales, goodness of MOS, sources of error, techniques of developing measurement tools, scaling, scale classification bases, scaling techniques, multi-dimensional scaling. Data collection, data preparation, descriptive statistics.	**05 Hours**
Module 4	**Sampling and statistical inference**: Sampling distribution, degree of freedom, standard error, central limit theorem, finite population correction, point estimation, interval estimation, sample size and its determination. **Testing of Hypothesis**, Chi-square tests, Analysis of variance, Linear regression analysis, factor analysis, discriminant analysis, cluster analysis. Multivariate techniques: Path analysis, canonical correlation, ANOVA, Latent structure Analysis.	**05 Hours**
Module 5	Fundamentals of Patent Law, Drafting of A Patent Specification, Patent Procedure in India, Patent Infringement, International Patent Regimes, Patenting Biotechnology Inventions, Patentability of Software Inventions, Law of Copyright and Designs, Understanding Copyright Law, Term of Protection, Subject - Matter of Copyright, Basic Principles of Design Rights.	**05 Hours**

Course outcomes:

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

- Comprehend requirements of engineering research.
- Articulate the procedure of research design.
- Adopt the fundamentals of patent laws and drafting procedure.
- Understand the copyright laws and subject matters of copyrights and designs.

- Apply the basic principles of design rights.

Text and Reference Books:

1. C R Kothari, Gaurav Garg, “Research Methodolgy”, New age International Publishers, 4 th edition, 2020.
2. Dipankar Deb, Rajeeb Dey, Valentina E. Balas “Engineering Research Methodology”, Springer, 1st edition, 2019, ISSN 1868-4394 ISSN 1868-4408.
3. David V. Thiel “Research Methods for Engineers” Cambridge University Press, 978-1-107-03488-4.

QUANTITY SURVEY & CONTRACT MANAGEMENT (21CV71)

Semester VII			
No. of Teaching hour/Week	2	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	Estimation: Type of estimates, Understanding the enclosures of an estimate, General terminology, units of measurement, Preparation of abstract, approximate methods of estimating buildings, cost of materials and recommended labour coefficients. Building Estimate: Methods of taking out quantities and cost (center line method & long and short wall method). Preparation of detailed and abstract estimates for– Buildings – Masonry structures, framed structures. Flat, slopped RCC roofs with all building components. Culverts (includes box culvert, pipe culvert and RC slab culverts) manhole and septic tank.	**05 Hours**
Module 2	Estimation of flat, slopped RCC roofs, steel truss. Culverts (including box culvert, pipe culvert and RC slab culverts) manhole and septic tank. Measurement of Earth Work for Roads: Methods for computation of earthwork by mid-section formula, trapezoidal or average end area or mean sectional area formula, prismoidal formula. Project report Preparation: Preliminary Survey Report and Detailed Project Report	**05 Hours**
Module 3	Significance of Microsoft Excel or any other equivalent software in estimation. Specifications: Definition of specifications, objectives of writing specifications, essentials in specifications, general and detailed specifications of item of works in buildings, specifications of aluminium and wooden partitions, false ceiling, aluminium and fiber doors and windows. Various types of claddings.	**05 Hours**
Module 4	Rate analysis: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes, bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works or doors, windows and ventilators.	**05 Hours**
Module 5	Contracts: Types of contract-essential of contract –legal aspects, penal provision on breach of contract. Definition of the terms-Tender, Earnest money deposit, tender forms, documents and types. Comparative statements, acceptance of contract documents and issue of work orders, duties and liabilities, termination of contract, completion certificate, quality control, right of contractor refund of deposit. Administrative approval - Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills.	**05 Hours**

Course outcomes:

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

1. Develop the quantity estimates for different Civil Engineering structures, works & also communicate the cost abstract in a simple form to the stake holders.
2. Prepare specifications of various Civil Engineering Structures/works, also will be able to analyze the requirement of a structure /work to arrive at a specific cost for completion of the same.
3. Make use of minimum basic knowledge gained in this course to take up entrepreneurship/employment as a contractor.

Text and Reference Books:

1. Datta B.N., "Estimating and costing", UBSPD Publishing House, New Delhi.
2. B.S. Patil, "Civil Engineering Contracts and Estimates", Universities Press.
3. M. Chakraborthi, "Estimation, Costing and Specifications", Laxmi Publications.
4. MORTH Specification for Roads and Bridge Works – IRC New Delhi.

References:

1. Kohli D.D and Kohli R.C, "Estimating and Costing", S.Chand Publishers, 12 th Edition, 2014.
2. Vazirani V.N and Chandola S.P, "Estimating and costing", Khanna Publishers, 2015.
3. Rangwala, C. "Estimating, Costing and Valuation", Charotar Publishing House Pvt. Ltd., 2015.
4. Duncan Cartlidge, "Quantity Surveyor's Pocket Book", Routledge Publishers, 2012.
5. Martin Brook, "Estimating and Tendering for Construction Work", A Butterworth-Heinemann publishers, 2008.
6. Robert L Peurifoy, Garold D. Oberlender , " Estimating Construction Costs" Tata McGraw-Hill , 5th ed , New Delhi.
7. David Pratt, "Fundamentals of Construction Estimating", Delmar Publications, 3rd Edition, 2012.
8. PWD Data Book, CPWD Schedule of Rates (SoR) and NH (SoR) – Karnataka FIDIC Contract forms.
9. B.S. Ramaswamy, "Contracts and their Management", Lexis Nexis (a division of Reed Elsevier India Pvt Ltd), 3rd edition.

DISASTER MANAGEMENT (21CV72)

Semester VI			
No. of Lecture hour/Week	02	**CIE Marks**	50
No. of Practical hours/week	00	**SEE Marks**	50
Total No. of Lecture hours	25	**Exam Hours**	03
L: T:P	2:0:0	**Credits**	02

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** Disasters, causes and impacts, scope of disaster management, disaster Managers- professionals and specialists active in various phases of disasters, Risk management, preparedness, operational functions of disaster management, Resource management, impact reduction.	**05 Hours**
Module 2	**Disasters:** Natural disasters - Drought, Floods, Earth Quake, Volcanoes, Land Slides, Cyclones, Tsunami; Manmade - Air accidents, Rail and Road accidents, Industrial, Chemical, Biological (Bio-Terrorism) nuclear Disasters, accidental oil spills and other types of Disasters.	**05 Hours**
Module 3	**Vulnerability Assessment and Disaster Preparedness**: Vulnerability assessment (VA). Importance and advantages, Process of VA, Steps in VA, Report, Prioritization, Emergency Response Plan (ERP).	**05 Hours**
Module 4	**Pre disaster Planning:** Earthquakes, cyclones, epidemics outbreak, drought and famine. Disaster resistant constructions, rehabilitation and reconstruction. Coping mechanism and relief assistance, disaster management continuum, Early warning and management, Global Disaster alerting and coordination system (GDACS), Flood forecasting, flood control systems.	**05 Hours**
Module 5	**Disaster Response Planning, Preparedness and Mitigation**: Earthquake, Cyclone, Landslide, Flood preparedness and response. NDMA act 2005, National Disaster Management Policy, Disaster Management Plans (DMP) , Guidelines. **Information Technology in Disaster Management:** Application of GIS and Remote sensing for Disaster Management, Simulation studies. Use of Unmanned aerial vehicles (UAVs) in disaster management and monitoring.	**05 Hours**

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

- State and classify disasters and identify the cause- effect relationships.
- Apply the knowledge of vulnerability assessment for pre-planning, early warning systems and response plan. Prepare on-site and off-site ERPs.
- Recognize the role of IT in creating vulnerability scenarios through simulation exercises using GIS and other related software and prepare Disaster and Environmental Management Plans.
- Consolidate the information on National policy on disaster management along with required legal framework for effective mitigation.

- Comprehend the lessons learnt from different natural and manmade disasters leading to newer initiatives for forecasting, planning and mitigation.

Text and Reference Books:

1. Trim, P.R.J. (2004), "An integrative approach to disaster management and planning", Disaster Prevention and Management, Vol. 13 No. 3, pp. 218- 225.
2. R Subramanian, "Disaster Management", Vikas Publishing House, 2018.
3. S Vaidyanathan, "An Introduction to Disaster Management", CBS Publishers & Distributers, Latest edition.

Reference Books:

1. National Research Council, "Improving Disaster Management: The Role of IT in Mitigation, Preparedness, Response, and Recovery", Washington, DC: The National Academies Press, 2007.
2. National Research Council, "Successful Response Starts with a Map: Improving Geospatial Support for Disaster Management", Washington, DC: The National Academies Press, 2007.
3. National Research Council, "Facing Hazards and Disasters: Understanding Human Dimensions. Washington, DC: The National Academies Press, 2006.
4. National Research Council, "Tools and Methods for Estimating Populations at Risk from Natural Disasters and Complex Humanitarian Crises", Washington, DC: The National Academies Press, 2007.
5. National Research Council, "The Indian Ocean Tsunami Disaster: Implications for U.S. and Global Disaster Reduction and Preparedness", Summary of the June 21, 2005 Workshop of the Disasters Roundtable, Washington, DC: The National Academies Press, 2006.
6. WCDR Session Report UNEP, "Environmental Management and Disaster Preparedness" Building a multi-stakeholder partnership, 2005.

PAVEMENT MATERIALS & CONSTRUCTION (21CV731)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Pavement Materials** **Aggregates-** Origin, Classification, Requirements, properties and tests on Road aggregates, Concepts of size and gradation- design gradation, maximum aggregate size, aggregate blending by different methods to meet specification. **Bituminous Binders-** Origin, Preparation, Properties and Chemical Constitution of bituminous road binders, Requirements. **Bituminous emulsion and Cutbacks-** Preparation, Characteristics, uses and test. Adhesion of bitumen binders to road aggregates, Adhesion failure, Mechanism of stripping, tests and methods of improving adhesion.	**08 Hours**
Module 2	**Bituminous mixes:** Mechanical properties, dense and open textured mixes, flexibility and brittleness, (No Hveem stabilometer and Hubbard- field tests) bituminous mixes, Design methods using Rothfutch's method only and specification, Marshall mix design, volumetric properties, Problems on above.	**08 Hours**
Module 3	**Cement and Cement concrete**: Material requirement for DLC and PQC, Admixtures, Temp Reinforcement, materials for joints construction, Fibers. **Recycled and Alternate Materials** – Use of RAP, RCA, Fly ash, Blast furnace Slag, waste plastic, etc. in sustainable pavement construction.	**08 Hours**
Module 4	**Equipment's in highway construction:** Various types of equipment for excavation, grading and compaction- their working principles, advantages and limitations. Special equipment for bituminous and cement concrete pavement and stabilized soil road construction. **Sub grade:** Earthwork grading and Construction of embankments and cuts for roads, Preparation of subgrade, quality control tests.	**08 Hours**
Module 5	**Flexible Pavements:** Specifications of materials, Construction method and field control checks for various types of flexible pavement layers. **Cement Concrete Pavements:** Specifications and method of cement concrete pavement construction (PQC, DLC, White topping, Quality control tests, Construction of various types of joints.	**08 Hours**

Course outcomes:

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

1. Evaluate and assess the suitability of any pavement material to be used in various components of pavement by conducting required tests as per IS, IRC specifications.
2. Formulate the proportions of different sizes of aggregates to suit gradation criteria for various mixes as per MORTH and also design bituminous mixes.
3. Adapt suitable modern technique and equipment for speedy and economic construction.
4. Execute the construction of embankment, flexible, rigid pavement and perform required quality control tests at different stages of pavement construction.

Text and Reference Books:

1. Khanna, S.K., and Justo, C.E.G, "Highway Engineering", Nem Chand and Bros, Roorkee.
2. Sharma, S.C, "Construction Equipment and its Management", Khanna Publishers.
3. Freddy L. Roberts, Kandhal, P.S, "Hot Mix Asphalt Materials, Mixture Design and Construction", Texas NAPA Education Foundation Lanham, Marylan, University of Texas Austin.
4. Prithvi Singh Kandhal, "Bituminous Road construction", PHI Publications, Latest edition.
5. Relevant IRC guidelines and MoRT& H specifications.

REPAIR & REHABILITATION OF STRUCTURES (21CV732)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	Introduction and Definition for Repair, Retrofitting, Strengthening and rehabilitation. Physical and Chemical Causes of deterioration of concrete structures, Evaluation of structural damages to the concrete structural elements due to earthquake.	**08 Hours**
Module 2	**Damage Assessment:** Purpose of assessment, Rapid assessment, Investigation of damage, Evaluation of surface and structural cracks, Damage assessment procedure, destructive, non-destructive and semi destructive testing systems.	**08 Hours**
Module 3	**Influence on Serviceability and Durability:** Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, and cathodic protection.	**08 Hours**
Module 4	**Maintenance and Retrofitting Techniques:** Definitions: Maintenance, Facts of Maintenance and importance of Maintenance Need for retrofitting, retrofitting of structural members i.e., column and beams by Jacketing technique, Externally bonding(ERB) technique, near surface mounted (NSM) technique, External post-tensioning, Section enlargement and guidelines for seismic rehabilitation of existing building.	**08 Hours**
Module 5	**Materials for Repair and Retrofitting:** Artificial fiber reinforced polymer like CFRP, GFRP, AFRP and natural fiber like Sisal and Jute. Adhesive like, Epoxy Resin, Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.	**08 Hours**

Course outcomes:

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

1. Identify the causes for structural (Concrete) deterioration.
2. Assess the type and extent of damage and carry out damage assessment of structures through various types of tests.
3. Recommend maintenance requirements of the buildings and preventive measures against influencing factors.
4. Select suitable material and suggest an appropriate method for repair and rehabilitation.

Text and Reference Books:

1. Sidney, M. Johnson, “Deterioration, Maintenance and Repair of Structures”
2. Denison Campbell, Allen & Harold Roper, “Concrete Structures – Materials, Maintenance and Repair”- Longman Scientific and Technical.

Reference Books:

1. R.T.Allen and S.C. Edwards, “Repair of Concrete Structures”-Blakie and Sons.
2. Raiker R.N., “Learning for failure from Deficiencies in Design, Construction and Service”- R&D Center (SDCPL).
3. CPWD Manual.

ADVANCED DESIGN OF RCC & STEEL STRUCTURES (21CV733)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Design of statically indeterminate RC beams:** Brief review of limit state design of RC member subjected to axial load, bending, shear & torsion. Application to analysis of continuous beams using IS coefficients method or any other methods and design of critical sections including flexure, shear and torsion.	**08 Hours**
Module 2	**Design of floor systems** Analysis and design of one way (simple and continuous) and two way slabs and detailing of reinforcement. Design of ribbed slabs and grid floors by approximate methods and check for ultimate capacity and serviceability.	**08 Hours**
Module 3	**Flat slabs & Columns** Application of IS code method of analysis and design of flat slabs and flat plates for bending and shear - one way and two way, shear due to unbalanced moment, flexural and shear reinforcement design and detailing. Moments in columns and design for vertical loads and moments.	**08 Hours**
Module 4	**Design of RC deep beams and corbels** Introduction, minimum thickness, design by IS 456 method, determination of reinforcement and detailing. Design of corbels by ACI method.	**08 Hours**
Module 5	**Roof Truss:** Design of roof truss for different cases of loading, forces in members to given. (Bolted Connection only) **Plate Girder:** Design of welded plate girder with intermediate stiffener, bearing stiffener and necessary checks **Gantry Girder:** Design of gantry girder with all necessary checks.	**08 Hours**

Course outcomes:

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

- Apply the basic knowledge of limit state design of RC and structural analysis to analyze and design continuous beams.
- Design simple and continuous one way and two way slabs, simple and continuous ribbed floors and waffle slabs.
- design flat slabs systems with/without column drops, with/without capitals and prepare reinforcement details, evaluate resistance to beam shear and punching shear by IS code method and design columns.
- Think laterally and originally and provide solutions to the complex problems of simple and continuous deep beams and corbels using IS method and provide reinforcement details.
- Design Roof truss & girders as per codal provisions.

Text and Reference Books:

1. P.C. Varghese, “Advanced reinforced concrete design”, PHI Learning Pvt. Ltd., Technology & Engineering Series, New Delhi, 2nd edition 2009.
2. S. Unnikrishna Pillai, And Devadas Menon, “Reinforced Concrete Design”, TMH, New Delhi, 3rd Edition 2009.
3. N Krishna Raju, “Structural Design and Drawing of Reinforced Concrete and Steel”, University Press.
4. Subramanian N, “Design of Steel Structures”, Oxford University Press, New Delhi.
5. K S Duggal, “Design of Steel Structures”, Tata McGraw Hill, New Delhi.

Reference Books:

1. IS 456: 2000: “Code Of Practice for Plain And Reinforced Concrete”, BIS, Fourth Revision, New Delhi.
2. SP-16: Design Aids for RC to IS: 456-1978.
3. SP 24: Explanatory Hand book to IS: 456-1978, BIS, New Delhi.
4. SP: 34 Handbook on Concrete Reinforcement and Detailing, BIS, New Delhi.

ADVANCED FOUNDATION ENGINEERING (21CV734)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Foundation design:** Criteria for choice of foundation, bearing capacity, total and differential settlements, tolerance for various types of structures, Interpretation of soil profile from design parameters like modulus of compressibility, Modulus of subgrade reaction, Poisson's ratio, etc.	**08 Hours**
Module 2	**Raft foundations:** Raft foundations for building and tower structures, including effects of soil-structure interaction and nonlinearity, different types of rafts.	**08 Hours**
Module 3	**Deep foundations:** Pile foundation-types, methods of installation, codal practices for permissible load under vertical and lateral loads, stresses during pile driving, load carrying capacity of pile groups, negative skin friction, under-reamed piles, Foundation for heavy structures, well foundations, caisson foundations, equipment used for construction of these foundation systems.	**08 Hours**
Module 4	**Machine foundations:** Theory of vibrations, free and forced vibrations with and without damping for a single degree freedom system, types of machine foundations, their design criteria, permissible amplitudes and bearing pressure.	**08 Hours**
Module 5	**Cantilever sheet piles and anchored bulkheads:** Earth pressure diagram, determination of depth of embedment in sands and clays, timbering of trenches, Earth pressure diagrams, forces in struts. **Cofferdams:** Stability, bearing capacity, settlements (qualitative treatment only, no designs).	**08 Hours**

Course outcomes:

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

- Identify a suitable foundation system for a structure.
- Evaluate the importance of raft foundation and principles of design for buildings and tower structures.
- Analyze and design pile foundations.
- Examine and discuss various machine foundations.
- Analyze and design Sheet piles and cofferdams.

Text and Reference Books:

1. Das, B.M., "Principles of Foundation Engineering", PWS Publishing, 4 th Edition, Singapore.
2. Bowles, J.E., "Foundation Analysis and Design", McGraw- Hill International, 5 th

Edition.
3. Shamsher Prakash, “Soil Dynamics”, John Wiley publications, 3 rd Edition.

Reference Books:

1. Murthy, V.N.S., “Soil Mechanics and Foundation Engineering”, Sai Krupa Technical Consultants, 4 th Edition.
2. Venkataramah, C., “Geotechnical Engineering”, New Age International Pvt. Ltd., 5th Edition, 2009.
3. Swami Saran, “Analysis and Design of Substructures”, Oxford & IBH Publishing Company Pvt. Ltd, 2nd Edition.
4. Gopal Ranjan & ASR Rao, “Basic and Applied Soil Mechanics”, New Age International Pvt. Ltd, Publishers, 3 rd Edition.
5. Srinivasulu, P and Vaidyanathan, G.V., “Handbook of Machine Foundations”, Tata McGraw Hill, 2 nd Edition.

AIR POLLUTION & CONTROL (21CV741)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** History of Air pollution and episodes, Sources of air pollution and types, Introduction to meteorology and transport of air pollution: Global winds, Headley cells, wind rose terrestrial wind profile, Effects of terrain and topography on winds, lapse rate, maximum mixing depths, plume rise.	**08 Hours**
Module 2	**Transport of Pollution in Atmosphere:** Plume behavior under different atmospheric conditions, Mathematical models of dispersion of air pollutants, Plume behavior in valley and terrains. Plume behavior under different meteorological conditions, Concept of isoplates.	**08 Hours**
Module 3	**Effects of Air Pollution:** Effects of Air Pollution on human beings, plants and animals and Properties. Global Effects-Greenhouse effect, Ozone depletion, heat island, dust storms, Automobile pollution sources and control, Photochemical smog, Future engines and fuels.	**08 Hours**
Module 4	**Air Pollution control:** Air Pollution control- at source-equipment's for control of air pollution-For particulate matter-Settling chambers-Fabric filters-Scrubbers-Cyclones-Electrostatic precipitators, For Gaseous pollutants-control by absorption-adsorptionscrubbers-secondary combustion after burners, Working principles advantages and disadvantages, design criteria and examples.	**08 Hours**
Module 5	**Air Quality Sampling and Monitoring:** Stack sampling, instrumentation and methods of analysis of SO2, CO etc, legislation for control of air pollution and automobile pollution.	**08 Hours**

Course outcomes:

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

- Understand Concepts of air pollution.
- How to estimate the quantity of air pollutant.
- Be able to develop control technologies.

Text and Reference Books:

1. H.C Parkins, "Air Pollution", Mc Graw Hill Publication, 1974.
2. H.S. Peavy, D.R. Row & G. Tchobanoglous, "Environmental Engineering", Mc Graw Hill International Edition.
3. Martin Crawford, "Air Pollution Control Theory", TMH Publ, 1976.

ENVIRONMENTAL BIOTECHNOLOGY (21CV742)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	Introduction to environmental biotechnology; Nucleic acids, polymerase chain reaction (PCR); reverse transcription PCR (RT-PCR) and its applications; Bacterial genetic recombination; Recombinant DNA technology and its applications in environmental engineering; Environmental monitoring- bioreporter, biomarker and biosensor technology.	**08 Hours**
Module 2	Overview of microbial transformations; Bioremediation of petroleum hydrocarbons, radionuclei, dyes and lignin removal; phytoremediation; biomass for removal and biosorption of heavy metals; removal of volatile organic compounds from waste gas.	**08 Hours**
Module 3	Clean technologies: biofertilizers, bio-pesticides, microbial polymer production and bio plastic technology; Biotechnology of fossil fuels: desulfurization of coal, microbial enhanced oil recovery (MEOR);	**08 Hours**
Module 4	Biofuels: biogas, bio hydrogen, bioethanol production. Biotechnology of mineral processing.	**08 Hours**
Module 5	Intellectual Properties rights; Copyright; Biosafety regulations; Ethical issues in environmental biotechnology.	**08 Hours**

Course outcomes:

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

1. Comprehend an elementary idea about key molecular biology tools such as PCR.
2. Understand Concepts of popular biotechnological processes such as bio-remediation and microbial degradation.
3. Understand of the applications of biotechnology for solving real life environmental problems.
4. Practice IPR and ethical issues in environmental biotechnology.

Text and Reference Books:

1. B. E. Rittmann and P. L. McCarty, “Environmental Biotechnology: Principles and Applications”, 2001.
2. B. Bhattacharya and R. Banerjee, “Environmental Biotechnology”, Oxford Higher education, 2008.
3. Smith, J.E., “Biotechnology”, Cambridge University Press, 3rd Edition, 2004.
4. Brown T. A., “Gene Cloning and DNA analysis”, Wiley-Blackwell publication, Sixth Edition.

ENVIRONMENTAL PROTECTION & MANAGEMENT (21CV743)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Environmental Management Standards**: Unique Characteristics of Environmental Problems - Systems approach to Corporate environmental management - Classification of Environmental Impact Reduction Efforts -Business Charter for Sustainable Production and Consumption – Tools, Business strategy drivers and Barriers - Evolution of Environmental Stewardship. Environmental Management Principles - National policies on environment, abatement of pollution and conservation of resources - Charter on Corporate responsibility for Environmental protection.	**08 Hours**
Module 2	**Environmental Management Objectives:** Environmental quality objectives – Rationale of Environmental standards: Concentration and Mass standards, Effluent and stream standards, Emission and ambient standards, Minimum national standards, environmental performance evaluation: Indicators, benchmarking. Pollution control Vs Pollution Prevention - Opportunities and Barriers – Cleaner production and Clean technology, closing the loops, zero discharge technologies.	**08 Hours**
Module 3	**Environmental Management System EMAS**: ISO 14000 - EMS as per ISO 14001– benefits and barriers of EMS – Concept of continual improvement and pollution prevention - environmental policy – initial environmental review – environmental aspect and impact analysis – legal and other requirements- objectives and targets – environmental management programs – structure and responsibility – training awareness and competence- communication – documentation and document control – operational control – monitoring and measurement – management review.	**08 Hours**
Module 4	**Environmental Audit:** Environmental management system audits as per ISO 19011- – Roles and qualifications of auditors - Environmental performance indicators and their evaluation – Non conformance – Corrective and preventive actions - compliance audits – waste audits and waste minimization planning – Environmental statement (form V) - Due diligence audit.	**08 Hours**
Module 5	**Applications of EMS**: Waste Audits and Pollution Prevention opportunities in Textile, Sugar, Pulp & Paper, Electroplating, Tanning industry, Dairy, Cement, Chemical industries, etc. Trans boundary movement, disposal, procedures, of hazardous wastes.	**08 Hours**

Course outcomes:

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

- Appreciate the elements of Corporate Environmental Management systems complying to international environmental management system standards
- Lead pollution prevention assessment team and implement waste minimization options.
- Develop, Implement, maintain and Audit Environmental Management systems for Organisations.

Text and Reference Books:

1. Christopher Sheldon and Mark Yoxon, "Installing Environmental management Systems – a step by step guide", Earthscan Publications Ltd, London, 1999.
2. ISO 14001/14004: "Environmental management systems – Requirements and Guidelines", International Organisation for Standardization, 2004
3. ISO 19011: 2002, "Guidelines for quality and/or Environmental Management System auditing", Bureau of Indian Standards, New Delhi, 2002
4. Paul L Bishop, "Pollution Prevention: Fundamentals and Practice", McGraw- Hill International, Boston, 2000.
5. "Environmental Management Systems: An Implementation Guide for Small and Medium-Sized Organizations", NSF International, Ann Arbor, Michigan, Second Edition, January 2001.

URBAN FLOOD MANAGEMENT (21CV744)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction:** The influence of climate, causes of flooding, types of flooding, fluvial/pluvial flooding, principles of land use planning. **Climate Change:** Key uncertainties and Robust Findings: A review of the past, signs of change, Expected consequences.	**08 Hours**
Module 2	**Hydrology of cities:** Urban hydrological cycle, Land use & runoff, Urban flood risk assessment, Tangible & intangible damages, Loss of life estimation in flood risk assessment, flood risk mapping.	**08 Hours**
Module 3	**Responding to Flood Risk:** Responses, Resilience, Vulnerability, Robustness & Sustainability, SPR Model, Confronting flood management with land use planning, Building types, infrastructure & public open spaces.	**08 Hours**
Module 4	**Urban drainage systems:** A historical perspective, Major & Minor flows, SUDS/LIDS, Practices in water sensitive urban design. **Enhancing coping & recover capacity:** Flood forecasting warning and response, Emergency Planning, Management & Evacuation.	**08 Hours**
Module 5	**Disaster mitigation & Management:** Modes of disaster management, primary & secondary data, EIA of flood management structures, traffic management during floods, socio-economic studies, interdepartmental cooperation, Regional & global disaster mitigation measurement.	**08 Hours**

Course outcomes:

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

- Understand the urban flooding-its types and characteristics, influence of urban density and climate change on urban floods.
- Comprehend the types of flood damages, loss of life estimation and to explain impacts of land use change on runoff
- Analyze and design the SUDS systems and FFWRS.

Text and Reference Books:

1. Chris Zevenbergen, Adraian Cashman, Erik Pasche and Richard Ashely, "Urban Flood Management", CRC Press, 2010.
2. Richard Ashley, Stephen Garvin, Erik Pasche, Andreas Vassilopoulos, Chris Zevenbergen, "Advances in Urban Flood Management", CRC Press, 2007.
3. Wheater, H. S., Mcintyre, N., Jackson, B. M., Marshall, M. R., Ballard, C., Bulygina, N. S., Reynolds, B. and Frogbrook, Z, "Multiscale Impacts of Land Management on Flooding", Wiley-Blackwell, Oxford, UK, 2010.
4. Arun Kumar, "Handbook of Flood Management: Flood Risk Simulation, Warning, Assessment and Mitigation", SBS Publisher, India, Vol. 1, 2009.

PAVEMENT DESIGN (21CV751)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Introduction**: Desirable characteristics of pavement, Types and components, Difference between Highway pavement and Air field pavement, Design strategies of variables, Functions of sub grade, sub base, Base course, surface course, comparison between Rigid and flexible pavement. **Fundamentals of Design of Pavements:** Stresses and deflections, Principle, Assumptions and Limitations of Boussinesq's theory, Burmister theory and problems on above.	**08 Hours**
Module 2	**Design Factors:** Design wheel load, contact pressure, Design life, Traffic factors, climatic factors, Road geometry, Subgrade strength and drainage, ESWL concept Determination of ESWL by equivalent deflection criteria, Stress criteria, EWL concept, and problems on above. **Flexible pavement Design:** using IRC-37-2018 covering granular, CTB, CTSB and recycled materials. Problems on above.	**08 Hours**
Module 3	**Flexible Pavement Failures, Maintenance and Evaluation:** Types of failures, Causes, Remedial/Maintenance measures in flexible pavements, Functional Evaluation by Visual inspection and unevenness measurements, Structural evaluation by Benkelman beam deflection method, Falling weight deflectometer, GPR method. Design factors for runway pavements, Design methods for Airfield pavement and problems on above.	**08 Hours**
Module 4	**Stresses in Rigid Pavement:** Types of stress, Analysis of Stresses, Westergaard's Analysis, Modified Westergaard equations, Critical stresses, Wheel load stresses, Warping stress, Frictional stress, combined stresses (using chart / equations), problems on above. **Design of Rigid Pavement**: Design of CC pavement by IRC: 58-2015 for dual and Tandem axle load, Reinforcement in slabs, Design of Dowel bars, Design of Tie bars, Design factors for Runway pavements, Design methods for airfield pavements, problems of the above.	**08 Hours**
Module 5	**Rigid Pavement Failures, Maintenance and Evaluation:** Types of failures, causes, remedial/maintenance measures in rigid pavements, Functional evaluation by Visual inspection and unevenness measurements, wheel load and its repetition, properties of sub grade, properties of concrete. External conditions, joints, Reinforcement, Requirements of joints,	**08 Hours**

Course outcomes:

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

- Systematically generate and compile required data for design of pavement (Highway & Airfield).
- Analyze stress, strain and deflection by boussinesq's, bur mister's and westergaard's theory.
- Design rigid pavement and flexible pavement conforming to IRC 58-2002 and IRC 37-2001.
- Evaluate the performance of the pavement and also develops maintenance statement based on site specific requirements.

Text and Reference Books:

1. S K Khanna, C E G Justo, and A Veeraragavan, "Highway Engineering", Nem Chand & Brothers.
2. L.R Kadiyali and Dr.N.B. Lal, "Principles and Practices of Highway Engineering", Khanna publishers.
3. Yang H. Huang, "Pavement Analysis and Design", University of Kentucky.
4. Yoder & wit zorac, "Principles of pavement design", John Wiley & Sons.
5. R Srinivasa Kumar, "Pavement evaluation and maintenance management system", University Press.
6. R Srinivasa Kumar, "Pavement Design", University Press.
7. Relevant IRC guidelines.

EARTHQUAKE ENGINEERING (21CV752)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Design philosophy**: Philosophy of earthquake resistant design, earthquake proof v/s earthquake resistant design, four virtues of earthquake resistant structures(strength, stiffness, ductility and configuration), seismic structural configuration, Introduction to IS: 1893 (Part I), IS: 875 (Part V), and IS code provisions.	**08 Hours**
Module 2	**Behavior of Structures During Earthquake and Earthquake Resistant Features of Structure**: Inertia forces in structures, Behavior of Brick and stone Masonry Structures: Behavior of Brick and stone Masonry Walls, Box Action, Different types of Bands, Earthquake Resistant Features of Stone Masonry Structures. Behavior of RC Structures: Load Transfer Path, Strength Hierarchy, Reversal of Stresses, Importance of Beam Column Joints, Importance of Stiffness and Ductility (Capacity Design Concept) in Structures, Effect of Short Column, Effect of Soft Storey, Improper Detailing, Effect of Masonry Infill Walls, Effect of Eccentricity.	**08 Hours**
Module 3	**Seismic-resistant building architecture**: Introduction; Lateral load resisting systems- moment resisting frame, Building with shear wall or bearing wall system, building with dual system; Building configuration – Problems and solutions; Building characteristics – Mode shape and fundamental period, building frequency and ground period, damping, ductility, seismic weight, hyperstaticity /redundancy, non-structural elements.	**08 Hours**
Module 4	**Ductility considerations in earthquake resistant design of RCC buildings**: Introduction; Impact of ductility; Requirements for ductility; Assessment of ductility–Member/element ductility, Structural ductility; Factor affecting ductility; Ductility factors; Ductility considerations as per IS13920.	**08 Hours**
Module 5	**Earthquake resistant design of a multi-storey RCC building**: Determination of lateral forces on an intermediate plane frame using Equivalent static method and Model analysis using response spectrum; Analysis of the intermediate frame for various load combinations as per IS1893 (Part 1); Identification of design forces and moments in the members; Design and detailing of typical flexural member, typical column, footing and detailing of a exterior joint as per IS13920.	**08 Hours**

Course outcomes:

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

- Understand the philosophy of Earthquake Resistant Design.
- Comprehend behavior of structure during earthquake.
- Understand the concept of Seismic-resistant building architecture.
- Apply the concept of ductile detailing in RC structures.

- Analyze and design earthquake resistant of multi-story RCC building.

Text and Reference Books:

1. Duggal, “Earthquake resistance design of structure”, Oxford University Press.
2. Dr. Vinod Hosur, “Earthquake Resistant Design of Building Structures”, Wiley India.
3. Agarwal, Shrikhande, “Earthquake resistant design of structures”, PHI learning.
4. Clough R.W. and Penzin J., “Dynamics of structure”, McGraw Hill Civil Engineering Series.
5. Anil Chopra, “Dynamics of structure”, Prentice Hall India Publication.
6. Mario Paz, “Dynamics of structure”, CBSPD Publication.

GROUND IMPROVEMENT TECHNIQUES (21CV753)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Mechanical Stabilization:** Relative Compaction, Field Compaction Control, Shallow and Deep Compaction, Sand Compaction pile, Vibrofloatation, Dynamic Compaction, Stone Column. Field compaction control- compactive effort & methods of compaction, lift thickness and number of passes, Proctor's needle, Compacting equipment and their suitability.	**08 Hours**
Module 2	**Chemical Stabilization** Cement, Lime, Flyash and Other Chemicals treatments-Mechanism, Suitability and factors influencing Chemical Stabilization (e.g: Terrazyme, Lignin etc). Field stabilization procedures and case studies.	**08 Hours**
Module 3	**Hydraulic Stabilization:** Dewatering, Electro-osmosis, Band drains, vertical drains, and Preloading. Electro kinetic dewatering, Other Methods of dewatering, seepage control, filter requirements.	**08 Hours**
Module 4	**Reinforced earth:** Concept, Components, Technique, advantages and disadvantages and applications **Soil Nailing:** Importance, procedure, advantages and disadvantages	**08 Hours**
Module 5	**Geosynthetics**: Types of geosynthetics, Mechanical and hydraulic properties, durability, applications of geosynthetics, Gabions and Mattresses, Anchors, Rock bolts, Micro piles.	**08 Hours**

Course outcomes:

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

1. Give solutions to solve various problems associated with soil formations having less strength.
2. Use effectively the various methods of ground improvement techniques depending upon the requirements.
3. Utilize properly the locally available materials and techniques for ground improvement so that economy in the design of foundations of various civil engineering structures.

Text and Reference Books:

1. Purushothama Raj P, "Ground Improvement Techniques", Laxmi Publications, New Delhi.
2. Koerner R.M, "Construction and Geotechnical Method in Foundation Engineering", McGraw HillPub.
3. G L Shivakumar babu, "An Introduction to Soil Reinforcement and Geosynthetics", Universities Press (India) Pvt. Ltd.
4. Bell,F.G., "Methods of treatment of unstable ground", Butterworths, London.
5. Nelson J.D and Miller D.J, "Expansive soils", John Wiley and Sons.
6. Ingles.C.G and Metcalf J.B, "Soil Stabilization: Principles and Practice", Butterworths.
7. Manfred Hausmann, "Engineering principles of ground modification", McGrawHill Pub.

DESIGN OF MASONRY STRUCTURES (21CV754)

Semester VII			
No. of Teaching hour/Week	3	**CIE Marks**	50
No. of Practical hours/week	0	**SEE Marks**	50
Total No. of Lecture hours	40	**Exam Hours**	03
L: T:P	3:0:0	**Credits**	03

Modules	Course Content	Teaching Hours
Module 1	**Masonry Units, Materials, types and masonry construction**: Bricks, Stone and Block masonry units- strength, modulus of elasticity and water absorption of masonry materials– classification and properties of mortars. Defects and Errors in masonry construction – cracks in masonry, types, reason for cracking, methods of avoiding cracks. **Strength and Stability:** Strength and stability of axially loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship. Compressive strength formulae based on elastic theory and empirical formulae.	**08 Hours**
Module 2	**Permissible stresses:** Types of walls, permissible compressive stress, stress reduction and shape modification factors, increase in permissible stresses for eccentric vertical and lateral load, permissible tensile stress and shear stresses. **Design Considerations:** Effective height of wall sand columns, openings in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action in lintels. Problems on design considerations for solid walls, cavity walls, wall with pillars.	**08 Hours**
Module 3	**Load considerations and design of Masonry subjected to axial loads:** Design criteria, design examples of walls under UDL, solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers.	**08 Hours**
Module 4	**Design of walls subjected to concentrated axial loads:** Solid walls, cavity walls, solid wall supported at the ends by cross wall, walls with piers, design of wall with openings. **Design of walls subjected to eccentric loads:** Design criteria – stress distribution under eccentric loads –Problems on eccentrically loaded solid walls, cavity walls, walls with piers.	**08 Hours**
Module 5	**Design of Laterally and transversely loaded walls:** Design criteria, design of solid wall under wind loading, design of shear wall – design of compound walls. Introduction to reinforced brick masonry, lintels and slabs. In-filled frames: Types – modes of failures – design criteria of masonry retaining walls.	**08 Hours**

Course outcomes:

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

1. Select suitable material for masonry construction by understanding engineering properties.
2. Compute loads, load combinations and analyze the stresses in masonry.

3. Design masonry under compression (Axial load) for various requirements and conditions.
4. Design masonry under bending (Eccentric, lateral, transverse load) for various requirements and conditions.
5. Assess the behavior of shear wall and reinforced masonry.

Text and Reference Books:

1. Dayaratnam P, “Brick and Reinforced Brick Structures”, Scientific International Pvt. Ltd.
2. M. L. Gambhir, “Building and Construction Materials”, McGraw Hill education Pvt. Ltd.
3. Henry, A.W., “Structural Masonry”, Macmillan Education Ltd., 1990.
4. IS 1905–1987 “Code of practice for structural use of un-reinforced masonry”, BIS, New Delhi.
5. SP 20 (S&T)–1991, “Hand book on masonry design and construction”, BIS, New Delhi.

ABILITY ENHANCEMENT COURSE III (21AEC77)

Semester VII			
No. of Lecture hour/Week	1	**CIE Marks**	50
No. of Tutorial hours/week	-	**SEE Marks**	-
Total No. of Lecture hours	15	**Exam Hours**	-
L: T:P	1:0:0	**Credits**	01

Modules	Course Content	Teaching Hours
Module 1	Information Design and Development- Different kinds of technical documents, Information development life cycle, Organization structures, factors affecting information and document design, Strategies for organization, Information design and writing for print and for online media.	**03 Hours**
Module 2	Technical Writing, Grammar and Editing- Technical writing process, forms of discourse, Writing drafts and revising, Collaborative writing, creating indexes, technical writing style and language.	**03 Hours**
Module 3	Basics of grammar, study of advanced grammar, editing strategies to achieve appropriate technical style. Introduction to advanced technical communication, Usability, Human factors, Managing technical communication projects, time estimation, Single sourcing, Localization.	**03 Hours**
Module 4	Communication and Technical Writing- Public speaking, Group discussion, Oral; presentation, Interviews, Graphic presentation, Presentation aids, Personality Development.	**05 Hours**
Module 5	Work culture in jobs, Personal memory, Rapid reading, Taking notes, Complex problem solving, Creativity.	**03 Hours**

Course outcomes

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

- Design and develop the technical documents and contents.
- Write & edit technical articles without grammatical mistakes.
- Manage technical communication projects.
- Address the public and participate in group discussions.
- Work cohesively at job roles and apply problem solving strategies.

Textbook/ Reference Books

1. David F. Beer and David McMurrey, “Guide to writing as an Engineer”, John Willey. New York, 2004.
2. Diane Hacker, “Pocket Style Manual”, Bedford Publication, New York, 2003, ISBN 0312406843.
3. Shiv Khera, “You Can Win”, Macmillan Books, New York, 2003.
4. Raman Sharma, “Technical Communications”, Oxford Publication, London, 2004.
5. Dale Jungk, “Applied Writing for Technicians”, McGraw Hill, New York, 2004. (ISBN: 07828357-4)
6. Sharma, R. and Mohan, K, “Business Correspondence and Report Writing”, TMH New Delhi 2002.
7. Xebec, “Presentation Book”, TMH New Delhi, 2000, ISBN 0402213.