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PROGRAMME REGULATIONS & CURRICULUM

2025-27

PRESIDENCY SCHOOL OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

MASTER OF TECHNOLOGY (M.TECH.) IN BUILDING CONSTRUCTION TECHNOLOGY

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PRESIDENCY SCHOOL OF ENGINEERING

DEPARTMENT OF CIVIL ENGINEERING

Program Regulations and Curriculum

2025-2027

MASTER OF TECHNOLOGY (M.Tech.) in

BUILDING CONSTRUCTION TECHNOLOGY

based on Choice Based Credit System (CBCS) and Outcome Based Education (OBE)

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PART A – PROGRAM REGULATIONS

1. Vision & Mission of the University and the School / Department

1.1 Vision of the University

To be a Value-driven Global University, excelling beyond peers and creating professionals of integrity and character, having concern and care for society.

1.2 Mission of the University

- Commit to be an innovative and inclusive institution by seeking excellence in teaching, research and knowledge-transfer.
- Pursue Research and Development and its dissemination to the community, at large.
- Create, sustain and apply learning in an interdisciplinary environment with consideration for ethical, ecological and economic aspects of nation building.
- Provide knowledge-based technological support and services to the industry in its growth and development.
- To impart globally-applicable skill-sets to students through flexible course offerings and support industry's requirement and inculcate a spirit of new-venture creation.

1.3 Vision of Presidency School of Engineering

To be a value based, practice-driven School of Engineering and Technology, committed to developing globally-competent Engineers, dedicated to transforming Society.

1.4 Mission of Presidency School of Engineering

- Cultivate a practice-driven environment with a contemporary Learning-pedagogy, integrating theory and practice.
- Attract and nurture world-class faculty to excel in Teaching and Research, in the field of Core Engineering.
- Establish state-of-the-art facilities for effective Teaching and Learning-experiences.
- Promote Interdisciplinary Studies to nurture talent and impart relevant skill-sets for global impact.
- Instil Entrepreneurial and Leadership Skills to address Social, Environmental, and Community-needs.

1.5 Vision of Department of Civil Engineering

To be a value-based, industry driven Civil Engineering Department committed to develop globally competent Civil Engineering professionals dedicated to transform the society.

1.6 Mission of Department of Civil Engineering

- Committed to inculcate application of Engineering knowledge, develop problem analysis and solving skills to be able to investigate complex engineering problems with modern tools.

- Create value-driven engineering professionals who are sensitive to societal concerns of environmental sustainability through ethical conduct.
- Develop excellent communication abilities with core skills of project management and team work.
- Imbibe passion for lifelong learning with individual growth path.
- Commitment towards excellence in Civil Engineering education through advancements in research and innovation.
- Design flexible course contents in disciplinary, interdisciplinary and research areas to enhance student's competitiveness.

2. Preamble to the Program Regulations and Curriculum

This is the subset of Academic Regulations and it is to be followed as a requirement for the award of M.Tech degree.

The Curriculum is designed to take into the factors listed in the Choice Based Credit System (CBCS) with focus on Social Project Based Learning, Industrial Training, and Internship to enable the students to become eligible and fully equipped for employment in industries, choose higher studies or entrepreneurship.

In exercise of the powers conferred by and in discharge of duties assigned under the relevant provision(s) of the Act, Statutes and Academic Regulations, 2025 of the University, the Academic Council hereby makes the following Regulations.

3. Short Title and Applicability

a. These Regulations shall be called the Master of Technology Degree Program Regulations and Curriculum 2024-2026.
b. These Regulations are subject to, and pursuant to the Academic Regulations 2025.
c. These Regulations shall be applicable to the ongoing Master of Technology Degree Programs of the 2024-2026 batch, and to all other Master of Technology Degree Programs which may be introduced in future.
d. These Regulations shall supersede all the earlier Master of Technology Degree Program Regulations and Curriculum, along with all the amendments thereto.
e. These Regulations shall come into force from the Academic Year 2024-2026.

4. Definitions

In these Regulations, unless the context otherwise requires:

a. "Academic Calendar" means the schedule of academic and miscellaneous events as approved by the Vice Chancellor;
b. "Academic Council" means the Academic Council of the University;
c. "Academic Regulations" means the Academic Regulations, of the University;
d. "Academic Term" means a Semester or Summer Term;
e. "Act" means the Presidency University Act, 2013;
f. "AICTE" means All India Council for Technical Education;
g. "Basket" means a group of courses bundled together based on the nature/type of the course;

h. *"BOE" means the Board of Examinations of the University;*

i. *"BOG" means the Board of Governors of the University;*

j. *"BOM" means the Board of Management of the University;*

k. *"BOS" means the Board of Studies of a particular Department/Program of Study of the University;*

l. *"CGPA" means Cumulative Grade Point Average as defined in the Academic Regulations;*

m. *"Clause" means the duly numbered Clause, with Sub-Clauses included, if any, of these Regulations;*

n. *"COE" means the Controller of Examinations of the University;*

o. *"Course In Charge" means the teacher/faculty member responsible for developing and organising the delivery of the Course;*

p. *"Course Instructor" means the teacher/faculty member responsible for teaching and evaluation of a Course;*

q. *"Course" means a specific subject usually identified by its Course-code and Course-title, with specified credits and syllabus/course-description, a set of references, taught by some teacher(s)/course-instructor(s) to a specific class (group of students) during a specific Academic Term;*

r. *"Curriculum Structure" means the Curriculum governing a specific Degree Program offered by the University, and, includes the set of Baskets of Courses along with minimum credit requirements to be earned under each basket for a degree/degree with specialization/minor/honours in addition to the relevant details of the Courses and Course catalogues (which describes the Course content and other important information about the Course). Any specific requirements for a particular program may be brought into the Curriculum structure of the specific program and relevant approvals should be taken from the BOS and Academic Council at that time.*

s. *"DAC" means the Departmental Academic Committee of a concerned Department/Program of Study of the University;*

t. *"Dean" means the Dean / Director of the concerned School;*

u. *"Degree Program" includes all Degree Programs;*

v. *"Department" means the Department offering the degree Program(s) / Course(s) / School offering the concerned Degree Programs / other Administrative Offices;*

w. *"Discipline" means specialization or branch of M.Tech. Degree Program;*

x. *"HOD" means the Head of the concerned Department;*

y. *"L-T-P-C" means Lecture-Tutorial-Practical-Credit – refers to the teaching – learning periods and the credit associated;*

z. *"MOOC" means Massive Open Online Courses;*

aa. *"MOU" means the Memorandum of Understanding;*

bb. *"NPTEL" means National Program on Technology Enhanced Learning;*

cc. *"Parent Department" means the department that offers the Degree Program that a student undergoes;*

dd. *"Program Head" means the administrative head of a particular Degree Program/s;*

ee. "Program Regulations" means the Master of Technology Degree Program Regulations and Curriculum, 2024-2026;

ff. "Program" means the Master of Technology (M.Tech.) Degree Program;

gg. "PSOE" means the Presidency School of Engineering;

hh. "Registrar" means the Registrar of the University;

ii. "School" means a constituent institution of the University established for monitoring, supervising and guiding, teaching, training and research activities in broadly related fields of studies;

jj. "Section" means the duly numbered Section, with Clauses included in that Section, of these Regulations;

kk. "SGPA" means the Semester Grade Point Average as defined in the Academic Regulations, 2021;

ll. "Statutes" means the Statutes of Presidency University;

mm. "Sub-Clause" means the duly numbered Sub-Clause of these Program Regulations;

nn. "Summer Term" means an additional Academic Term conducted during the summer break (typically in June-July) for a duration of about eight (08) calendar weeks, with a minimum of thirty (30) University teaching days;

oo. "SWAYAM" means Study Webs of Active Learning for Young Aspiring Minds.

pp. "UGC" means University Grant Commission;

qq. "University" means Presidency University, Bengaluru; and

rr. "Vice Chancellor" means the Vice Chancellor of the University.

5. Program Description

The Master of Technology Degree Program Regulations and Curriculum 2024-2026 are subject to, and, pursuant to the Academic Regulations, 2021. These Program Regulations shall be applicable to the following ongoing Master of Technology (M.Tech.) Degree Programs of 2024-2026 offered by the Presidency School of Engineering (PSOE):

1. Master of Technology in Building and Construction Technology, abbreviated as M.Tech. (BCT)

2. Master of Technology in Embedded System and VLSI as M.Tech. as (VLSI)

3. Master of Technology Product Design and Development abbreviated as M.Tech. (PDD)

5.1 These Program Regulations shall be applicable to other similar programs, which may be introduced in future.

5.2 These Regulations may evolve and get amended or modified or changed through appropriate approvals from the Academic Council, from time to time, and shall be binding on all concerned.

5.3 The effect of periodic amendments or changes in the Program Regulations, on the students admitted in earlier years, shall be dealt with appropriately and carefully, so as to ensure that those students are not subjected to any unfair situation whatsoever, although they are required to conform to these revised Program Regulations, without any undue favour or considerations

6. Minimum and Maximum Duration

6.1 Master of Technology Degree Program is a Two-Year, Full-Time Semester based program. The minimum duration of the M.Tech. Program is four (02) years and each year comprises of two academic Semesters (Odd and Even Semesters) and hence the duration of the M.Tech. program is four (04) Semesters.

6.2 A student who for whatever reason is not able to complete the Program within the normal period or the minimum duration (number of years) prescribed for the Program, may be allowed a period of two years beyond the normal period to complete the mandatory minimum credits requirement as prescribed by the concerned Program Regulations and Curriculum. In general, the permissible maximum duration (number of years) for completion of Program is 'N' + 2 years, where 'N' stands for the normal or minimum duration (number of years) for completion of the concerned Program as prescribed by the concerned Program Regulations and Curriculum.

6.3 The time taken by the student to improve Grades/CGPA, and in case of temporary withdrawal/re-joining (Refer to Clause 16.1 of the Academic Regulations), shall be counted in the permissible maximum duration for completion of a Program.

6.4 In exceptional circumstances, such as temporary withdrawal for medical exigencies where there is a prolonged hospitalization and/or treatment, as certified through hospital/medical records, women students requiring extended maternity break (certified by registered medical practitioner), and, outstanding sportspersons representing the University/State/India requiring extended time to participate in National/International sports events, a further extension of one (01) year may be granted on the approval of the Academic Council.

6.5 The enrolment of the student who fails to complete the mandatory requirements for the award of the concerned Degree (refer Section 19.0 of Academic Regulations) in the prescribed maximum duration (Sub-Clauses 18.1 and 18.2 of Academic Regulations), shall stand terminated and no Degree shall be awarded.

7 Programme Educational Objectives (PEO)

After two years of successful completion of the program, the graduates shall be:

PEO1. To prepare graduates who will be successful professionals in industry, government, academia, research, entrepreneurial pursuit and consulting firms.

PEO2. To prepare graduates who will contribute to society as broadly educated, expressive, ethical and responsible citizens with proven expertise.

PEO3. To prepare graduates who will achieve peer recognition as individuals or in a team through demonstration of good analytical, research, design and implementation skills.

PEO4. To prepare graduates who will thrive to pursue life-long reflective learning to fulfil their goals.

8 Programme Outcomes (PO) and Programme Specific Outcomes (PSO)

8.1 Programme Outcomes (PO)

On successful completion of the Program, the students shall be able to:

PO 1. An ability to analyze, manage and supervise engineering systems and processes with the aid of appropriate advanced tools.

PO 2. An ability to design a system and process within constraints of health, safety, security, economics, manufacturability to meet desired needs.

PO 3. An ability to carry out research in the respective discipline and publish the findings.

PO 4. An ability to effectively communicate and transfer the knowledge/ skill to stakeholders.

PO 5. An ability to realize the impact of engineering solutions in a contemporary, global, economical, environmental, and societal context for sustainable development

8.2 Program Specific Outcomes (PSOs):

On successful completion of the Program, the students shall be able to:

PSO 01: Able to pursue professional career in the constantly changing field of construction, Engineering, Technology.

PSO 02: Able to contribute to knowledge base through teaching and research.

PSO 03: Able to practice and promote sustainable construction technologies for social needs.

9 Admission Criteria (as per the concerned Statutory Body)

The University admissions shall be open to all persons irrespective of caste, class, creed, gender or nation. All admissions shall be made on the basis of merit in the qualifying

examinations; provided that forty percent of the admissions in all Programs of the University shall be reserved for the students of Karnataka State and admissions shall be made through a Common Entrance Examination conducted by the State Government or its agency and seats shall be allotted as per the merit and reservation policy of the State Government from time to time**.** The admission criteria to the M.Tech. Program is listed in the following Sub-Clauses:

- Have a Bachelor's degree in engineering (B.E./B.Tech) from a recognized university.
- Have a minimum aggregate of 50% in your Bachelor's degree.
- Have a minimum aggregate of 45% in your Bachelor's degree if you belong to a reserved category.
- Have to Submit score card from any state or central entrance exam or the Presidency University admission qualifying exam.

10. Specific Regulations regarding Assessment and Evaluation (including the Assessment Details of NTCC Courses, Weightages of Continuous Assessment and End Term Examination for various Course Categories)

10.1 The academic performance evaluation of a student in a Course shall be according to the University Letter Grading System based on the class performance distribution in the Course.

10.2 Academic performance evaluation of every registered student in every Course registered by the student is carried out through various components of Assessments spread across the Semester. The nature of components of Continuous Assessments and the weightage given to each component of Continuous Assessments (refer Clause 8.8 of academic regulations) shall be clearly defined in the Course Plan for every Course, and approved by the DAC.

10.3 Format of the End-Term examination shall be specified in the Course Plan.

10.4 Grading is the process of rewarding the students for their overall performance in each Course. The University follows the system of Relative Grading with statistical approach to classify the students based on the relative performance of the students registered in the concerned Course except in the following cases:

- Non-Teaching Credit Courses (NTCC)

Absolute grading method may be adopted, where necessary with prior approval of concerned DAC.

Grading shall be done at the end of the Academic Term by considering the aggregate performance of the student in all components of Assessments prescribed for the Course. Letter Grades shall be awarded to a student based on her/his overall performance relative to the class performance distribution in the concerned Course. These Letter Grades not only indicate a qualitative assessment

of the student's performance but also carry a quantitative (numeric) equivalent called the Grade Point.

10.5 Assessment Components and Weightage

Table 1: Assessment Components and Weightage for different category of Courses

Nature of Course and Structure	Evaluation Component	Weightage
Lecture-based Course L component in the L-T-P Structure is predominant (more than 1) (Examples: 3-0-0; 3-0-2; 2-1-0; 2-0-2, 2-0-4 etc.)	Continuous Assessments	50%
	End Term Examination	50%
Lab/Practice-based Course P component in the L-T-P Structure is predominant (Examples: 0-0-4; 1-0-4; 1-0-2; etc.)	Continuous Assessments	50%
	End Term Examination	50%
Skill based Courses like Industry Internship, Capstone project, Research Dissertation, Integrative Studio, Interdisciplinary Project, Summer / Short Internship, Social Engagement / Field Projects, Portfolio, and such similar Non-Teaching Credit Courses, where the pedagogy does not lend itself to a typical L-T-P structure	Guidelines for the assessment components for the various types of Courses, with recommended weightages, shall be specified in the concerned Program Regulations and Curriculum / Course Plans, as applicable.	

The exact weightages of Evaluation Components shall be clearly specified in the concerned PRC and respective Course Plan.

Normally, for Practice/Skill based Courses, without a defined credit structure (L–P–C) [NTCC], but with assigned Credits (as defined in Clause 5.2 of the Academic Regulations), the method of evaluation shall be based only on Continuous Assessments. The various components of Continuous Assessments, the distribution of weightage among such components, and the method of evaluation/assessment, shall be as decided and indicated in the Course Plan/PRC. The same shall be approved by the respective DAC.

10.6 Minimum Performance Criteria:

10.6.1 Theory only Course and Lab/Practice Embedded Theory Course

A student shall satisfy the following minimum performance criteria to be eligible to earn the credits towards the concerned Course:

a. A student must obtain a minimum of 30% of the total marks/weightage assigned to the End Term Examinations in the concerned Course.

b. The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of the components of Continuous Assessments, Mid Term Examinations and End Term Examinations in the concerned Course.

10.6.2 Lab/Practice only Course and Project Based Courses

The student must obtain a minimum of 40% of the AGGREGATE of the marks/weightage of all assessment components in the concerned Course.

10.6.3 A student who fails to meet the minimum performance criteria listed above in a Course shall be declared as "Fail" and given "F" Grade in the concerned Course. For theory Courses, the student shall have to re-appear in the "Make-Up Examinations" as scheduled by the University in any subsequent semester, or, re-appear in the End Term Examinations of the same Course when it is scheduled at the end of the following Semester or Summer Term, if offered. The marks obtained in the Continuous Assessments (other than the End Term Examination) shall be carried forward and be included in computing the final grade, if the student secures the minimum requirements (as per sub-Clauses 8.9.1 and 8.9.2 of academic regulations) in the "Make-Up Examinations" of the concerned Course. Further, the student has an option to re-register for the Course and clear the same in the summer term/ subsequent semester if he/she wishes to do so, provided the Course is offered.

11 Additional clarifications - Rules and Guidelines for Transfer of Credits from MOOC.

The University allows students to acquire credits from other Indian or foreign institutions and/or Massive Open Online Course (MOOC) platforms, subject to prior approval. These credits may be transferred and counted toward fulfilling the minimum credit requirements for the award of a degree. The process of transfer of credits is governed by the following rules and guidelines:

11.1 The transfer of credits shall be examined and recommended by the Equivalence Committee (Refer ANNEXURE B of academic regulations) and approved by the Dean - Academics.

11.2 Students may earn credits from other Indian or foreign Universities/Institutions with which the University has an MOU, and that MOU shall have specific provisions, rules and guidelines for transfer of credits. These transferred credits shall be counted towards the minimum credit requirements for the award of the degree.

11.3 Students may earn credits by registering for Online Courses offered by *Study Web of Active Learning by Young and Aspiring Minds* (SWAYAM) and *National Program on Technology Enhanced Learning* (NPTEL), or other such recognized Bodies/ Universities/Institutions as approved by the concerned BOS and Academic Council from time to time. The concerned School/Parent Department shall publish/include the approved list of Courses and the rules and guidelines governing such transfer of credits of the concerned Program from time to time. The Rules and Guidelines for the transfer of credits specifically from the Online Courses conducted by SWAYAM/ NPTEL/ other approved MOOCs are as stated in the following Sub-Clauses:

11.3.1 A student may complete SWAYAM/NPTEL/other approved MOOCs as mentioned in Clause 11.3 (as per academic regulations) and transfer equivalent credits to partially or fully complete the mandatory credit requirements of Discipline Elective Courses and/or the mandatory credit requirements of Open Elective Courses as prescribed in the concerned Curriculum Structure. However, it is the sole responsibility of the student to complete the mandatory credit requirements of the Discipline Elective Courses and the Open Elective Courses as prescribed by the Curriculum Structure of the concerned Program.

11.3.2 SWAYAM/NPTEL/ other approved MOOCs as mentioned in Clause 11.3 (as per academic regulations) shall be approved by the concerned Board of Studies and placed (as Annexures) in the concerned PRC.

11.3.3 Parent Departments may release a list of SWAYAM/NPTEL/other approved MOOCs for Pre-Registration as per schedule in the Academic Calendar or through University Notification to this effect.

11.3.4 Students may Pre-Register for the SWAYAM/NPTEL/other approved MOOCs in the respective Departments and register for the same Courses as per the schedule announced by respective Online Course Offering body/institute/ university.

11.3.5 A student shall request for transfer of credits only from such approved Courses as mentioned in Sub-Clause 11.3.2 above.

11.3.6 SWAYAM/NPTEL/other approved MOOCs Courses are considered for transfer of credits only if the concerned student has successfully completed the SWAYAM/NPTEL/other approved MOOCs and obtained a certificate of successful/satisfactory completion.

11.3.7 A student who has successfully completed the approved SWAYAM/NPTEL/ other approved MOOCs and wants to avail the provision of transfer of equivalent credits, must submit the original Certificate of Completion, or such similar authorized documents to the HOD concerned, with a written request for the transfer of the equivalent

credits. On verification of the Certificates/Documents and approval by the HOD concerned, the Course(s) and equivalent Credits shall forwarded to the COE for processing of results of the concerned Academic Term.

11.3.8 The credit equivalence of the SWAYAM/NPTEL/other approved MOOCs are based on Course durations and/or as recommended by the Course offering body/institute/university. The Credit Equivalence mapped to SWAYAM/ NPTEL approved Courses based on Course durations for transfer of credits is summarised in Table shown below. The Grade will be calculated from the marks received by the Absolute Grading Table 8.11 in the academic regulations.

Table 2: Durations and Credit Equivalence for Transfer of Credits from SWAYAM-NPTEL/ other approved MOOC Courses

Sl. No.	Course Duration	Credit Equivalence
1	4 Weeks	1 Credit
2	8 Weeks	2 Credits
3	12 Weeks	3 Credits

11.3.9 The maximum permissible number of credits that a student may request for credit transfer from MOOCs shall not exceed 20% of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree.

11.3.10 The University shall not reimburse any fees/expense; a student may incur for the SWAYAM/NPTEL/other approved MOOCs.

11.4 The maximum number of credits that can be transferred by a student shall be limited to forty percent (40%) of the mandatory minimum credit requirements specified by the concerned Program Regulations and Curriculum for the award of the concerned Degree. However, the grades obtained in the Courses transferred from other Institutions/MOOCs, as mentioned in this Section (11.0), shall not be included in the calculation of the CGPA.

PART B: PROGRAM STRUCTURE

12.0 Structure / Component with Credit Requirements Course Baskets & Minimum Basket wise Credit Requirements

The M.Tech. (Building Construction Technology) Program Structure (2024-2026) totalling 68 credits. Table 3 summarizes the type of baskets, number of courses under each basket and the associated credits that are mandatorily required for the completion of the Degree.

Table 3: Summary of mandatory courses and minimum credit contribution from various baskets	
Baskets	**Credit Contribution**
SCHOOL CORE (SC)	32
PROGRAM CORE (PC)	15
DISCIPLINE ELECTIVE (DE)	15
OPEN ELECTIVE (OE)	06
TOTAL CREDITS	**Min. 68**

In the entire Program, the practical and skill based course component contribute to an extent of approximately 61% out of the total credits of 68 for M.Tech. (Building Construction Technology) program of two years duration.

13. Minimum Total Credit Requirements of Award of Degree

As per the AICTE guidelines, a minimum of 68 credits is required for the award of a M.Tech. degree.

14. Other Specific Requirements for Award of Degree, if any, as prescribed by the Statutory Bodies,

14.1 The award of the Degree shall be recommended by the Board of Examinations and approved by the Academic Council and Board of Management of the University**.**

14.2 A student shall be declared to be eligible for the award of the concerned Degree if she/he:

a. Fulfilled the Minimum Credit Requirements and the Minimum Credits requirements under various baskets;

b. Secure a minimum CGPA of 5.0 in the concerned Program at the end of the Semester/Academic Term in which she/he completes all the requirements for the award of the Degree as specified in Sub-Clause 19.2.1 of Academic Regulations**;**

c. No dues to the University, Departments, Hostels, Library, and any other such Centers/ Departments of the University; and

d. No disciplinary action is pending against her/him.

15. Curriculum Structure – Basket Wise Course List

List of Courses Tabled – aligned to the Program Structure

Table 3.1: List of School Core Courses (SC)						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	MAT6001	Advanced Engineering Mathematics	3	0	0	3
2	ENG5001	English for Employability	2	0	2	3
3	SEM5001	Seminar – I	-	-	-	1
4	SEM5002	Seminar – II	-	-	-	1
5	PIP6001	Dissertation/ Internship - I	-	-	-	10
6	PIP6002	Dissertation/ Internship - II	-	-	-	14
Total No. of Credits						**32**

Table 3.2: List of Program Core Courses (PC)						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CIV6001	Advanced Construction Materials and Technology	2	0	2	3
2	CIV5005	Quality, Risk and Safety in Construction	3	0	0	3
3	CIV5006	Construction Planning, Schedule and Control	2	0	2	3
4	CIV6002	Building Services and Building Information Modelling	2	0	2	3
5	CIV5007	Construction Economics and Contract Specifications	3	0	0	3
Total No. of Credits						**15**

16. Practical / Skill based Courses – Internships / Thesis / Dissertation / Capstone Project Work / Portfolio / Mini project

Practical / Skill based Courses like internship, project work, capstone project, research project / dissertation, and such similar courses, where the pedagogy does not lend itself to a typical L-T-P-C Structure as defined in Clause 5.1 of the Academic Regulations are simply assigned the number of Credits based on the quantum of work / effort required to fulfil the learning objectives and outcomes prescribed for the concerned Courses. Such courses are referred to as Non-Teaching Credit Courses (NTCC). These Courses are designed to provide students with hands-on experience and skills essential for their professional development. These courses aim to equip students with abilities in problem identification, root cause analysis, problem-solving, innovation, and design thinking through industry exposure and project-based learning. The expected outcomes are first level proficiency in problem solving and design thinking skills to better equip M.Tech. graduates for their professional careers. The method of evaluation and grading for the Practical / Skill based Courses shall be prescribed and approved by the concerned

Departmental Academic Committee (refer Annexure A of the Academic Regulations). The same shall be prescribed in the Course Handout.

16.1 Internship

A student may undergo an Internship for a period of 12-14 weeks in an industry / company or academic / research institution during 3rd and 4th Semesters, subject to the following conditions:

16.1.1 The Internship shall be in conducted in accordance with the Internship Policy prescribed by the University from time to time.

16.1.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Internship to a student;

16.1.3 The number of Internships available for the concerned Academic Term. Further, the available number of internships shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Internship, as stated in Sub-Clause 16.1.2 above.

16.1.4 A student may opt for Internship in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the Internship on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Internship confirms to the University that the Internship shall be conducted in accordance with the Program Regulations and Internship Policy of the University.

16.1.5 A student selected for an Internship in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Internship Policy of the University.

16.2 Project Work

A student may opt to do a Project Work for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Internship during the 3rd and 4th Semester as applicable, subject to the following conditions:

16.2.1 The Project Work shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

16.2.2 The student may do the project work in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 16.2.1). Provided further, that the Industry / Company or academic / research institution offering such project work confirms to the University that the project work will be conducted in accordance with the Program Regulations and requirements of the University.

16.3 Capstone Project

A student may undergo a Capstone Project for a period of 12-14 weeks in an industry / company or academic / research institution in the 3rd and 4th Semester as applicable, subject to the following conditions:

16.3.1 The Capstone Project shall be in conducted in accordance with the Capstone Project Policy prescribed by the University from time to time.

16.3.2 The selection criteria (minimum CGPA, pass in all Courses as on date, and any other qualifying criteria) as applicable / stipulated by the concerned Industry / Company or academic / research institution for award of the Capstone Project to a student;

16.3.3 The number of Capstone Project available for the concerned Academic Term. Further, the available number of Capstone Project shall be awarded to the students by the University on the basis of merit using the CGPA secured by the student. Provided further, the student fulfils the criteria, as applicable, specified by the Industry / Company or academic / research institution providing the Capstone Project, as stated in Sub-Clause 16.3.2 above.

16.3.4 A student may opt for Capstone Project in an Industry / Company or academic / research institution of her / his choice, subject to the condition that the concerned student takes the responsibility to arrange the I Capstone Project on her / his own. Provided further, that the Industry / Company or academic / research institution offering such Capstone Project confirms to the University that the Capstone Project shall be conducted in accordance with the Program Regulations and Capstone project Policy of the University.

16.3.5 A student selected for a Capstone Project in an industry / company or academic / research institution shall adhere to all the rules and guidelines prescribed in the Capstone Project Policy of the University.

16.4 Research Project / Dissertation

A student may opt to do a Research Project / Dissertation for a period of 12-14 weeks in an Industry / Company or academic / research institution or the University Department(s) as an equivalence of Capstone Project, subject to the following conditions:

16.4.1 The Research Project / Dissertation shall be approved by the concerned HOD and be carried out under the guidance of a faculty member.

The student may do the Research Project / Dissertation in an Industry / Company or academic / research institution of her / his choice subject to the above mentioned condition (Sub-Clause 18.4.1). Provided further, that the Industry / Company or academic / research institution offering such Research Project / Dissertation confirms to the University that the Research Project / Dissertation work will be conducted in accordance with the Program Regulations and requirements of the University.

17. List of Discipline Elective Courses:

Table 3.3: Discipline Elective Courses (DE)						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CIV5008	Construction Demolition and Waste Management	3	0	0	3
2	CIV5009	Mechanization in Construction	3	0	0	3
3	CIV6003	Pre – Engineered Construction	3	0	0	3
4	CIV6004	Retrofitting and Repair Techniques	3	0	0	3
5	CIV6005	Formwork and Scaffolding Design	3	0	0	3
6	CIV5010	Building Automation and 3D Printing	3	0	0	3
7	CIV6006	Advanced Design of RC Structures	3	0	0	3
8	CIV6007	Seismic analysis and Design of Buildings	3	0	0	3
9	CIV5011	Human Resource Management	3	0	0	3
10	CIV5012	Elements of Prestressed Concrete Structures	3	0	0	3
11	CIV6008	Advanced Design of Steel Structures	3	0	0	3
12	CIV5013	Design concepts of substructures	3	0	0	3
13	CIV5014	Applications of Remote Sensing and GIS in Construction	2	0	2	3
Total No. of Credits						**15**

18. List of Open Electives to be offered by the School / Department

Table 3.3: Discipline Elective Courses (DE)						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1	CIV5008	Construction Demolition and Waste Management	3	0	0	3
2	CIV5009	Mechanization in Construction	3	0	0	3
3	CIV6003	Pre – Engineered Construction	3	0	0	3
4	CIV6004	Retrofitting and Repair Techniques	3	0	0	3
5	CIV6005	Formwork and Scaffolding Design	3	0	0	3
6	CIV5010	Building Automation and 3D Printing	3	0	0	3
7	CIV6006	Advanced Design of RC Structures	3	0	0	3
8	CIV6007	Seismic analysis and Design of Buildings	3	0	0	3
9	CIV5011	Human Resource Management	3	0	0	3
10	CIV5012	Elements of Prestressed Concrete Structures	3	0	0	3
11	CIV6008	Advanced Design of Steel Structures	3	0	0	3
12	CIV5013	Design concepts of substructures	3	0	0	3
13	CIV5014	Applications of Remote Sensing and GIS in Construction	2	0	2	3
Total No. of Credits						**15**

OPEN ELECTIVE Minimum of 6 Credits to be earned from this basket						
Civil Engineering Basket						
Sl. No.	**Course Code**	**Course Name**	**L**	**T**	**P**	**C**
1.	CIV5001	Sustainable Smart Cities	3	0	0	3
2.	CIV5002	Systems Design for Sustainability	3	0	0	3
3.	CIV5003	Self Sustainable Buildings	3	0	0	3
4.	CIV5004	Energy and Buildings	3	0	0	3
Law Basket						
1.	LAW5001	International Trade Law	3	0	0	3
2.	LAW5002	Law relating to Business Establishment	3	0	0	3
3.	LAW5003	Data Protection Law	3	0	0	3
4.	LAW5004	Law Relating to Consumer Protection	3	0	0	3
5.	LAW5005	Law Relating to Infrastructure Projects	3	0	0	3
Computer Science and Engineering Basket						
1.	CSE5001	Programming Methodologies using Java	3	0	0	3
2.	CSE5002	Human Computer Interaction	3	0	0	3
3.	CSE5003	IOT Applications	3	0	0	3
4.	CSE5004	Programming Essentials in Python	3	0	0	3
1.	ECE5001	Wearable Computing	3	0	0	3
2.	ECE5002	MEMS and Nanotechnology	3	0	0	3
3.	ECE5003	Advanced Computer Networks	3	0	0	3
4.	ECE5004	Pervasive Computing	3	0	0	3
Computer Science and Engineering Basket						
1.	MEC5001	Optimization Techniques	3	0	0	3
2.	MEC5002	Industry 4.0	3	0	0	3
3.	MEC5003	Six Sigma for Engineers	3	0	0	3
4.	MEC5004	Design for Internet of Things	3	0	0	3
Management Basket						
1	MBA3042	Innovation and Business Incubation	3	0	0	3
2	MBA3037	Personal Wealth Management	3	0	0	3
3	MBA3038	Team Dynamics	3	0	0	3
4	MBA3039	Market Research	3	0	0	3
5	MBA2023	Design Thinking for Business Innovation	3	0	0	3
6	MBA3046	Game Theory in Business	3	0	0	3
7	MBA3047	Data Story Telling	3	0	0	3
8	MBA3048	Environmental Sustainability and Value Creation	3	0	0	3

9	MBA3049	Industry 4.0	3	0	0	3
Media Studies Basket						
1	BAJ5001	Media and Entertainment Business	3	0	0	3
2	BAJ5002	TV Journalism and News Management	2	0	2	3
Research Basket						
1.	RES5001	Research Methodology	3	0	0	3
2	RES3001	Research Methodology	3	0	0	3
1.	URE7001	University Research Experience	-	-	-	3
2.	URE7002	University Research Experience	-	-	-	0

19. Recommended Semester Wise Course Structure / Flow including the Programme / Discipline Elective Paths / Options

SEMESTER - 1				**CREDIT STRUCTURE**						
S. No.	**COURSE CODE**	**COURSE type**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**TYPE OF SKILL/ FOCUS**	**COURSE CATERS TO**
1	MAT6001	SC	Advanced Engineering Mathematics	3	0	0	3	3	S	
2	ENG5001	SC	English for Employability	2	0	2	3	4	S	HP
3	CIV6001	PC	Advanced Construction Materials and Technology	2	0	2	3	4	S	ES
4	CIV5005	PC	Quality, Risk and Safety in Construction	3	0	0	3	3	S	HP
5	CIV5006	PC	Construction Planning, Schedule and Control	2	0	2	3	4	S	HP
6	CIVXXXX	DE	Discipline Elective - I	3	0	0	3	3	EM	
7	CIVXXXX	DE	Discipline Elective - II	3	0	0	3	3	EM	
8	SEM5001	SC	Seminar – I	-	-	-	1	-	S	
			Total	18	0	6	22	24		

S-Skill Development; P-Human Values and Professional Ethics; F-Foundation; GS-Gender Sensitization;
EM-Employability Skills; EN-Entrepreneurship skills; ES- Environment and Sustainability

SEMESTER - 2				**CREDIT STRUCTURE**						
S. No.	**COURSE CODE**	**COURSE type**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**TYPE OF SKILL / FOCUS**	**COURSE CATERS TO**
1	CIV5007	PC	Construction Economics and Contract Specifications	3	0	0	3	3		HP
2	CIV6002	PC	Building Services and Building Information Modelling	2	0	2	3	4		HP/ ES
3	CIVXXXX	DE	Discipline Elective - III	3	0	0	3	3		
4	CIVXXXX	DE	Discipline Elective - IV	3	0	0	3	3		
5	CIVXXXX	DE	Discipline Elective - V	3	0	0	3	3		
6	XXXxxxx	OE	Open Elective - I	3	0	0	3	3		
7	XXXxxxx	OE	Open Elective - II	3	0	0	3	3		
8	SEM5002	SC	Seminar – II	-	-	-	1	-	S	
			Total	20	0	2	22	22		

SEMESTER - 3	**CREDIT STRUCTURE**	

S. No.	COURSE CODE	COURSE type	COURSE NAME	L	T	P	C	CONTACT HOURS	TYPE OF SKILL / FOCUS	COURSE CATERS TO
1	PIP6001	SC	Dissertation/ Internship - I	-	-	-	10	-	EM/EN	ES/HP
			Total	0	0	0	10	0		
SEMESTER - 4				**CREDIT STRUCTURE**						
S. No.	**COURSE CODE**	**COURSE type**	**COURSE NAME**	**L**	**T**	**P**	**C**	**CONTACT HOURS**	**TYPE OF SKILL / FOCUS**	**COURSE CATERS TO**
1	PIP6002	SC	Dissertation/ Internship - II	-	-	-	14	-	EM/EN	ES/HP
			Total	0	0	0	14	0		

20. Course Catalogue

Course Catalogue of all Courses Listed including the Courses Offered by other School / Department and Discipline / Programme Electives – Course Code, Course Name, Prerequisite, Anti-requisite, Course Description, Course Outcome, Course Content (with Blooms Level, CO, No. of Contact Hours), Reference Resources.

Program Core Course Catalogues:-

Course Code: MAT6001	**Course Title: Advanced Engineering Mathematics** **Type of Course: School Core**	**L-T-P-C**	3	0	0	3
Version No.	2.0					
Course Pre-requisites	**Basic Engineering Mathematics**					
Anti-requisites	None					
Course Description	This course is intended to provide an in-depth theoretical background and mathematical skills that are imperative for the effective understanding of engineering problems. The topics introduced will serve as basic tools for specialized studies in many engineering fields. The course focuses on various mathematical techniques with a strong focus on modelling, simulation and solving problems relevant to the industry. The course covers topics such as linear algebra, numerical methods and optimization techniques.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Advanced Engineering mathematics** and attain **Skill Development** through **Problem Solving techniques.**					
Course Outcomes:	On successful completion of this course, the students will be in a position to **CO-1:** comprehend the concepts of vector spaces and linear transformations. **CO-2:** apply various numerical methods to solve linear and nonlinear equations. **CO-3:** adopt various optimization techniques to optimize real-life problems. CO-4: employ PERT and CPM techniques to solve network problems.					
Module 1	**Linear Algebra**					**10 classes**
Introduction to vector spaces and sub-spaces, definitions, illustrative Example. Linearly independent and dependent vectors- Basis-definition and problems. Linear transformations-definitions. Matrix form of linear transformations-Illustrative examples. Computation of Eigen values and Eigen vectors of real symmetric Matrices-Given's and Jacobi's method.						
Module 2	**Numerical Methods**					**15 classes**
Introduction, Newton-Raphson method for system of nonlinear equations, Runge-Kutta Method system of first order ODEs and for second order ODEs, shooting method, finite difference method for boundary value problems, finite difference method for PDEs, Crank-Nicolson method for parabolic PDEs, explicit finite difference method for hyperbolic PDEs, Gauss-Seidel iteration method for elliptical PDEs.						
Module 3	**OR and LPP**					**12 classes**
Review of OR: Definition and basics of OR, characteristics of OR, OR and decision making, scope and limitations of OR, linear programming problem, formulation of LPP, graphical solution of LPP, simplex method, Big-M method, transportation problem, assignment problem, travelling salesman problem.						
Module 4	**PERT & CPM**					**8 classes**
PERT and CPM: Basic components, logical sequencing, rules of network construction, shortest-route problem, critical path analysis, PERT networks.						
Targeted Applications & Tools that can be used:						

The objective of the course is to familiarize students with the concepts of advanced engineering mathematics. Tools used: R Software / MS-Excel / Matlab / Mathematica / Maple
Text Books T1: Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Willely India, 2016. T2: C. Ray Wylie and Louis C Barrett, "Advanced Engineering Mathematics", 6th Edition, McGraw-Hill, 2012. T3: M K Jain, S.R.K Iyengar, R K. Jain, Numerical methods for Scientific and Engg. Computations, New Age International, 2003. T4: H.A. Taha, Operations Research: An Introduction, Pearson Education, 9th Edn., 2012.
References R1: Steven C Chapra and Raymond P Canale, Numerical Methods for Engineers, McGraw-Hill, 2018. R2: B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2019. R3: I. N. Herstein, Topics in Algebra, 3nd addition, Willely India, 1996. R4: F.S. Hillier and G.J. Lieberman, Introduction to Operations Research, 9th Edn., McGraw Hill-Higher Education, 2010. R5: Kanti Swarup, P.K. Gupta and Man Mohan, Operations Research, Sultan Chand & Sons, New Delhi, 2015.

Catalogue prepared by	Dr S Maruthamanikandan
Recommended by the Board of Studies on	9th BOS Meeting on 20/01/2023
Date of Approval by the Academic Council	20th ACM held in February 15 2023

Course Code: ENG5001	Course Title: English for Employability Type of Course: School Core	L- P-C	2	2	3
Version No.	1.0				
Course Pre-requisites	**Graduate Level English Language Proficiency**				
Anti-requisites	**NIL**				
Course Description	The purpose of this course is to enable students enhance their vocabulary, pronunciation and accent and thus ensuring employability. The course is designed in a structured format so as to help students internalize the content. The modules provide adequate scope for internalization through meaningful and relevant activities. Assessments are built at regular intervals to facilitate learning. They also acquire research writing skills which enables them in academic writing.				
Course Outcomes	**On successful completion of the course the students shall be able to:** 1. Identify appropriate vocabulary, pronunciation and accent. 2. Interpret main ideas and supporting details while listening attentively 3. Develop speaking ability in English both in terms of fluency and comprehensibility 4. Discover reading skills, reading speed and read to analyze and interpret information 5. Adapt the knowledge of mechanics of research writing and write a research article.				
Module 1	**Improve your English-Speaking skills**	**Pronunciation & Vocabulary Drill**	**Vocabulary Building**		
1. Enhance your vocabulary 2. Pronunciation and accent 3. Think in English 4. Build English speaking confidence					
Module 2	**Active Listening**	**Listening to audio clips and answering the questions**	**Listening skills**		
1. The importance of Listening. Listening vs Hearing 2. Types of Listening – Informational, Discriminative, Critical, Empathetic,					

Appreciative

3. Comprehensive or Rapport, Selective or biased
4. Listening and Critical Thinking
5. Barriers to Effective Listening

Module 3	**Effective Speaking**	**Presentation**	**Speaking Skills**

1. Workplace Communication and Communication Etiquette
2. Aspects of Effective Speaking – Vocabulary, voice, non-verbal
3. Practical frameworks to improve speaking
4. Attending Interviews
5. Greetings – Formal and Informal and Self Introduction
6. Asking and responding to questions Formal and Informal Communication
7. Expressing views, opinions and preferences
8. Engaging in discussions
9. Short speeches

Module 4	**Reading Strategies**	**Reading Research Articles**	**Reading Skills**

1. Components of reading
2. Improving thinking skills, analytical abilities and decision making through Reading
3. Difficulties in reading and remedial strategies
4. Reading Strategies
5. Benefits of Reading

Module 5	**Scientific Writing/Writing dissertation**	**Writing Reports**	**Writing Skills**

1. Referencing Skills for Academic Report Writing
2. Presentation Skills
3. Reporting your findings
4. Writing bibliography

Texts:

1. 1. Redman, Stuart. English Vocabulary in Use. Cambridge University Press, 1997.
2. MacCarthy, Michael, and Felicity O'Dell. English Vocabulary in Use, Cambridge University Press
3. Turton, Nigel D. ABC of Common Grammatical Errors. Macmillan India, 1995 https://1filedownload.com/wp-content/uploads/2020/12/Abc-Of-Common-Grammatical-Errors-.pdf

References: 1. Hart, Steve, Aravind R Nair, and Veena Bhambhani. Embark: English for Undergraduates. Cambridge University Press 2. Hari Prasad, M., John Verghese, R.Kishore Kumar, Komali Prakash, and U. Saraswati Rao. Strengthen Your Steps: A Multimodal Course in Communication Skills. Maruti Publications.	
Catalogue prepared by	Dr. Vinodhini Chinnaswamy
Recommended by the Board of Studies on	BOS NO: 8 BOS- 28th December 2022
Date of Approval by the Academic Council	20th ACM held in February 2023

Course Code: SEM5001	**Course Title: Seminar - I** **Type of Course: School Core**	**L-T-P-C**	-	-	-	1
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This course provides expertise in practice, and assess effective scientific seminar techniques. The seminar report writing process is also covered in the course, which calls for students to be able to connect theories, research questions, and experiment design. The seminars will assist students in acquiring the abilities needed to effectively compete for positions in various research domains. The presentation abilities they learn in the process will be crucial throughout their entire professional careers. These abilities will enable students to respond to constructive criticism and work to explain scientific concepts to peers, other scientists, and the general public.					
Course Outcome	**On successful completion of this course the students shall be able to:** (1) Understand scientific and engineering work. (2) Present their own work. (3) Analyze technical aspects of knowledge and technology using scientific approaches. (4) Communicate science and engineering topics in a given stipulated time.					
Course Content:	Research articles / publications corresponding to a particular domain of interest will be presented					
Targeted Application & Tools that can be used: 1. Emerging areas in engineering and science based research domains. 2. TED Talks 3. You Tube Links						
Text Book NA						
References NA						
Catalogue prepared by	Dr. Nakul R					

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: SEM5002	**Course Title: Seminar - II** **Type of Course: School Core**	**L-T-P-C**	-	-	-	1
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	This course provides expertise in practice, and assess effective scientific seminar techniques. The seminar report writing process is also covered in the course, which calls for students to be able to connect theories, research questions, and experiment design. The seminars will assist students in acquiring the abilities needed to effectively compete for positions in various research domains. The presentation abilities they learn in the process will be crucial throughout their entire professional careers. These abilities will enable students to respond to constructive criticism and work to explain scientific concepts to peers, other scientists, and the general public.					
Course Outcome	**On successful completion of this course the students shall be able to:** (1) Understand scientific and engineering work. (2) Present their own work. (3) Analyze technical aspects of knowledge and technology using scientific approaches. (4) Communicate science and engineering topics in a given stipulated time.					
Course Content:	Research articles / publications corresponding to a particular domain of interest will be presented					
Targeted Application & Tools that can be used: 4. Emerging areas in engineering and science based research domains. 5. TED Talks 6. You Tube Links						
Text Book NA						
References NA						
Catalogue prepared by	Dr. Nakul R					

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: PIP6001	**Course Title: Dissertation/ Internship - I** **Type of Course: School Core**	**L-T-P-C**	-	-	-	10
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The PIP6001 involving internship links the university with the professional world, by infusing the reality of the world of work into the educational process. The classroom is shifted for a period of four to five months to a professional location where the students, under the supervision of the faculty, are involved in applying the knowledge acquired in the classroom for finding solutions to real life problems. The Dissertation however enables a student to implement the ideas that he/she would have into reality either through simulation or experimental prototypes. PIP6001 enables students to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics, science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. This course also enables the students to take research oriented tasks in order to provide solutions for real-life problems.					
Course Outcome	**On successful completion of this course the students shall be able to:** (1) Identify the engineering problems related to local, regional, national or global needs. (2) Apply appropriate techniques or modern tools for solving the intended problem. (3) Design the experiments as per the standards and specifications. (4) Interpret the events and results for meaningful conclusions. (5) Appraise project findings and communicate effectively through scholarly publications.					
Course Content:	**Not Applicable**					

Targeted Application & Tools that can be used: 1. Industry specific tools and work functions	
Text Book NA	
References NA	
Catalogue prepared by	Dr. Nakul R
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: PIP6002	**Course Title: Dissertation/ Internship - II** **Type of Course: School Core**	**L-T-P-C**	-	-	-	14
Version No.	1.0					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The PIP6002 involving internship links the university with the professional world, by infusing the reality of the world of work into the educational process. The classroom is shifted for a period of four to five months to a professional location where the students, under the supervision of the faculty, are involved in applying the knowledge acquired in the classroom for finding solutions to real life problems. The Dissertation however enables a student to implement the ideas that he/she would have into reality either through simulation or experimental prototypes. PIP6002 enables students to develop and refine their language, communication and inter-personal skills, both by its very nature, and by the various evaluation components, such as seminar, group discussion, project report preparation, etc. The broad-based core education, strong in mathematics, science and rich in analytical tools, provides the foundation necessary for the student to understand properly the nature of real-life problems. This course also enables the students to take research oriented tasks in order to provide solutions for real-life problems.					
Course Outcome	**On successful completion of this course the students shall be able to:** (1) Identify the engineering problems related to local, regional, national or global needs. (2) Apply appropriate techniques or modern tools for solving the intended problem. (3) Design the experiments as per the standards and specifications. (4) Interpret the events and results for meaningful conclusions. (5) Appraise project findings and communicate effectively through scholarly					

	publications.
Course Content:	**Not Applicable**
Targeted Application & Tools that can be used: 2. Industry specific tools and work functions	
Text Book NA	
References NA	
Catalogue prepared by	Dr. Nakul R
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV6001	**Course Title: Advanced Construction Materials and Technology** **Type of Course: Program Core Theory &Integrated Laboratory**	**L-T-P-C**	2	0	2	3
Version No.	1.2					
Course Pre-requisites	**NIL**					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to appreciate the application of advanced construction materials in civil engineering and to develop the abilities required for selection and design of various composite materials used for construction project. The course is both conceptual and analytical in nature and needs fair knowledge of Basic construction materials. The course develops the critical thinking and basic skills required for a Civil Engineer. The course also enhances the analytical skills through assignments. The associated laboratory provides an opportunity to validate the concepts Taught, enhances the ability to interpret the performance of concrete and other materials with experiments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Advanced Construction Materials and Technology** and attain **Skill Development** through **Experiential Learning** techniques.					

Course Outcomes	On successful completion of this course the students shall be able to: 1] Define the various constituents of concrete. 2] Recognize the different applications of admixtures for concrete 3] Describe the properties of fresh concrete and hardened concrete 4] Compute mix proportions for concrete mixes			
Course Content:				
Module 1	Introduction to Basic Building Materials	Assignment	MS word and Excel	08 Sessions
Topics: Cement – Introduction, Chemical composition, Hydration process, types of cement, Aggregates- classification, effect of geometry & texture, strength, mechanical properties -recycled Aggregates. Admixtures - types, necessity and benefits, Mineral admixture & Chemical admixtures.				
Module 2	Concrete	Case Study	Analysis of test results and can be dealt with Lab	11 Sessions
Topics: Workability, Segregation and bleeding, Compressive and tensile strength and, Factors influencing strength, Microstructure of concrete, Creep –factors affecting creep. Shrinkage of concrete – types & Factors. Definition and significance of durability. Internal and external factors influencing durability. Mix design IS code.				
Module 3	Advanced concretes, steel & Structural Glass	Assignment	Data Collection and Interpretation of special concrete types	10 Sessions
Topics: High Strength/Performance Concrete, Light Weight Concrete, High Density Concrete, Ferro-cement, Reactive Powder Concrete, Roller Compacted Concrete, Geo-polymer and green cement. Decorative Concrete, Types of Reinforcement materials, measures of protection of steel in concrete, adhesives and sealants- types and their uses. Structural glazing.				

List of Laboratory Tasks:

Experiment No 1: Effect of water to cement ratio on workability and strength of concrete.
Level 1: Prepare concrete mixes of varied water to cement ratio and compare the workability and strength parameters of concrete.
Level 2: Prepare concrete mixes of varied water to cement ratio and compare the workability, strength and durability parameters of concrete.

Experiment No. 2: Effect of aggregate to cement ratio on workability and strength of concrete.
Level 1: Prepare concrete mixes of varied aggregate to cement ratio and compare the workability and strength parameters of concrete.
Level 2: Prepare concrete mixes of varied aggregate to cement ratio and compare the workability, strength and durability parameters of concrete.

Experiment No. 3: Effect of chemical and mineral admixtures on fresh and hardened properties of concrete.
Level 1: Prepare concrete mixes of varied chemical, mineral admixtures content and compare the workability and strength parameters of concrete.
Level 2: Prepare concrete mixes of varied chemical, mineral admixtures content and compare the workability, strength and durability parameters of concrete.

Experiment No. 4: Correlation between strength of cube, cylinder and Split Tensile strength of concrete.
Level 1: Determine the compressive strength of cube, cylinder and split tensile strength of cylinder on specimens made of single concrete mix.
Level 2: Determine the compressive strength of cube, cylinder and split tensile strength of cylinder on specimens made of single concrete mix with varied admixture content.

Experiment No. 5: Design mix for self-compacting concrete and Measure Workability of self-compacting Concrete by flow test.
Level 1: Prepare Design mix for self-compacting concrete of M40 grade and Measure Workability of self-compacting Concrete by flow tests.
Level 2: Prepare Design mix for self-compacting concrete of M70 grade and Measure Workability of self-compacting Concrete by flow tests.

Experiment No. 6: Perform Non Destructive testing on concrete
Level 1: Perform Rebound hammer test and Ultrasonic pulse velocity test on Concrete cubes.
Level 2: Perform Rebound hammer test and Ultrasonic pulse velocity test on Concrete beams and columns of an existing structure in field.

Targeted Application & Tools that can be used:
Students get the beforehand knowledge about Basic building material and its various application for present day need. MS excel can used to do analyze the concrete test results and perform various mix designs.

Textbooks:
T1 A.R. Santhakumar, *"Concrete Technology"*, Oxford.
T2 M.S Shetty, *"Concrete Technology Theory and Practice"*, S.Chand & Company Pvt. Ltd.

<table>
<tr><td colspan="2">References:
R1 P.C Varghese, "A textbook Building Materials", Prentice-Hall of India Pvt. Ltd.
R2 S. K. Duggal, "Building Materials", New age International Publishers.
R3 Codal Provisions : IS 456 2000 for Plain and reinforced concrete,
IS 10262 2019 Recommended guidelines for concrete mix design
PU Web Resources
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2196240&site=ehost-live&ebv=EB&ppid=pp_x

https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1558372&site=ehost-live
Web references: https://nptel.ac.in/courses/105106053
Standards/Hand Book: IS 456 2000 for Plain and reinforced concrete
IS 10262 2019 Recommended guidelines for concrete mix design.</td></tr>
<tr><td colspan="2">Topics relevant to "Skill Development": Introduction to basic construction materials, Design mix of concrete, Tests on concrete and analysis of concrete properties, Usage of mineral admixtures in concrete, structural glass for natural lighting for Skill Development through Experiential Learning techniques. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td>Catalogue prepared by</td><td>Mr. Harshith Jagadish Gupta
Mr. Ahamed Sharif</td></tr>
<tr><td>Recommended by the Board of Studies on</td><td>BoS No. 12 held on 07 August 2021</td></tr>
<tr><td>Date of Approval by the Academic Council</td><td>Academic Council Meeting No. 16 held on 23 October 2021</td></tr>
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Course Code: CIV5005	**Course Title: Quality, Risk and Safety in Construction** **Type of Course: Program Core and Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.2					
Course Pre-requisites	**Basic terminologies of quality, risk and safety** **General parameters of quality**					
Anti-requisites	NIL					
Course Description	The purpose of this deal with significance of Quality, Risk and Safety in Construction and to develop the basic abilities of risk management. The course is more of conceptual in nature and needs fair knowledge of causes for construction accidents, risk identification. This course mainly focuses on management aspects of construction project such as organization, quality management and safety management. The course develops the construction site safety skills by attaining quality.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Quality, Risk and Safety in Construction** and attain **Skill Development** through **Participative Learning** techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1) **Describe construction project management process and variou engineering roles involved in project organization.** 2) **Discuss total quality management and safety for construction projects.** 3) **State aspects of Safety.** 4) **Apply construction safety rules, solutions for safety related issues in construction site.** 5) **Identify risks involved in construction projects.**					
Course Content:						
Module 1	Project Organization Management	Assignment	Data Collection	**10 Sessions**		
Topics: Construction Projects: Concept, Project Categories, Characteristic of projects, project life cycle phase, Project Management- Project Management Function, Role of Project Manager, Organizing for Construction - Principles of organization, type of organization structure.						
Module 2	Construction Quality Management	Case Study	Data Collection	**12 Sessions**		
Topics: Construction Quality, Inspection and Testing, Quality control, Quality Assurance, Total Quality Management, Critical factors of TQM, TQM in Projects, Benchmarking, concepts of quality policy, standards, manual, Quality philosophy. Quality Certification for companies and laboratories, ISO Certification.						
Module 3	Safety Management	Case Study	Data Collection	**8 Sessions**		

Topics:
Safety in Construction: Causes, classification, cost of an accident, safety programme for construction, protective equipment, accident report. Types of injuries, Personal & Structural safety. Recording injuries
Construction Accident Statistics, Factors Affecting Effectiveness of Safety Programmes and Safety Performance on Construction Sites, Safety Auditing and Its Use in Proactive Prevention of Accidents.

Module 4	Construction Safety	Assignment	Data Collection	**5 Sessions**

Topics:
Safety consideration during construction, demolition, storage and handling of building materials and during use of equipment. Safety legislation and Standards, Human Pain and Suffering Costs of Construction Accidents

Module 5	Construction Risk Management	Term paper	Data Collection	**5 Sessions**

Topics:
Certainty, Risk and Uncertainty Reasons for the risks, Types of Risks, Risk Management, Identification and Nature of Construction Risks, Minimizing risks and mitigating losses, Risk mitigation

Targeted Application & Tools that can be used:
Construction Sites, Risk managing consultancy, EHS dept.

Text Books:
T1. Kumar Neeraj Jha, Pearson *"Construction Project Management", Second Edition, 2011.*
T2. P.S. Gahlot, B. M. Dhir, *"Construction Planning and Management Paperback", 2018.*

References:
R1. David Gold Smith, Mc Graw Hill, *"Safety Management in construction and Industry" 1987.*
R2. K N Vaid, *"Construction Safety Management", NICMAR, Bombay*
R3. N. Logothetis, *"Management for Total Quality", Prentice Hall 2.*
R4. "Project Management Body of Knowledge" (PMBOK® GUIDE, Guide, A.), Project Management Institute, 2001.
R5. Nigel J smith, *"Managing Risk in Construction Projects", 3rd Edition*

Weblinks:
https://onlinecourses.nptel.ac.in/noc21_ce16/preview
https://onlinecourses.nptel.ac.in/noc22_mg55/preview
https://nptel.ac.in/courses/110/105/110105094/

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMjQ2NDA2OF9fQU41?sid=3281a842-6740-4e2b-a3d5-36b396d796c3@redis&vid=4&format=EB&rid=4

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMzIyMDcyX19BTg2?sid=3281a842-6740-4e2b-a3d5-36b396d796c3@redis&vid=5&format=EB&rid=1

Topics relevant to development of "Skill": Organizing for Construction, Principles of organization, Project Management- Project Management Function, Role of Project Manager for **Skill Development** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Mrs. Sowmyashree T/ Mr. Ahamed Sharif

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV 5006	**Course Title: Construction Planning Schedule and Control** **Type of Course:** Program Core, Theory & Integrated Laboratory	**L-T-P-C**	2	0	2	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course deals with the Project planning & scheduling in civil engineering and to develop the basic abilities required for project planning, scheduling along with monitoring and control techniques for construction project. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematics and skills of logical reasoning. The course develops the critical thinking and basic skills required for a project manager. The course also enhances the analytical skills through assignments and usage of software. The associated laboratory provides an opportunity to validate the concepts Taught, enhances the ability to visualize the project schedules and analyze various techniques to optimize them.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Construction Planning Schedule and Control** and attain **Skill Development** through **Experiential Learning** techniques.					
Course Outcomes	On successful completion of the course the students shall be able to: 1] Describe the basic concepts of construction project management and Project organization. 2] Prepare project Time plan and network diagram for various construction projects. 3] Prepare project Resource schedule by allocating resources and optimizing resource allocation. 4] Apply different monitoring and control techniques to monitor progress of construction projects. 5] Prepare schedule of projects in MS Project/ Primavera software and perform various operations to optimize the schedule.					
Course Content:						
Module 1	Basic concepts of a Project	Assignment	Data Collection	**6 Sessions**		
Topics: Introduction to construction project, phases of a construction project, Project management in construction, Stakeholders of a construction project, Forms of business organizations, Traits of a						

project manager. Different methods of time estimates.

Module 2	Basics of Project Planning	Assignment	Programming simulation type	**10 Sessions**

Topics:
Introduction to construction planning, type of project plans, work breakdown structure (WBS). Planning terminologies: activity, event, network, precedence, duration of an activity, forward and backward pass, float or slack time, activity path and critical path of activities. Preparation of network diagram – Activity on Arrow and Activity on Node.

Module 3	Planning techniques	Assignment	Data Simulation and Analysis	**8 Sessions**

Topics:
Basic conventional tools for planning, Planning techniques: critical path method (CPM), program evaluation and review technique (PERT), Advantages of network techniques, Introduction to Graphical evaluation and review technique (GERT).

Module 4	Resource Management	Assignment	Data Simulation and Analysis	**8 Sessions**

Topics:
Introduction to Resource scheduling, Resource allocation, Resource levelling and smoothening, Network crashing, Cost-Time trade-off.

Module 5	Project Monitoring and Control	Assignment	Data Simulation and Analysis	**8 Sessions**

Topics:
Introduction to precedence diagramming method, Updating project schedule: Using Bar chart, Using PERT/CPM, Using Precedence network.
Project control: Progress control by Monthly progress reports and progress reviews, Cost control by using S-curve and Unit costing. Control of schedule, cost and technical performance by Earned value method.

List of Laboratory Tasks:

Experiment N0 1: Creating project tasks in MS Project or Primavera.
Level 1: Define project tasks and its duration associated with construction of a Two storied residential Building with Conventional RCC construction.
Level 2: Define project tasks and its duration associated with construction of a Two storied residential Building with Conventional RCC construction including services such as electrical, plumbing and sanitary works.

Experiment No. 2: Defining Milestones and Dependencies among the project tasks in MS Project or Primavera.
Level 1: Define Milestones and assign logical relationships between project tasks for a Two storied residential Building with Conventional RCC construction.
Level 2: Define Milestones and assign logical relationships between project tasks for a Two storied residential Building with Conventional RCC construction including services such as electrical, plumbing and sanitary works.
Experiment No. 3: Creating and assigning resources in MS Project or Primavera
Level 1: Creating required resources for the project and assigning them to project tasks involved in construction of a Two storied residential Building with Conventional RCC construction.
Level 2: Creating required resources for the project and assigning them to project tasks involved in construction of a Two storied residential Building with Conventional RCC construction including services such as electrical, plumbing and sanitary works.

Experiment No. 4: Creating Project Baseline and Generating reports in MS Project or Primavera.
Level 1: Create project baseline and generate resource reports, cost reports and progress reports for a Two storied residential Building with Conventional RCC construction.
Level 2: Create project baseline and generate resource reports, cost reports and progress reports for a Two storied residential Building with Conventional RCC construction including services such as electrical, plumbing and sanitary works.

Experiment No. 5: Preparation of Project plan and schedule on MS Project or Primavera.
Level 1: Prepare a comprehensive project plan for one of the infrastructure project mentioned in the theory lecture using all the skills acquired in previous lab sessions.
Level 2: Prepare a comprehensive project plan for one of the infrastructure project mentioned in the theory lecture using all the skills acquired in previous lab sessions and perform resource optimization on the prepared plan.

Targeted Application & Tools that can be used:
Application area is Construction Project management consultancies, Construction companies, Entrepreneurship.
Professionally used software: MS Project, Oracle Primavera.

Text Book:
T1 Kumar Neeraj Jha, "*Construction Project Management – Theory and Practice*", Pearson.
T2 Jimmie W. Hinze "*Construction Planning and Scheduling*" Tata McGraw Hill

References:
R1 Sengupta B. and Guha H, "*Construction Management and Planning*", Tata McGraw Hill, New Delhi.
R2 Moder J.J. and Phillips C.R., "*Project Management with CPM and PERT*"
R3
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=iih&AN=127161593&site=ehost-live
https://web.s.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTg1NzUwM19fQU41?sid=3c1a81df-4265-4bb8-97a9-c4d919cf0793%40redis&vid=2&format=EB&rid=1
https://web.s.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTA4MDg0Nl9fQU41?sid=3c1a81df-4265-4bb8-97a9-c4d919cf0793%40redis&vid=2&format=EK&rid=1
https://web.s.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTUyMzcxMV9fQU41?sid=3c1a81df-4265-4bb8-97a9-c4d919cf0793%40redis&vid=2&format=EB&rid=1

Website:
Scheduling techniques in Projects: https://swayam.gov.in/nd1_noc19_ce24/preview
Project Planning and Control: https://swayam.gov.in/nd1_noc19_ce30/preview
Project Management: https://swayam.gov.in/nd1_noc19_mg30/preview

Topics relevant to "Skill development": Project planning and techniques, Project monitoring and control techniques. Application of planning, scheduling techniques using software. Stakeholders of a construction project, Forms of business organizations, Traits of a project manager for **Skill Development** through **Experiential Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Ms. Sowmyashree T/ Mr. Ahamed Sharif

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV6002	**Course Title: Building Services and Building Information Modelling** **Type of Course: Program Core Theory & Integrated Laboratory**	**L-T-P-C**	2	0	2	3
Version No.	1.1					
Course Pre-requisites	**Basics of civil engineering- for having basic knowledge of Building materials, component parts of types of building. Ability to use computer.**					
Anti-requisites	**NIL**					
Course Description	The course deals with concepts of building services and building information modeling. This course focuses on the skills and information needed to effectively use an existing Building Information Modeling (BIM) tool in planning and execution of a building construction project. This is a project-based course where students gain knowledge on the implementation of BIM concepts throughout the lifecycle of a building, from planning and design, to construction and operations. It helps students to develop the basic abilities of building information modeling. Topics include HVAC, Lighting, Electrical and Water Services, Vertical transportation, fire safety, Modeling Building Elements: modeling exterior and interior walls, creating floors and roofs, adding doors, windows, footings, columns, and beams, Building Envelope: modeling wall types and design features, working with doors, windows, and wall openings, creating roofs with different shapes and slopes.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Building Services and Building Information Modeling** and attain **Skill Development** through **Experiential Learning** techniques.					
Course Outcomes	On successful completion of this course the students shall be able to: 1. Choose the different types of services required for structure 2. Create projects using Revit Architectural Template and work with Family tools. 3. Demonstrate competency using REVIT to create and document residential buildings and small commercial buildings					
Course Content:						
Module 1	**Introduction to Building services**	Assignment	Data Collection	**07 Sessions**		

Topics: Describe basics of building services. Apply various types of services as per needs of building. Classification of building services, Types of services and selection of services. Natural and artificial lighting, principles and factors, Necessity of Ventilation, Types – Natural and Mechanical, Factors to be considered in the design of Ventilation				
Module 2	**Electrical and Water services**	Assignment	Data Collection	**07 Sessions**
Topics: Electrical services in the building, Technical terms and symbols for electrical installations and Accessories of wiring, Prepare electrical services requirement and Layout of a given building (Eg. Residence, small work shop, show room, school building), cold and hot water systems				
Module 3	**Vertical transportation and Fire safety**	Assignment	Data Collection	**07 Sessions**
Topics: Types of Lifts, Design Considerations, Location, Sizes as per NBC 2016, Different types of elevators and Escalators, Different types of Conveyors and benefits, Causes of fire, fire resistance and rating, means of escape, alarms, provisions of NBC 2016				
Module 4	**BIM**	Assignment	Data Collection	**15 Sessions**
BIM and lean construction interactions, parametric modeling in construction				

List of Laboratory Tasks:

Task 01: Introduction to BIM and Autodesk REVIT, Basic Drawing and Editing Tools

Task 02: Views, View Controls and Properties

Task 03: Dimensions and Constraints

Task 04: Categories, Families, Types, and Instances

Task 05: Levels, Perspective and Sheet Creation

Task 06: Section Views

Task 07: Material and Additional Settings

Task 08: Compound and Custom Walls

Task 09: Creating and Modifying Footprint Roofs

Task 10: Editing Wall Profiles

Task 11: Floor and Foundation

Task 12: Staircase

Level No. 02: Implementation of REVIT tools on different types of buildings.

Targeted Application & Tools that can be used:

Application area is Construction works of residential and commercial projects, Construction companies.

Professionally used software: Revit software tool for BIM.

Textbooks:

T1. T.W. MEVER, *"Building Services Design"*.

T2. Faye C. McQuiston and Jerald D, *"Heating Ventilating and Air Conditioning Analysis and Design",* Parker.

T3. H.L. MALHOTRA, *"Design of fire resisting structures".*

T4. D.DRYSDALE, *"An introduction to fire dynamics".*

T5. G.C. BARNEY, *"Elevator technology".*

T6. D.CAMPBELL, ALLEN & H. ROPER, *"Concrete Structures: Materials, Maintenance and Repair"*.

References:

R1. "Hand Book of Functional Requirements of Buildings, (SP-41 & SP- 32)", Bureau of Indian Standards, BIS 1987 and 1989.

R2. Markus, T.A. & Morris, E.N., (1980) *"Building Climate and Energy",* Pitman publishing limited.

R3. Croome, J.D. Roberts, B.M, *"Air Conditioning and Ventilation of Buildings VOL-1"*, Pergamon press.

R4. F.S. MERRIT & J. AMBROSE, *"Building Engineering & System Design"*.

R5. SP-35 (1987): *Handbook of Water supply & drainage*-BIS

R6. R. Udaykumar "A text book on Building Services " Eswar Press, ISBN-13,9788178740638, Chennai

R7. Eastman, "BIM Handbook: A Guide to Building Information Modeling for Owners, Managers, Designers, Engineers and Contractors".

R8. Allen and Edward, "Fundamentals of Building Construction", Wiley.

R9. S. M. Patil "Building Services", Seema Publication, ISBN-13, Mumbai Revised edition.

R10. Dr. B. C. Punmia "Building Construction", Laxmi Publications (P) Ltd.

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTEzMTIyN19fQU41?sid=6f5bc344-a2dd-41d3-a665-989372bd4e1f@redis&vid=9&format=EB&rid=3

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMjMyNjYyOV9fQU41?sid=6f5bc344-a2dd-41d3-a665-989372bd4e1f@redis&vid=3&format=EB&rid=1

Weblinks:

1. https://nptel.ac.in/courses/105/107/105107156/
2. https://nptel.ac.in/courses/124/107/124107006/

Topics relevant to development of "SKILL DEVELOPMENT": BIM Modeling of Buildings using REVIT, Vertical transportation and Fire safety, Electrical services in the building, building services for **Skill Development** through **Experiential Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Mrs. Sowmyashree T/ Mr. Ahamed Sharif
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022

Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV 5007	**Course Title: Construction Economics and Contract Specifications** **Type of Course: Program Core and Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Knowledge of Construction Equipment, basic knowledge of economics					
Anti-requisites	**NIL**					
Course Description	The purpose of this course is to enable the students to gain knowledge of Construction economics is a branch of general economics. It consists of the application of the techniques and expertise of economics to the study of the construction firm, the construction process and the construction industry. The course is both conceptual and analytical in nature and needs fair knowledge of Mathematics. The course develops the critical thinking for decision making and analytical skills to choose construction resources for the construction project. By participating in the course students will be able to understand the economics of construction projects, idea of decision making to make the project monitoring more efficient by understanding profit or loss. The second part Construction contract management by studying it, students will be able to gain the complete knowledge on contract and its management for any construction work. The course also enhances the contractual abilities by understanding the Contract Specifications.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Construction Economics and Contract Specifications** and attain **Skill Development** through **Problem Solving** methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: **1)** Distinguish the balance sheet and cash flow statement for projects. **2)** Express the economy of equipment's based on its life cycle cost. **3)** Prepare basic tender documents for the project and review plans for dispute resolution in construction contracts.					
Course Content:						
Module 1	Construction Economics	Assignment	Data Collection	**15 Sessions**		

Topics:
Engineering economics: Basic principles – Time value of money, Quantifying alternatives for decision making, Cash flow diagrams, Equivalence- Single payment in the future, Present payment compared to uniform series payments, Future payment compared to uniform series payments, Arithmetic gradient, Geometric gradient. Comparison of alternatives: Present and annual worth method of comparing alternatives, Rate of return, Incremental rate of return

Module 2	Equipment economics	Case Study	Data Collection	**12 Sessions**

Topics:
Equipment costs, Ownership and operating costs, Buy/Rent/Lease options, Replacement analysis. Depreciation, Inflation and Taxes. Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis. Profit and loss, Balance sheets, financial ratios, Working capital management.

Module 3	Construction Contracts & Changes	Case Study	Data Collection	**11 Sessions**

Topics:
Elements of contracts-types of contracts- Contract Formation and Parties to the Contract, Prime Contract, Tenders-Prequalification-bidding-accepting-evaluation of tender- potential contractual problems, Forms of Contracts, Bids and Proposal, Breach of the Contract, Contract Changes, Documentation & Records and Construction Contract Claims, and Dispute Resolution. Insurance requirements in construction industry

Targeted Application & Tools that can be used:
Applicable in project management, resource management, project planning

Text Book

1. Blank, L. T. and Tarquin,A. J.,*"Engineering Economy", Fourth Edition, WCB/McGraw-Hill, 1998.*

2. Collier, Kieth, *"Managing Construction Contracts".*

References

1. K N Jha, *"Construction Project Management", Second edition, Pearson.*

2. S. Ranaga Rao, *"Contract Management and Dispute Resolutions", Engineering staff College of India, January 2008.*

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMjE5NjI0NF9fQU41?sid=6f5bc344-a2dd-41d3-a665-989372bd4e1f@redis&vid=16&format=EB&rid=10

https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTM1MzI5NI9fQU41?sid=6f5bc344-a2dd-41d3-a665-989372bd4e1f@redis&vid=23&format=EB&rid=2

Web links:

https://nptel.ac.in/courses/105/103/105103023/

https://nptel.ac.in/courses/105/104/105104161/

https://nptel.ac.in/courses/105/103/105103093/

Topics relevant to "Skill Development": Quantifying alternatives for decision making, Incremental rate of return, Break-even comparisons. Comparing alternatives for **Skill Development** through **Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	**Mrs. Sowmyashree T** **Mr. Ahamed Sharif**
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV5008	**Course Title: Construction and Demolition Waste Management** **Type of Course:** Department Elective and Theory only	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	This course provides insights about the latest technological advancements in construction demolition and subsequent waste management concepts. It deals with issues such as the regulatory framework, government policy, waste management, processing, recovery, and the supply network, recycling opportunities, sustainable ways forward and the economics of sustainability.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Construction and Demolition Waste Management** and attain **Employability Skills** through **Participative Learning techniques**.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Apply the knowledge of key recent research in recycling and reusing concrete and demolition waste to reduce environmental impacts to meet national, regional and global environmental targets. 2. Analyse the dynamic behavior of the urban system in context to physical appearance and by focusing on representations, properties and impact factors of construction demolition. 3. Develop the key steps in handling construction and demolition waste,					

	based on waste minimization concept.			
Course Content:				
Module 1	Construction and Demolition (C&D) Waste	Assignment	Data Collection/ Programming	**12 Sessions**
Topics: Construction and demolition waste: Concepts, Challenges, Evolution of construction waste; Categories of construction wastes. C&D waste management Rules in India, C&D Waste Management Rules, 2016. Estimation of C&D waste across Indian cities. Participatory Planning Process and Policies, Programmes and Legislation Methods, role of stakeholders, Related Acts, Policies and Programs at various levels.				
Module 2	Inventorisation of C&D waste in urban area	Assignment	Programming	**12 Sessions**
Topics: Indian Construction Industry: Overview, Past, Present and future. Hierarchy in waste management, Importance of recycling C & D Wastes, Sustainable Model on C & D waste management, Generation, Collection, Transportation and Disposal of C&D waste. Estimation of the generation of C&D waste by various methods. Existing collection methods, Technological interventions.				
Module 3	Processing and Utilisation of C&D waste	Minor project	Data Collection/ Analysis	**16 Sessions**
Topics: Processing and Utilisation of C&D waste, Transport, Energy/ Utilities, protection of the environment and safety. Existing practices requiring changes with changing practices, technology. Secondary Construction Materials from C&D waste. Utilisation of processed C&D waste. Elements of Tendering, Environmental Management of C & D Wastes				
Targeted Application & Tools that can be used: Application areas: Decision Support for Inventorisation of C&D, Processing and Utilisation of C&D waste in urban area **Professionally used software/Platform**: MATLAB/GIS/Python/IoT				

Text Books Advances in Construction and Demolition Waste Recycling Management, Processing and Environmental Assessment A volume in Woodhead Publishing Series in Civil and Structural Engineering Sustainable Waste Management and Recycling: Construction Demolition Waste. Mukesh C. Limbachiya and John J. Roberts, Default Book Series. September 2004 **References** "Guidelines on Environmental Management of Construction & Demolition (C & D) Wastes", CENTRAL POLLUTION CONTROL BOARD (Ministry of Environment, Forests & Climate Change), 2017. **Additional web-based resources** NPTEL course – Integrated Waste Management for a Smart City - Prof. Brajesh Kumar Dubey, Department of Civil Engineering IIT Khargpur (Web) https://nptel.ac.in/courses/105/105/105105160/ https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=1437851&site=ehost-live https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=670909&site=ehost-live
Topics relevant to development of "Employability Skills": Inventorisation of C&D waste in urban area, Processing and Utilization of C&D waste for developing **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout**

Catalogue prepared by	Prof. Jagdish H Godihal
Recommended by the Board of Studies on	BoS No. 11 held on 05 September 2020
Date of Approval by the Academic Council	Academic Council Meeting No. 13 held on 06 November 2020

Course Code: CIV5009	**Course Title: Mechanization in Construction** **Type of Course: Discipline Elective and Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.2					

Course Pre-requisites	NIL			
Anti-requisites	NIL			
Course Description	This course deals with different construction methods and its applications in various fields of civil engineering. The purpose of the course is to identify the latest construction techniques and its importance in creating smarter and more durable structures in less duration of time. This course is conceptual in nature and presents new opportunities of growth in the construction field. The course provides highlights about advanced construction techniques such as Box pushing and Trenchless technology used in tunnelling and pipe laying respectively that can be beneficial at subsurface level projects. The course also talks about the safety and environmental issues in mechanization.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Mechanization in Construction** and attain **Skill Development** through **Experiential Learning** techniques.			
Course Out Comes	On successful completion of the course the students shall be able to: **1)** Identify different Construction methods and its application. **2)** Recognize the latest techniques used in surface and subsurface construction. **3)** Discuss the methods of drilling and blasting in tunnels and components of a tower crane **4)** Relate with different automated and robotic systems used in construction			
Course Content:				
Module 1	Introduction to Mechanization	Assignment	Case study	**9 Sessions**
Topics: **Definition, advantages and limitation of mechanization. Indian and Global Scenario.** Factors involved in Renting, Leasing and purchase of a machinery, Specifications for ordering a machinery/equipment. Commonly used construction equipment and their uses. Reasons behind the deterioration of Machinery/Equipment and their Preventive measures. **Mechanization in aggregate manufacturing:** Selection of crushing equipment, crushing and screen plant- Stone Crushers, jaw crushers, impact crushers, roll crushers, cone crushers, and gyratory crushers. Mechanization in rebar fabrication, Mechanization in concrete production and placement, Concrete mixers, concrete batching and mixing plant- concreting, pumping, vibrators.				
Module 2	Latest Techniques in Surface and Sub-surface Construction	Case Study	Data Collection and Analysis	**9 Sessions**
Topics: **Mechanization through Construction technologies:** -Precast Flat Panel System, 3D Volumetric Modules, Flat Slabs, Precast Cladding Panels, Concrete Wall and Floors, Twin Wall Technology, Precast Concrete Foundation, Concrete Formwork Insulation. **Subsurface Construction Techniques:-** Box pushing technology for tunneling, Trenchless technology and Pile driving techniques-Pile hammers, selecting a pile hammer, energy loss due to impact and due to causes other than impact.				
Module 3	Drilling, Blasting and Securing of Tunnels	Assignment	Data Collection and Analysis	**6 Sessions**

Topics:
Mechanization through methods of Drilling, Blasting and Tunneling:- Definition of terms, selecting the drilling method and equipment; Different drilling patterns-selecting drilling pattern.
Tower Cranes- Types of Tower cranes-Selection, erection and operation of tower cranes

Module 4	Robotics and Automated systems in Construction	Case Study	Seminars	**8 Sessions**

Topics:
On – site Automated and Robotic systems: Single task construction robots (STCRs) for bricklaying, steel-truss assembly, steel welding, façade installation, wall painting, concrete laying, etc., Swarms and robots for building component assembly, Drones or Terrestrial, aerial or nautical vehicles (Piloted or autonomous), Impact and Opportunities of automation in Construction.
Exoskeletons- Purpose, Types of Construction Exoskeletons, Functions, Benefits, Practical implications.
Assignment: Enquire about the latest techniques in Construction using Robotics and Automation

Targeted Application & Tools that can be used:
Infrastructure projects such as tunnels, underground passages below railways, large scale project foundations etc
Tools used: - HDD Software for Trenchless technology – Drillers toolbox software

Text Book:
T1. Mahesh Varma, *Construction Equipment and its Planning and Applications, Metropolitan Book Co. (P) Ltd., New Delhi. India.*
T2. Sharma S.C., *Construction Equipment and Management, Khanna Publishers, Delhi, 1988.*
T3. Arora S. P and Bindra S. P, *A Text Book of Building Construction, Dhanpat Rai Publication, New Delhi, 2013.*

References:
R1. Sharma &Kaul, *Building Construction, S. Chand & Company Pvt, New Delhi, 1998*
R2. Varghese P.C, *Building Constructions, Prentice Hall*
R3. Feng Han etal, *Application of Energy-Concentrated Hydraulic Blasting Technology in Tunnel Construction in China, May 2022 (* https://doi.org/10.1155/2022/4724343)
R4. Mahesh Varma , *Construction Equipment and its Planning and Applications", Metropolitan Book* Co.(P) Ltd., New Delhi. India.
R5. James F Russell, *Construction Equipment*, Prentice Hall
Weblinks:
https://rdso.indianrailways.gov.in/works/uploads/File/WKS-R-1.pdf
https://onlinecourses.nptel.ac.in/noc21_ce21/preview
E-Books:
Concrete Formwork Systems
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=11532&site=ehost-live
Beyond Mechanization: Work and Technology in a Postindustrial Age
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=50417&site=ehost-live
Robotics and Automated Production Lines
https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1281530&site=ehost-live&ebv=EB&ppid=pp_a

Topics relevant to the development of "Employability Skills": Mechanization through methods of Drilling, Blasting and Tunneling Box pushing technology for tunneling, Trenchless technology and Pile driving techniques for **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	**Mrs. Divya Nair**

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV 6003	**Course Title: Pre-Engineered Construction** **Type of Course: Discipline Elective and Theory**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	**Basics of precast building components and materials.**					
Anti-requisites	**NIL**					
Course Description	This course deals with the pre-fabrication and to develop the basic abilities of modular coordination. The course is more of conceptual in nature and needs fair knowledge of building components. The course develops the critical thinking and conceptual knowledge on precast construction. By participating in this course student can understand the significance of prefabrication in construction industry with all its advantages over conventional technique for building huge repetitive construction project. Student can have an ideology of pre-engineered buildings (PEB) and can design for the suitable application that will help student to apply the knowledge of standardization in field of steel and concrete prefab industry. They can even describe about the new trends in prefab such as segmental construction, bridge and flyover construction using precast segments.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Pre-Engineered Construction** and attain **Employability Skills** through **Participative Learning techniques**.					
Course Outcomes	On successful completion of the course the students shall be able to: 1) Describe principles and components of prefabricated structures. 2) Choose different prefabricated elements based on the project requirement. 3) Apply the knowledge of design, production and hoisting technology of prefabricated member.					
Course Content:						

Module 1	**General Principles of Prefabrication**	Assignment	Data Collection	**12 Sessions**
Topics: Introduction, Comparison with monolithic construction – Types of prefabrication – site and plant prefabrication, Economy of prefabrication, different types of stresses acting on the structures while lifting the prefabricated structures: Modular coordination – Standardization – Planning for Components of prefabricated structures – planning and handling of simple rectangular beams and I beams – Handling and erection, Pre-Engineered Buildings Vs Conventional Steel Buildings				
Module 2	**Prefabricated Elements**	Case Study	Data Collection	**12 Sessions**

Topics:
Roof and floor panels, ribbed floor panels – wall panels – footings – Joints for different structural Connections – Effective sealing of joints for water proofing–Expansion joints in pre-cast construction. Precast units –Purlins, Principal rafters, roof trusses, lattice girders, gable frames – Foundation, Floor, Wall, Stairs

Module 3	**Production Technology**	Case Study	Data Collection	**12 Sessions**

Topics:
Choice of production setup – Stationary and mobile production – Planning of production setup – Storage of precast elements – Dimensional tolerances – Acceleration of concrete hardening. Precast sandwich Panels, Prestressed concrete solid flat slabs, Hollow core slab/panels, Pre-stressed concrete Double "T", Precast segmental Box Girders, Specifications and Seismic considerations. Equipment for hoisting and erection, Vacuum lifting pads. Apllication of Mechanisation in PEB

Text Book

1. L. Mokk, *"Prefabricated Concrete for Industrial and Public Structures", Publishing House of the Hungarian Academy of Sciences, Budapest, 2017.*
2. Marta Serrats, *"PreFab Houses Design", 2012.*

References

1. T. Koncz, *"Manual of Precast Concrete Construction", Vol. I, II, III & IV, Berlin, 1971.*
2. B. Lewicki, *"Building with Large Prefabricates", Elsevier Publishing Company, Amsterdam, London, New York, 1998.*
3. Betor Verlag, *"Structural Design Manual, Precast Concrete Connection Details",Society for the Studies in the use of Precast Concrete, Netherland, 2009.*
4. Hass, A.M, *"Precast concrete design and Applications", Applied Science Publishers, 1983.*

Weblink:

1. https://nptel.ac.in/courses/105/106/105106113/
2. **https://web.p.ebscohost.com/ehost/ebookviewer/ebook/ZTAwMHh3d19fMTIzODg0N19fQU41?sid=b81e2543-0496-424e-81ee-1a83bb5ff548@redis&vid=9&format=EB&rid=3**
3. **https://web.p.ebscohost.com/ehost/resultsadvanced?vid=7&sid=b81e2543-0496-424e-81ee-1a83bb5ff548%40redis&bquery=Prefabricated+Concrete&bdata=JmRiPWUwMDB4d3cmdHlwZT0xJnNlYXJjaE1vZGU9U3RhbmRhcmQmc2l0ZT1laG9zdC1saXZl**
4. **https://web.p.ebscohost.com/ehost/resultsadvanced?vid=4&sid=b81e2543-0496-424e-81ee-1a83bb5ff548%40redis&bquery=pre-engineered+construction&bdata=JmRiPWUwMDB4d3cmdHlwZT0xJnNlYXJjaE1vZGU9UmVsZXZhbmN5JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d**

Topics relevant to development of "Employability": Modular coordination, Standardization. Production and Hoisting Technology of pre-engineered building members for developing **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	**Mrs. Sowmyashree T**

Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV6004	**Course Title: Retrofitting and Repair Techniques** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Basic knowledge of Concrete technology and Building Materials.					
Anti-requisites	NIL					
Course Description	This course deals with the methods of assessing the deterioration mechanisms, management of repairs of concrete structures, investigative methods and causes of deterioration and durability aspects, condition survey & non-destructive evaluation, various aspects of non-destructive, partially-destructive tools to assess the condition of the structures. Guidelines on selecting repair materials and related specifications of commonly used repair items, rehabilitation and retrofitting methods, typical practices for near-surface repair, corrosion protection, structural strengthening, guidelines for framing terms and conditions for retrofitting will be discussed in detail.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Retrofitting and Repair Techniques** and attain **Employability Skills** through **Participative Learning techniques**.					
Course Outcomes	On successful completion of the course the students shall be able to: 1. Describe the cause(s) for deterioration of structures. 2. Explain the Non-Destructive Test (NDT) methods available for conditional field assessment of a structure 3. Choose repair material(s) to retrofit a deficient member. 4. Demonstrate appropriate method for retrofitting a distressed structure.					
Course Content:						
Module 1	**Causes for deterioration, Inspection and NDT of structures**	Assignment	Data collection, Case study on application of NDT and Data analysis	**10 Classes**		

Topics:
Introduction – Physical causes, Causes of distress in concrete structures, types of failure in concrete structures, concrete defects, durability aspects, distress identification and repair management - Causes of distress in concrete structures - Holistic Models for deterioration of concrete.
Condition Survey- Definition, objectives, different stages - Preliminary inspection, planning stage, visual inspection, field and laboratory testing. Non-Destructive evaluation tests - Concrete strength assessment- Rebound hammer test - Ultrasonic pulse velocity tests, penetration resistance, pull out tests, core sampling and testing - Chemical Tests - Carbonation and chloride content, Corrosion potential assessment- cover meter survey, half-cell potentiometer test, resistivity measurement, Evaluation of reserve strength of existing structures.

Module 2	**Repair Materials**	Assignment	Theory based question	**7 Classes**

Topics:
Selection of repair materials for concrete - performance requirements of repair systems, Strength and durability aspects, cost and suitability aspects, Materials for repair - Premixed cement concrete and mortars, polymer modified mortars and concrete, epoxy systems including epoxy mortars and concrete, polyester resins, coatings.

Module 3	**Repair Methods**	Assignment	Case study on RCC jacketing techniques	**10 Classes**

Topics
Repair methods - Chemical and electrochemical method of repair, Guniting, shotcreting, Resin/polymer modified slurry injection, polymer concrete system, reinforcement replacement, plate bonding technique, polymer and epoxy overlays, fiber-wrap technique, ferrocement jacketing, RCC jacketing, propping and supporting, foundation rehabilitation methods, NSM method.

Guidelines for framing terms and conditions for repair and rehabilitation works contracts - engagement of consultants, contractors, execution of work, post repair inspection.

Module 4	**Retrofitting Techniques**	Assignment	Article review on recent retrofitting techniques from E-Resources	**9** Classes

Need for retrofitting, Design philosophy of strengthening structures, strengthening of existing structures; Techniques available for strengthening including conventional and innovative techniques. Repairs to overcome low member strength, deflection, cracking, chemical disruption, weathering, wear, fire, leakage, marine exposure. Seismic retrofit of concrete structures: Local & global deficiencies in structure requiring seismic retrofit, Design philosophy, Techniques to enhance the seismic resistance of structures.

Targeted Application & Tools that can be used:
The Course enables the students to identify the cause of deterioration and distress in the structures. Use of appropriate NDT equipment for obtaining the data such as reserve strength and corrosion penetration and estimation of extent of chemical attack. The course also enables the students to choose an appropriate material for repair of structures and suitable methods of strengthening the structures.

Text Books:

1. "CPWD Handbook on Repair and Rehabilitation of RCC buildings", Govt of India Press, New Delhi, 2002.

2. R.N. Raika, "Learning from failures - Deficiencies in Design, Construction and Service" Rand Centre (SDCPL), Raikar Bhavan, Bombay, 1987

3. Dr. B. Vidivelli, "Rehabilitation of Concrete Structures", Standard Publishers, 2009.

References

1. Santhakumar A.R., "Concrete Technology" Oxford University Press, New Delhi, 2007
2. J.G. Teng, J.F. Chen, S.T. Smith, L. Lam, "FRP: Strengthened RC Structures", Wiley Publications.
3. 440.2R-10/17: Guide for the Design and Construction of Externally Bonded FRP Systems for Strengthening Concrete Structures.

Web and E-Resources

1. Michaela Kostelecká, "Rehabilitation and Reconstruction of Buildings", Trans Tech Publications Ltd. 2018 https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1884051&site=ehost-live
2. https://nptel.ac.in/courses/105/106/105106202/
3. https://nptel.ac.in/courses/105/105/105105213/
4. https://onlinecourses.nptel.ac.in/noc20_ce26/preview

Topics related to Employability: NDT tests, Selection of suitable materials for repairs, Methods of repair, Retrofitting/Jacketing techniques for developing **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Dr. Nakul R/ Mr. Gopalakrishnan N
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV6005	**Course Title: Formwork and Scaffolding Design** **Type of Course: Discipline Elective / Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.2					
Course Pre-requisites	Nil					
Anti-requisites	NIL					
Course Description	The course deals with the importance of Formwork management in civil engineering and covers the basics of formwork design and scaffolding design for construction projects. The course is both conceptual and analytical in nature and needs fair knowledge of Construction techniques. The course develops the critical thinking and basic skills required for a project in charge. The course also enhances the analytical skills through assignments and usage of case studies.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Formwork and Scaffolding Design** and attain **Employability Skills** through **Problem Solving** methodologies.					

Course Outcomes	On successful completion of the course the students shall be able to: 1) Identify various formwork and scaffolding used in construction. 2) Articulate the design concepts for formwork and scaffolding. 3) Recognize modern and special formworks. 4) Interpret the safety requirements in design and erection of formwork.			
Course Content:				
Module 1	Introduction to Formwork	Assignment	Data collection and analysis	**8 Sessions**
Topics: Introduction: Formwork and false work, Temporary work systems, Construction planning and site constraints, Materials and construction of the common formwork and false work systems, Special and proprietary forms. Formwork Materials, Shoring Towers, and Scaffolds.				
Module 2	Formwork Design	Assignment	Data Collection and Analysis	**8 Sessions**
Topics: Conventional and Proprietary (timber and steel) Formwork Design: Foundation, Wall, Column, Slab and Beam formworks. Design of Decks and False works. Effects of various loads. Loading and moment of formwork, IS Code provisions.				
Module 3	Introduction to special formwork and safety in formwork	Assignment	Case studies	**6 Sessions**
Topics: Flying Formworks such as Table Forms, Tunnel Formwork System, Column Mounted Shoring System, Gang Forms, Slip form, Formwork for Precast Concrete. Formwork Failure, Construction Sequence and Safety in use of Formwork.				
Module 4	Proprietary formwork systems and components	Case Study	Seminars	**8 Sessions**
Topics: Formwork systems from PERI- its specifications and applications: Slab formwork systems, wall formwork systems; Aluminium formwork systems from MIVAN- advantages, disadvantages and Economics of aluminium formwork.				
Targeted Application and Tools used: All civil engineering construction of buildings, bridges and other infrastructure. Professionally used software: ArchiCAD, Autodesk Revit				
Text Book T1 Jha, K.N., *"Formwork for Concrete Structures"*, First Edition, McGraw Hill. 2012 T2 Austin, C.K., *"Formwork for concrete"*, Cleaver - Hume Press Ltd., London, 1996 T3 Michael P. Hurst, *"Construction Press"*, London and New York., 2003				
References R1 Robert L. Peurifoy and Garold D. Oberiender, *"Formwork for Concrete Structures"*, McGrawHill, 1996. R2 Tudor Dinescu and Constantin Radulescu, *"Slip Form Techniques"*, Abacus Press, Turn Bridge Wells, Kent, 2004. **Web-based and E-Resources** W1 Dr Janardan Jha and Prof S K Sinha *"Modern Practices in Formwork for Civil Engineering Construction Works"*, Laxmi Publications Pvt Ltd. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1227253&site=eho				

st-live W2 https://nptel.ac.in/courses/105/102/105102088/ W3 https://egyankosh.ac.in/bitstream/123456789/28755/1/Unit-4.pdf W4 https://web.iitd.ac.in/~bishwa/LEC_PDF_774/LEC18.pdf	
Topics relevant to the development of "Employability Skills": Conventional and Proprietary (timber and steel) Formwork Design, Formwork erection and safety **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**	
Catalogue prepared by	Mr. Ahamed Sharif/ Mrs. Sowmyashree T
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV5010	**Course Title: Building Automation and 3D Printing** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Nil					
Anti-requisites	NIL					

Course Description	The purpose of this course is to enable the students to appreciate the importance of Building automation in civil engineering and to develop the basic abilities required for understanding design, operation & application of various automation packages in Buildings. The course is both conceptual and analytical in nature and needs fair knowledge of Building services. The course develops the critical thinking and basic skills required for a project manager. The course also enhances the analytical skills through assignments and usage of case studies. This course also enables the student to understand the concept of 3D printing and its application in civil engineering. It helps the student in realizing the challenges while adopting 3D printing in civil engineering through various case studies.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Building Automation and 3D Printing** and attain **Employability Skills** through **Participative Learning techniques**.			
Course Out Comes	On successful completion of the course the students shall be able to: 1) Outline the basic concepts of Building automation. 2) Summarize the various aspects of automation in building services. 3) Identify the need of integrated Building management systems. 4) Describe the basics of 3D printing and its application in civil engineering.			
Course Content:				
Module 1	Introduction to Building Automation	Assignment	Data collection and analysis	**7 Sessions**
Topics: Concept and application of Building Management System (BMS) and Automation, requirements and design considerations, architecture and components of BMS. Building Automation Hardware: controllers, sensors, actuators. Communication network. Building Automation Software, Communication protocols, Building Management Systems (BMS).				
Module 2	Fire alarm system, Access control systems	Assignment	Algorithms and flowcharts	**7 Sessions**
Topics: Fundamentals: What is Fire? Fire modes, History, Components, and Principles of Operation. FAS Components: Different fire sensors, smoke detectors and their types, Fire control panels, design considerations for the FA system. Design aspects and components of PA system. Access Control System: Access Components, Access control system Design. CCTV: Camera: Operation & types, Camera Selection Criteria, Camera Applications, CCTV Applications.				
Module 3	Energy Management systems and Integrated BMS	Assignment	Algorithms and flowcharts	**8 Sessions**
Topics: Energy Management System: Energy Savings concept & methods, Lighting control, Building Efficiency improvement, Green Building (LEED) Concept & Examples. IBMS (HVAC, Fire & Security) project cycle, Project steps BMS. Verticals: Advantages & Applications of BMS, Examples Integration: IBMS, Advantages of BMS.				
Module 4	Introduction to 3D printing	Case Study	Seminars	**8 Sessions**

Topics: Basic concepts of 3D printing: Model visualization, Layers, Material requirement. Application of 3D printing in civil Engineering: Concept of printable buildings, Building components, advantages, limitations and scope for research.
Targeted Application: Buildings of various application such as residential, commercial, retail, institutional etc.
Text Book T1 Shengwei Wang, Intelligent buildings and building automation, Spon Press, 2010 T2 Intelligent Building Systems by Albert Ting-Pat So, WaiLok Chan, Kluwer Academic publisher,3rd ed., 2012.
References R1 Derek Clements-Croome, Intelligent Buildings: Design Management and Operation, 2004. R2 Jim Sinopoli, Smart Buildings, Spicewood Publishing, May 23, 2006. R3 Jim Sinopoli, Smart Building Systems for Architects, Owners, and Builders, Butterworth Heinemann; 1 edition, 2009. **Web based and E-Resources** W1 https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=607370&site=ehost-live W2 https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=199390&site=ehost-live
Topics relevant to the development of "**Employability Skills**": Fire alarm systems, Access control systems, HVAC systems, Energy Management systems, 3D printing in civil Engineering for developing **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout**

Catalogue prepared by	**Mr. Ahamed Sharif**
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV6006	**Course Title: Advanced Design of RC Structure Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.2					
Course Pre-requisites	**Strength of Materials, Structural analysis and Design of RCC Structures**					
Anti-requisites	**NIL**					

<table>
<tr><td>Course Description</td><td colspan="4">This course enables understanding of the concepts for designing special RC structural elements for different loading conditions. The course is both conceptual and analytical in nature which enable applying mathematical and engineering knowledge to understand the behavior of the structure. The course focuses on computing the internal forces which are required to determine the required cross-sectional dimensions and reinforcement to carry the external load or to resist the induced internal forces.</td></tr>
<tr><td>Course Objective</td><td colspan="4">The objective of the course is to familiarize the learners with the concepts of Advanced RCC Structures and attain <u>Employability Skills</u> through <u>Problem Solving.</u></td></tr>
<tr><td>Course Out Comes</td><td colspan="4">On successful completion of the course the students shall be able to:
1. Illustrate the design concepts of building frames by limit state approach.
2. Sketch the reinforcement details for RC flat slabs with or without drops.
3. Compute the required cross-sectional area of steel for a combined foundation as per BIS codal provisions.
4. Demonstrate the design procedure for cantilever and counterfort retaining walls.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Concepts of Limit State Design and Design concepts of Portal Frames</td><td>Assignment</td><td>Numerical problems with Software Programming</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Basic concept of R.C. design and behavior of R.C members under different loading conditions. Transmission of Load path in rigid frames, Analysis of Portal frames with different end conditions and design concepts of portal frame as per BIS codal provisions.</td></tr>
<tr><td>Module 2</td><td>Design Concepts of Flat Slabs</td><td>Assignment</td><td>Numerical problems with Software Programming</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction, need for flat slab, general notes on flat slabs, advantages and disadvantages of flat slabs components, BIS code provisions, design methods, design for flat slabs with drops, Design of flat slabs without drops.</td></tr>
<tr><td>Module 3</td><td>Introduction to Design of Combined foundation and Mat foundation</td><td>Assignment</td><td>Numerical problems with Software Programming</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics:
Design of combined foundations - Introduction to combined foundations, Types of combined foundations, Design of rectangular and trapezoidal combined footings. Introduction to raft foundation, need for raft foundation-definitions, types, analysis and design of raft foundation.</td></tr>
<tr><td>Module 4</td><td>Design of Retaining wall</td><td>Assignment</td><td>Numerical problems with Software Programming</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics:
Types of Retaining walls, Forces acting on retaining walls, stability requirement, Design of Cantilever Retaining wall, Design of Stem, Design of Toe Slab, Design of Heel Slab, Design of Shear key, Check for Shear. Reinforcement detailing. Concepts on Design of counterfort-Horizontal ties, Vertical stirrups.</td></tr>
</table>

Targeted Application & Tools that can be used: The knowledge acquired by the students help in designing the structural components which are provided in Warehouses, Hangars, Factories, Large retail units etc. Flat slab will be provided in commercial buildings for longer spans and also to enhance the aesthetic appearance of the structure. The Mat and combined foundation are adopted for multistoried buildings and where soil is soft. **Professionally Used Software:** STAAD Pro, ETABS, MATLAB, SAP 2000 and Auto CAD Software.
Text Book: T1. Unnikrishna Pillai and Menon "Reinforced concrete Design', Tata McGraw Hill Publishers Co. Ltd., New Delhi, 2016. T2. Varghese.P.C, "Advanced Reinforced Concrete Design", Prentice Hall of India, Second Edition, 2009
References: R1. Purushothaman. P, "Reinforced Concrete Structural Elements: Behaviour Analysis and Design", Tata McGraw Hill, 1998. R2. Web Based Resource: NPTEL Course on "Design of Concrete Structures", Prof. J.N. Bandopadhyay https://nptel.ac.in/courses/105/105/105105104/ **E-Books:** Advanced R.C.C. Design (RCC Volume- II) https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2706885&site=ehost-live Reinforced Concrete: Design, Performance and Applications https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1488063&site=ehost-live
Topics relevant to development of "Employability Skills": Design concept for flat slabs with and without drops, design of portal frames, Design concept of combined footings and Mat foundation, Design concept of retaining walls **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	**Mrs. Divya Nair/ Dr. S.B. Anadinni**
Recommended by the Board of Studies on	14th BOS held on 30/07/2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18, Dated 03/08/22

Course Code: CIV6007	**Course Title: Seismic Analysis and Design of Buildings** **Type of Course: Discipline Elective** **Theory Only Course**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	Engineering Geology, Geotechnical Engineering, Design of RCC Structural Elements, Design of Steel Structures					

Anti-requisites	**NIL**			
Course Description	This Course is designed to give an idea of basic seismology and its effects on structures. The objective of this course is to teach the students how to design a structure resistant to the natural force of an earthquake. The course includes basics of engineering seismology, conceptual design, linear earthquake analysis and response spectra, load combinations. The course finds its application in effective design of Reinforced Concert Structures resistant to natural earthquake forces resulting from tectonic plate movements. Also, a glimpse into the latest seismic response control methods and retrofitting techniques will be studied			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Seismic Analysis and Design of Buildings** and attain **Employability Skills** through **Problem Solving** methodologies.			
Course Out Comes	On successful completion of the course the students shall be able to: 1] Apply the basic principles of structural dynamics to calculate mode shapes 2] Describe the basic concepts of engineering seismology. 3] Recognize the detrimental effects of structural irregularity on seismic performance of a structure. 4] Apply the Indian Standard codal provisions for the seismic analysis of reinforced concrete structures. 5] Comprehend the various seismic response control and retrofitting concepts			
Course Content:				
Module 1	Engineering Seismology	Case Study	Case Study of any relevant past earthquake with presentation.	**10 Sessions**
Topics: Causes of Earthquake – Elastic Rebound Theory, Theory of Plate Tectonics; Types of Seismic waves; Basic terms, Magnitude and intensity of Earthquake; Characteristics of Ground Motion; Classification of Earthquakes; Seismic zoning; Vertical irregularity and plan configuration problems, Conceptual Design - Building configuration – building characteristics – Quality of construction and materials.				
Module 2	Code Based Seismic Analysis Methods	Programming Assignment	Write a program to calculate base shear distribution for regular buildings using static and dynamic method.	**15 Sessions**
Topics: Seismic design philosophy, Design Earthquake Loads and Load Combinations; Basic Assumptions, Methods of Elastic Analysis – Equivalent lateral force method, response spectrum method. Step-by-step Procedure for Seismic Analysis of a Multi-storeyed RC Building. Lateral Force Path; Requirements of efficient earthquake-resistant structural system, Seismic response control concepts – passive, active, semi-active and hybrid systems, Seismic evaluation and retrofitting of structures.				
Module 3	Design and detailing of RC Building Structures	Programming Assignment	Write a program to calculate core confining concrete	**10 Sessions**

Topics: Ductility Considerations in Earthquake Resistant Design of RC Buildings, Ductile detailing as per IS 13920: 2016, Step-by-step Procedure for Seismic Design of a Multi-storeyed RC Building. Reinforced Concrete Shear Walls: Structural behaviour, failure pattern, design and detailing.
Targeted Application & Tools that can be used: Applied in structural engineering consultancies to provide earthquake resistant design of structures. Tools: ETABS, Staad Pro.
Text Book 1. Pankaj Agarwal and Manish Shrikande, "Earthquake Resistant Design of Structures", Prentice Hall of India Private Ltd, New Delhi 2. Duggal S K, "Earthquake Resistant Design of Structures". Oxford University Press, New Delhi
References 1. Anil K Chopra, "Dynamics of Structures", Pearson Education, Asia, New Delhi 2. Dr. Vinod Hosur, "Earthquake-Resistant Design of Building Structures", Wiley Precise Textbook, New Delhi 3. https://nptel.ac.in/courses/105/101/105101004/ 4.https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=2013888&site=ehost-live
Topics relevant to development of "Employability Skills": Step-by-step Procedure for Seismic Analysis of a Multi-storeyed RC Building, Seismic response control concepts – passive, active, semi-active and hybrid systems, Seismic evaluation and retrofitting of structures. Ductile detailing as per IS 13920: 2016, Step-by-step Procedure for Seismic Design of a Multi-storeyed RC Building **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Ms. Anju Mathew
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV5011	**Course Title: Human Resource Management** **Type of Course: Discipline Elective and Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					

Anti-requisites	NIL			
Course Description	This course caters to the comprehensive review of key HRM concepts and Professional ethics. The purpose of the course is to identify the job analysis and design, recruitment and selection processes, evaluation, performance management, and the strategic contribution of HRM to organizational performance. This course is conceptual in nature and also focuses on the employee development and welfare. The course enables in tackling the people at workplace and also maintain ethics at work.			
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Human Resource Management** and attain **Employability Skills** through **Participative Learning techniques**.			
Course Out Comes	On successful completion of the course the students shall be able to: 1) Recognize various functions, principles and challenges in HRM. 2) Design a job description and job specification for various levels of employees 3) Create information regarding the effectiveness of recruiting methods & selection procedures**.** 4) Discuss the regulations governing the employee benefit practices.			
Course Content:				
Module 1	Introduction to Human Resource management	Assignment	Case Study	**7 Sessions**
Topics: **Human Resource Management: Definition and Functions** Introduction, Major functions and Principles of HRM, Current and Future Challenges, Critical importance of Human Resources in the 21st Century, Recurring Themes in Human Resource Management. **e-HRM: Human resource management in the Digital Age**:- Definition, types-Operational, Relational and Transformational Goals, Advantages and Disadvantages, E-recruitment practices.				
Module 2	Strategic Planning for Personnel Management	Case Study	Data Collection and Analysis	**9 Sessions**
Topics: **Strategic Human Resource Management:** -Transforming HR staff and Structure, Enhancing Administrative Efficiency, Fitting HR practices to Business Strategy, Management of Organizational behavior-Leading human resources, Professional Ethics. **Job Analysis:** Process of Job Analysis , methods of collecting data, job description and job specification, Jobs and Careers in HRM.				
Module 3	Human Resource Approaches to Improve Competitiveness	Assignment	Case study	**6 Sessions**
Topics: **Recruitment:-** Constraints and challenges, Sources and Methods of Recruitment, New approaches to recruitment- Selection process **Performance Assessment and Management process: -** Functions of Performance assessment, Criteria for a good assessment system, Methods of Appraising Performance, Enhancing Employee performance, The Feedback of Results: The performance assessment interview.				
Module 4	Training, Development and Employee welfare	Case Study	Seminars	**8 Sessions**

Topics:

Training Vs Employability: Systematic approach towards training, Training methods, Training Evaluation techniques, Job evaluation, Compensation planning, Compensation pay structure in India and Abroad. Career Planning – Need for career planning, career planning process, Career development.

Employee Welfare and Grievance Redressal- Types of Welfare Facilities and Statutory Provisions, Causes of Employee Grievance, Employee Grievance procedure and Management in India, Absenteeism, Managing Difficult employees, Counselling.

Targeted Application & Tools that can be used:

HR Cloud that enables businesses to create, modify, and manage their HR processes in an efficient way

Tools used: -

- **Bambee -**HRMS Software tools connects companies with dedicated HR managers used for recruiting, hiring and onboarding.
- **Blueboard-** reward and recognition platform for employees
- KissFlow HR Cloud, iCIMS Talent Acquisition ADP etc – store key information and data about the employees, managing recruitment, performance monitoring , payroll services etc

Text Book:

T1. Dessler, Gary and Varkkey, Biju. , *Human Resource Management (14th edition). New Delhi: Pearson education, 2016.*

T2. Mondy RW, Martocchio JJ*, Human Resource Management (14th edition). New Delhi: Pearson education, 2016.*

References:

R1. Armstrong, Michael., *Armstrong's Handbook of Human Resource Management Practice. London: Kogan Page. 2017.*

R2. P.Subba Rao, *Human Resource Management & Industrial relations, Himalaya Publishing House, Mumbai.*

R3. Aswathappa, K., *Human Resource Management (5th edition).Tata McGraw Hill, 2008.*

Weblinks:

https://onlinecourses.nptel.ac.in/noc20_mg15/preview

https://onlinecourses.swayam2.ac.in/cec21_mg06/preview

E-BOOKS:

1. UGC NET/SET DIGEST : HUMAN RESOURCE MANAGEMENT
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1941689&site=ehost-live
2. **Strategic Human Resource Development**
   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=251415&site=ehost-live
3. **Electronic HRM in the Smart Era**

   https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1429379&site=ehost-live

Topics relevant to the development of "Employability Skills": Process of Job Analysis, methods of collecting data, job description and job specification, Sources and Methods of Recruitment, Methods of Appraising Performance for developing **Employability Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	**Mrs. Divya Nair**

Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV 5012	**Course Title: Elements of Pre-Stressed Concrete Structures** **Type of Course: Discipline Elective** **Theory Only Course**	**L-T-P-C**	3	0	0	3
Version No.	1.0					
Course Pre-requisites	**CIV 211 - Design of RCC Structural Elements**					
Anti-requisites	**NIL**					
Course Description	The main objective of this course is to provide civil engineering students with the knowledge of pre-stressed concrete structures. This course is an introduction to design of pre-stressed concrete structures. It deals with the characteristics of high strength concrete and steel, basic principles of pre-stressing, pre-tensioning and post-tensioning system, analysis of section for flexure, stresses in concrete due to self-weight, normal force and bending, losses of pre-stress, deflection of pre-stressed structures, losses in pre-tensioning and post-tensioning members, design of pre-stressed concrete structures using limit state of collapse, design of end blocks and beams. This Course helps to design pre and post tensioned concrete structures used for bridges and other important places.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Elements of Pre-Stressed Concrete Structures** and attain **Employability Skills** through **Problem Solving** methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Summarize the pre-stressing systems and analytical procedure involved in determining stresses and cracking moments 2] Predict losses and deflections in prestressed concrete members 3] Illustrate design principles of prestressed concrete sections under flexure and shear 4] Estimate transmission length, bond stresses, anchorage zone stress and dimensions of prestressed flexural members					
Course Content:						
Module 1	Introduction, Pre-stressing systems, Analysis of PSC Beams	Assignment	Data Analysis Task	**13 Sessions**		

Topics:
Basic concepts of pre stressing, historical development need for high strength of steel and concrete, terminology, advantages and applications. High strength concrete and high tensile steel Tensioning device, post tensioning systems, thermo electric pre stressing, chemical pre stressing. Basic assumptions, analysis of pre-stress, resultant stresses at a section, pressure line or thrust line. Concept of load balancing, stresses in tendons, cracking moments.

Module 2	Losses of pre-stress, Deflection, Flexural and shear strength of pre-stressed concrete members	Assignment	Data Collection	**15 Sessions**

Topics:
Nature of losses of pre stress, losses due to elastic deformation, loss due to shrinkage, creep, relaxation of stresses in steel, friction, anchorage slips, and total losses allowed for design, Factors influencing the deflections, Importance of control of deflection. Short-term and long-term deflections.

Types of flexural failure, strain compatibility, code procedures, Full and partial pre-stressed sections. Principal stresses, design of section for Flexure, ultimate shear resistances, design of shear reinforcements

Module 3	Transfer of pre-stress, Anchorage zone stresses, Design of prestressed flexural members	Assignment	Programming Task, Data Analysis Task	**12 Sessions**

Topics:
Transmission of prestressing force by bond, transmission length, bond stresses, end zone reinforcement, and flexural bond stresses as per code practice.
Stress distribution in end block, investigation of anchorage zone stresses, anchorage reinforcement. Dimensioning of flexural members, estimation of self-weight of the beam, design of pre and post tensioned beams.

Targeted Application & Tools that can be used:
Application Area is Infrastructure developing companies, Design and Construction Companies, Structural Consultancy Servicing Firms, Central and State Public Works Department.

Professionally Used Software: Excel, MATLAB, SAP 2000, STAAD Pro-RCDC, ETABS, ProConcrete, PRE-Stress, RAM Concept and Auto CAD Software.

Text Book

T1. N.Krishna Raju, "Prestressed concrete", 6th Edition, Tata McGraw Publishers.

References

R1. T.Y.Lin and Ned H. Burns, "*Design of Pre-stressed concrete structures*", John Wiley and sons, New York.

R2. K.U. Muthu, Ibrahim Azmi, Janardhana Maganti and Vijayanand M, "*Prestressed Concrete*", 2016, Prentice Hall India Learning.

Web Resources:

1. https://nptel.ac.in/courses/105/106/105106118/
2. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=NAP_1_4412

Topics relevant to development of "Employability Skills": Analysis of losses of pre-stressing force in Pre-stressed concrete beams, Determination Short term and Long term deflections in Pre stressed concrete beams, Analysis and Design of Pre stressed concrete subjected to Flexure and shear **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Ms. Anju Mathew
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: CIV6008	**Course Title: Advanced Steel Design** **Type of Course: Discipline Elective & Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Structural analysis and Design of Structural Steel elements					
Anti-requisites	NIL					
Course Description	The objective of this course is to understand the importance of connections in steel structures and the principles of plastic analysis of structures as well as to expose to design of industrial steel structures. This course is a second level course on steel structures. It also deals with the design of structural sections for adequate fire resistance as per Indian codal provisions. The basic knowledge of structural analysis and design of steel structures will help to easily understand this course. This Course also covers the design of steel trusses for supporting the roof of industrial structures, railway stations and to design gantry girders used in factories and manufacturing industries to lift and move heavy machinery/equipment.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Advanced Steel Design** and attain **Employability Skills** through **Problem Solving** methodologies.					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Design the different types of connections in steel structures 2) Understand the concept of plastic analysis of steel structure 3) Apply design principles in analysis and design industrial buildings 4) Design structural sections for adequate fire resistance					
Course Content:						
Module 1	Connections	Assignment	Numerical problems			**08 Sessions**
Topics: Bearing type joints - unstiffened and stiffened seat connections - moment resisting connection of brackets-bolted and welded-semi-rigid connections.						
Module 2	Plastic Analysis	Assignment	Numerical problems			**10 Sessions**

Topics: Introduction to plastic behaviour of Structural steel, Plastic theory, Plastic hinge concept, Plastic collapse load, load factor, Shape factor, Theorem of plastic collapse, Methods of Plastic analysis, conditions of plastic analysis, Plastic analysis of Beams.				
Module 3	Industrial Buildings	Assignment	Numerical problems	**10 Sessions**
Topics: Industrial buildings-braced and unbraced - Gable frames with Gantry-Rigid industrial Frames-Fire-Fatigue resistant design.				
Module 4	Fire resistance	Assignment	Numerical problems	**08 Sessions**
Topics: Fire resistance level, Period of Structural Adequacy, Properties of steel with temperature, Limiting Steel temperature, Protected and unprotected members, Methods of fire protection, Fire resistance ratings- Numerical Examples.				
Targeted Application & Tools that can be used: Application area is application of design of steel trusses and industrial buildings as per limit state of design following the Indian codal provisions and design of steel trusses for supporting the roof of industrial structures, railway stations and to design gantry girders used in factories.				
Text Books: 1 **.** Duggal S.K, *"Limit State Design of Steel Structures"*, Tata Mac Graw Hill, New Delhi, 2010. **2**. N. Subramanian "Design of Steel Structures"- Oxford, 2008.				
References **1** . Dayaratnam. P, "Design of Steel Structures," Chand. S, Limited, New Delhi. 2008. 2. Web Based Resource: NPTEL Course on "Design of Steel Structures II", Prof. S.R.Satish Kumar and Prof. A.R.Santha Kumar. https://nptel.ac.in/courses/105/106/105106113/ **PU Web Resources:** https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=691972&site=ehost-live				
Topics relevant to "Employability Skill": Design of unstiffened and stiffened seat connections, Design of industrial structures including fatigue resistance, Fire resistance of steel structures. Design of industrial structures including connections, Plastic Analysis of steel structures and usage of relevant IS codes **for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**				
Catalogue prepared by	Mr. Dayalan J			
Recommended by the Board of Studies on	BoS No. 13 held on 30 December 2021			
Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022			

Course Code: CIV 5013	**Course Title: Design Concepts of substructures** **Type of Course: Discipline elective Theory only**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	**Foundation Engineering, Design of RCC and PSC Structural Elements**					
Anti-requisites	**NIL**					
Course Description	This Course is intended to cover the various concepts of substructures and marine substructures. The students need to have a prior knowledge of Foundation engineering and Reinforced Concrete Design to pursue the Course.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Design Concepts of substructures** and attain **Employability Skills** through **Problem Solving** methodologies					
Course Outcomes	On successful completion of this course the students shall be able to: 1) Study different types of foundations for sub structures 2) Recognize the importance of subsoil exploration in substructures 3) Evaluate the design parameters required for well foundation 4) Understand the bridge sub structures					
Course Content:						
Module 1	**Introduction to substructures**	Assignment	Collection of data of substructures			**08 Sessions**
Topics: Substructures – Definition and purpose, Role of Foundation Engineer, General Requirements of Substructures, Scope, Types of Foundations, Selection of type of foundation, Basic requirements of a foundation, Terminology, computation of loads, design steps.						
Module 2	**Subsoil Exploration**	Assignment	Collection of subsoil exploration report			**07 Sessions**
Topics: Introduction, Site investigation, In-situ testing of soils, Subsoil exploration, Classification of foundations systems. Concept of soil shear strength parameters, Settlement analysis of footings, Shallow foundations in clay, Shallow foundation in sand & C-Φ soils. In – situ methods of bearing capacity: SPT, SCPT, DCPT and Plate Bearing Tests. Footings on layered soils and sloping ground, Design for Eccentric or Moment Loads.						
Module 3	**Introduction to bridge foundations**	Assignment	Collection of data on bridge substructures			**07 Sessions**

<table>
<tr><td colspan="5">Topics:
Discharge for design of foundations, determination of the maximum depth of scour, depth of foundation, allowable bearing pressure, loads to be considered.</td></tr>
<tr><td>Module 4</td><td>Concepts of Well / Caisson foundations:</td><td>Case study</td><td>Data collection on Case studies on construction of well foundation</td><td>08 Sessions</td></tr>
<tr><td colspan="5">Topics:
Lateral stability of well foundation, design of pier cap, design of pier and abutments, types of well foundation, sinking stresses in well</td></tr>
<tr><td colspan="5">Targeted Application & Tools that can be used:
This course is emphasizing the design of sub structures used in various civil engineering structures.
Professionally Used Software: Plaxis 2D</td></tr>
<tr><td colspan="5">Text Book:
T1. Swami Saran, Analysis and Design of Substructures, Second edition, Oxford & IBH publishing co. pvt ltd. (2006)
T2. V.N.S.Murthy, Advanced Foundation Engineering, CBS publishers & distributors, first edition (2007)</td></tr>
<tr><td colspan="5">References
R1. Bowles, J.E. – Foundation Analysis and Design, 5th Edition, BBS Publisher, 2009.
R2. Donald P Coduto – Foundation Design Principles and Practices, 2nd edition, Pearson, Indian edition, 2012
Weblink:
https://nptel.ac.in/courses/105/101/105101083/
E book link:
https://puniversity.informaticsglobal.com:2229/login.aspx?direct=true&db=nlebk&AN=541555&site=ehost-live&ebv=EB&ppid=pp_Cover</td></tr>
<tr><td colspan="5">Topics relevant to “Employability Skills”: Advising on design and the suitability of substructures along with its construction materials for developing Employability Skills through Problem Solving methodologies. This is attained through assessment component mentioned in course handout.</td></tr>
<tr><td colspan="2">Catalogue prepared by</td><td colspan="3">Mr. Jagdish B Biradar/Mrs. Madhavi T</td></tr>
<tr><td colspan="2">Recommended by the Board of Studies on</td><td colspan="3">BoS No. 12 held on 07 August 2021</td></tr>
<tr><td colspan="2">Date of Approval by the Academic Council</td><td colspan="3">Academic Council Meeting No. 16 held on 23 October 2021</td></tr>
</table>

Course Code: CIV5014	Course Title: Applications of Remote Sensing and GIS in Construction **Type of Course:** Discipline Elective & Theory Only	L-T-P-C	2	0	2	3
Version No.	1.1					
Course Pre-requisites	Engineering Geology, Surveying and Geotechnical Engineering					
Anti-requisites	**NIL**					
Course Description	This course explains about concept of remote sensing and GIS techniques are indispensable and potential tools for solving problems in civil engineering construction field. Integrating the various layers can be used to solve Civil engineering problems which are appropriate, accurate, timely, accessible and available in a suitable format, and better way such as new road alignment, urban growth, infrastructure management, site analysis, to reduce the cost of management, town planning, landslide prediction and analysis etc. GIS (Geographic Information System) helps to understand the site conditions that affect the schedule baseline and cost involved. It also aids construction within budget and schedule, site efficiency by timely usage of construction equipment, working hours, effects of seasonal fluctuations, optimizing routes, earth filling and cutting, calculation of volumes and areas of constructed phase thereby helping in estimation and valuation. The clients can see data, visualize change over time and observes patterns and trends, disseminate knowledge to the field personnel like engineers, managers in a more interactive manner in a construction project for better management. The course has various applications, both for students and industries. The advancements in technology have enhanced the Remote sensing capability and GIS tools, particularly how the data can be collected and analyzed. GIS is of large help to students and professionals.					
Course objective	The objective of the course is to familiarize the learners with the concepts of **Applications of Remote Sensing and GIS in Construction** and attain **Employability Skills** through **Experiential Learning** techniques					

<table>
<tr><td>Course Outcomes</td><td colspan="4">On successful completion of this course the students shall be able to:

1) Clarify the basic conception of remote sensing, types of sensors used in remote sensing satellites and spectral signatures of surface features like rocks, soils, vegetation, terrain features etc.;

2) Express the different Earth Observation satellite data and select suitable satellite images for Civil engineering constructions.

3) Explain the use of high-resolution satellite images, data from Drone / UAV techniques and its application in solving construction problems and monitoring in Civil Engineering projects.

4) Use of GIS software, data integration and analyze of geospatial data and integrate in GIS to Create maps, images, and spatial analysis techniques to communicate spatial data and non-spatial information in a meaningful way to others.</td></tr>
<tr><td>Course Content:</td><td colspan="4"></td></tr>
<tr><td>Module 1</td><td>Principles of Remote Sensing</td><td>Assignment</td><td>Data Analysis task</td><td>12 Sessions</td></tr>
<tr><td colspan="5">Topics:
Concepts of Remote Sensing, Physics of remote sensing, effects of atmosphere, Principle of scanner and CCD array, Spectral reflectance of earth’s surface features in different wavelength region of electromagnetic spectrum: spectral characteristics of surface features (rocks, soils, vegetations, water).
Remote Sensing platforms, characteristics of Landsat, WorldView, Cartosat, Sentinel, GeoEye, ERS, RADARSAT Satellites and their sensors, geometry and radiometry, Orbital characteristics, Data products. Types of remote sensing– active and passive remote sensing. Introduction to UAV remote sensing, techniques and prospects used in data collection</td></tr>
<tr><td>Module 2</td><td>Digital image Processing and interpretation techniques.</td><td>Case Studies</td><td>Case Studies on image classification and interpretation using QGIS.</td><td>11 Sessions</td></tr>
<tr><td colspan="5">Topics:
Introduction to digital image: Principles, stages, Image registration, enhancement, filtering, and image transformation.
Image classification - Supervised, Unsupervised, Ground truth data and training set manipulation, Classification accuracy assessment.
Applications in Civil engineering construction including case studies</td></tr>
<tr><td>Module 3</td><td>Introduction to Geographic Information System and its applications</td><td>Assignment</td><td>Data Collection and Analysis</td><td>10 Sessions</td></tr>
<tr><td colspan="5">Topics:
Basic principles, Raster and vector data.
Map projection, Topology creation, Overlay analysis, Data structure and Digital cartography.
Case studies and applications.</td></tr>
</table>

Targeted Application & Tools that can be used:
The benefits of Remote Sensing and GIS are very real in the construction industry especially for project managers, site engineers and also clients. Planning, managing and executing the infrastructural projects in the construction industry in a new era of globalization and economic liberalization demands for new skills, approach and technology.
Professionally used software: ARCMap / QGIS, MS Office.

Text Books

T1 Remote Sensing and GIS - Lillesand and Kiefer, John Willey 2008.
T2 Introduction to Geographic Information System – Kang-Tsung Chang, McGraw-Hill 2015

References

R1. Remote Sensing and Geographic Information System, M. Anji Reddy, Fourth Edition, BS Publications
R2. Fundamentals of Remote Sensing, George Joseph and C Jeganathan, Fourth Edition, The Orient Blackswan
R3. C. P. Lo, Albert K. W. Yeung, "Concept and Techniques of Geographic Information Systems", Second Edition, Pearson, 2016.

Web resources

https://www.iirs.gov.in/https://bhuvan.nrsc.gov.in/
http://edc.usgs.gov/http://www.cr.usgs.gov/http://www.earthsat.com/
https://www.gislounge.com/https://www.esri.com/en-us/what-is-gis/overviewhttps://www.usgs.gov/products/data-and-tools/gis-datahttps://www.qgis.org/https://www.qgistutorials.com/

E-resources:
https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=167467&site=ehost-live
https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=1790627&site=ehost-live

Topics related to development of "Employability Skills": Map projection, Topology creation, Overlay analysis, Data structure and Digital cartography for developing **Employability Skills** through **Experiential Learning techniques. This is attained through assessment component mentioned in course handout.**

Catalogue prepared by	Dr. Chandankeri G G
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV5001	**Course Title: Sustainable Smart Cities** **Type of Course: Open Elective and Theory only**		**L-T-P-C**	3	0	0	3
Version No.	1						
Course Pre-requisites	**NIL**						
Anti-requisites	**NIL**						
Course Description	This course helps the students learn to identify urban problems, effective and feasible ways to coordinate urban technologies, various types of models and methods for effective implementation of smart cities concepts with new technologies for urban utilities, communication and dissemination. New forms of Urban Governance and Organization.						
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Sustainable Smart Cities** and attain **Entrepreneurial Skills** through **Participative Learning techniques**.						
Course Out Comes	On successful completion of the course the students shall be able to: 1. Identify the latest technology enabled systems for the management of cities. 2. Interpret the dynamic behavior of the urban system in context to physical appearance and by focusing on representations, properties and impact factors. 3. Demonstrate the urban infrastructure systems to benefit the citizens, based on smart cities concept as responsive cities.						
Course Content:							
Module 1	Urban Infrastructure	Assignment	Data Collection	**14 Sessions**			
Topics: Components of Urban Infrastructure, Smart City: Concepts, Benefits and Challenges, Evolution of smart city; Dimensions of smart city development; Smart City Taxonomy; Smart city documentation of GOI; Smart Cities: Mission Statement and Guidelines; Disruptive technologies for smart city; Case Study - Smart Cities Lighthouse projects.							
Module 2	Planning interventions of Urban Infrastructure	Case Study	Data Interpretation	**14 Sessions**			

Topics:
Urban Planning; Understanding Inclusive Planning: components; process of urban consultations; urban strategic planning for smart, sustainable, biophillic and resilient cities; Smart governance; Traffic dashboards; Data cycle for dashboards; Capability Framework and Maturity Model for Smart Cities.

Module 3	Smart Urban Infrastructure	Minor projects	Data Collection /Analysis/ Smart solutions	**12 Sessions**

Topics:
Innovative Approaches for Smart Cities; Perspectives: Technical infrastructure, Application domain, System integration, Data processing. Advanced Decision Support for Smart Governance; Smart mobility; Smart Living, Water supply, Sanitation, Environment and Safety, Energy, Urban disaster management.

Targeted Application & Tools that can be used:
Application areas: Decision Support for Smart Governance; city transport for all; water supply, sanitation, environment and safety, energy, urban disaster management.
Professionally used software/Platform: MATLAB/GIS/Python/IoT

Text Books

1. Joseph N. Pelton; Indu B. Singh (2018), "Smart Cities of Today and Tomorrow: Better Technology, Infrastructure and Security" publication: Copernicus; 1st ed. 2019 edition.
2. UN-Habitat; "Inclusive and sustainable urban planning: a guide for Municipalities"; Volume 3: Urban Development Planning (2007); United Nations Human Settlements Programme (ISBN: 978- 92-1-132024-4).
3. Giffinger, Rudolf; Christian Fertner; Hans Kramar; Robert Kalasek; Nataša Pichler- Milanovic; Evert Meijers (2007),"Smart cities – Ranking of European medium-sized cities". Smart Cities. Vienna: Centre of Regional Science.

References

1. "Draft Concept Note on Smart City Scheme". Government of India - Ministry of Urban Development (http://indiansmartcities.in/downloads/CONCEPT NOTE-3.12.2014 REVISED AND LATEST .pdf)
2. Kent E. Calder (2016),"Singapore Smart City, Smart State" Brookings Institution Press publication.

PU e-Library Resource

1. https://search.ebscohost.com/login.aspx?direct=true&db=nlebk&AN=1586504&site=ehost-live

Topics relevant to development of "Entrepreneurial Skills": Traffic dashboards, System integration, Data processing, Advanced Decision Support for Energy, water, waste, and disaster management for developing **Entrepreneurial Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout**

Catalogue prepared by	Dr. Jagdish H Godihal/ Mr. Ajay H A
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV5002	**Course Title: Systems design for sustainability** **Type of Course: Open elective/ Theory only course**		**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Environmental studies.					
Anti-requisites	Nil					
Course Description	The purpose of this course is to provide impetus in enhancing design thinking process among students for widening the boundaries of the objective of design so as to contribute positively to sustainable development. This course includes the Design approaches, methods and tools along with case examples with reference to Selection of resources with low environmental impact; Design of products with low environmental impact; and Product-Service System Design for eco-efficiency. This course has been designed to teach about environment, energy and economy through the use of case studies and seminars from the point of view of sustainable development and changing societal, industrial demands. Case studies provide the basis for group projects as well as individual projects. The course is theory only course.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Systems design for sustainability** and attain **Entrepreneurial Skills** through **Participative Learning techniques**.					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Discuss the sustainability and engineered systems for resource and energy recovery. 2) Describe the various levels of design, redesign and Sustainable water management in view of LEED requirements. 3) Explain the resource management, approaches to sustainable development and Case studies.					
Course Content:						
Module 1	**Introduction**	Assignment	Data collection	**13 sessions**		

Topics: **Sustainability**-Definition, Elements, The 3Es model, Problems, Solutions, Key concepts for sustainable development and measures for sustainability. **Engineered systems for resource and Energy recovery**- Selection of suitable energy resources and waste to energy techniques which will result in sustainability.				
Module 2	**Design for environment**	Assignment	Presentation on topics	**15 sessions**
Topics: The various levels of design, Redesign of processes versus redesign of products to reduce impact on environment. Sustainable water management in view of LEED requirements-Water efficiency credits, Innovative wastewater technologies, Water use reduction, Storm water design(Quality and Quantity control) and LEED with respect to sustainable water systems and water quality cascade.				
Module 3	**Resource management and Environment**	Case Study	Data collection and interpretation	**15 sessions**
Topics: Approaches in resource management: ecological approach, economic approach, ethnological approach, implications of the approaches, integrated resource management strategies, concept of sustainability science, different approach towards sustainable development and its different constituents, sustainability of society, resources and framework, sustainable energy strategy, principles of energy conservation. Case Studies: R and D efforts in solid by product management in SAIL, Water pollution control and disposal of wastewater in HPCL refinery, Reuse of wastewater in small paper mills etc				
Targeted Application & Tools that can be used: Application area of Systems designs for environment and sustainability is for data collection from various industries and of environment. In companies environmental sustainability engineer gets post of Sustainability specialist, environmental engineer, sustainability manager, and sustainability director etc. Professionally used software: ArcGIS.				
Text Book T1: *Metcalf and Eddy, "Wastewater Engineering", McGraw Hill Publication 2017.*				
References R1: *S. C. Bhatia, "Environmental pollution and control in chemical process industries", Khanna Publishers 2017.* **Web Source:** *https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=456241&site=ehost-live*				
Topics related to " Entrepreneurial Skills ": Selection of suitable energy resources and waste to energy techniques for developing **Entrepreneurial Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**				
Catalogue prepared by	Mr. Bhavan Kumar			
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021			
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021			

Course Code: CIV5003	**Course Title: Self-Sustainable Buildings** **Type of Course: Open Elective/ Theory based Course**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	1) Basic knowledge of environmental sciences with concept of sustainability. 2) Basic knowledge about different building construction materials.					
Anti-requisites	NIL					
Course Description	This course delves into various emerging delivery systems for high performance green buildings, as well as the foundational concepts for evaluating their sustainability. The course provides an overview of; introduction and definition of sustainability, carbon cycle and the role of construction materials such as concrete and steel, CO2 contribution from cement and other construction materials. It also investigates the ideas regarding indoor air quality, no/low cement concrete, recycled and manufactured aggregate, life cycle and sustainability. This is a theory based course which will give understanding of efforts that can be made at the Industry and Government level to improve the environment, the economy and the quality of life of biotic and abiotic communities etc.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Self-Sustainable Buildings** and attain **Entrepreneurial Skills** through **Participative Learning techniques**.					
Course Out Comes	On successful completion of the course the students shall be able to: 1] Recognize the importance of sustainability and prepare Life Cycle Analysis. 2] Discuss the construction materials of green building and their properties. 3] Infer the performance rating of green building with zero energy to overcome harmful impacts of Indoor air pollution.					
Course Content:						
Module 1	**Introduction to sustainability and life cycle analysis**	Assignment	Data Collection/ Data Analysis			**10 Sessions**
Topics: Sustainability - Concept and Terms, Challenges and Opportunities, Population : Impact formula, Malthusian catastrophe, Point of crisis, Neo-Malthusianism, J-curves, S-curves, Carrying capacity Embodied Energy – Concept, Components and Calculations for Building materials, Introduction to Ecological footprint. Life Cycle Analysis **-** Scope, Purpose, Stages; Environmental Management standards, ISO 14000 Series; Carbon Footprint, Carbon-dioxide Contribution from Construction materials; Carbon Cycle; Global Warming –Concept, Greenhouse Gases, Effects, Preventive Measures, Indian Scenario and Projections, Case Studies.						

Module 2	**Green Building construction and materials**	Case study	Data Interpretation/ Analysis	**12 Sessions**

Topics:
Introduction, Construction materials and techniques, Supplementary Cementitious material(No/Low Cement Concrete), Recycled and Manufactured Aggregates, GGBS Concrete, High performance concrete, High volume Fly ash Concrete, Geopolymer Concrete, Green Concrete, Ferro-cement concrete, Case Studies; Role of insulation and thermal properties of construction materials. Influence of moisture content.

Module 3	**Performance Rating of Green Buildings and Indoor Air Quality**	Quiz	Interpretation	**12 Sessions**

Topics:
Introduction to Green Buildings, Role of Quality Control and durability in Green Buildings, Green Building Certifications, LEED (Leadership in Energy and Environmental Design) ,GRIHA and IGBC certifications;
Zero Energy Building –Introduction, Zero Energy Buildings' design and construction, Case Studies.
Indoor Air pollution –Causes, Sources, Consequences and Health Hazards, List of pollutants and their limits, Ventilation –Types; Protocols and Environmental Agreements, Environmental Legislation in India –Air Act and Water Act.
Energy sources: Basic concepts-Conventional and Non-Conventional Energy, Solar ,Wind, Bio-fuel Energy; Case Studies; Life Cycle Energy use, Control of Energy use in Buildings

Targeted Application & Tools that can be used: [Mention here the application area of the contents of the Module and the name of any specialized professionally used tools (Like software, Hard ware, any other form of tool) relevant to the contents of the module.]

Professionally Used Software: MS office, Autodesk Insight 360, Autodesk Revit, and Autodesk FormIt 360**.**

Text Book

T1 Charles J. Kibert, *Sustainable Construction: Green Building Design and Delivery*", Wiley Publication. 2016.
T2 K. S. Jagadeesh, B. V. Venkatarama Reddy & K. S. Nanjunda Rao, *Alternative building material and technology,* New Age International Publishers. 2017.

References

R1 Traci Rose Rider, "Understanding Green Building Guidelines: For Students and Young Professionals", W.W Norton and Company. 2010.
R2 D S Chauhan, S K Sreevastava, "Non-conventional Energy resources", New age international publishers. 2017.

Case study link: https://www.slideshare.net/vinaymandaloju/green-building-case-study-on-teribangalore

E book link R1: https://web.s.ebscohost.com/ehost/detail/detail?vid=3&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#
E book link R1: https://web.s.ebscohost.com/ehost/detail/detail?vid=4&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#

Web Resources: https://nptel.ac.in/courses/105/102/105102195/
IIT Delhi Dr. B. Bhattacharjee
Web Resources: https://onlinecourses.nptel.ac.in/noc19_ce40/preview by Prof. B.Bhattacharjee, IIT Delhi

Topics relevant to "ENTREPRENEURIAL SKILLS": Life Cycle Analysis **-** Scope, Purpose, Stages; Environmental Management standards, ISO 14000 Series for developing **Entrepreneurial Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout**.	
Catalogue prepared by	Ms. Shwetha A / Dr. Venkatesh Raju
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021

Course Code: CIV5004	**Course Title: Energy and Buildings** **Type of Course: Open Elective/ Theory Course**	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	Basic knowledge of sustainability.					
Anti-requisites	NIL					
Course Description	The purpose of the Course is providing an overview of emerging delivery systems for high performance green buildings and the basis on which their sustainability can be evaluated. There are various benefits and advantages of sustainable construction, deals with Cost Reduction, Increased productivity, Improved health, Waste minimization, better use of materials, Environmental protection, Lesser noise pollution, Higher quality of life Emerging market, and Room for experimentation. This is a theory based course which will give an idea of what is sustainable construction and its advantages etc.					
Course Objective	The objective of the course is to familiarize the learners with the concepts of **Energy and Buildings** and attain **Entrepreneurial Skills** through **Participative Learning techniques.**					
Course Out Comes	On successful completion of the course the students shall be able to: 1) Recognize the importance of sustainability and prepare Life Cycle Analysis. 2) Select the Green building materials for construction. 3) Explain the performance rating of green building, the harmful impact of Indoor air pollution and the Life cycle energy use.					
Course Content:						
Module 1	**Introduction to sustainability and life cycle analysis**	Assignment	Data Collection/ Data Analysis			**10 Sessions**
Topics: Sustainability - Concept and Terms, Challenges and Opportunities, Embodied Energy – Concept, Components and Calculations for Building materials, Introduction to Ecological footprint**.** Life Cycle Analysis **-** Scope, Purpose, Stages; Environmental Management standards, ISO 14000 Series; Carbon Footprint, Carbon-dioxide Contribution from Construction materials.						

Module 2	**Green Building construction and materials**	Case study	Data Interpretation/ Analysis	**18 Sessions**
Topics: Introduction to Green Buildings, Energy sources: Basic concepts - Conventional and Non-Conventional Energy, Solar, Wind, Bio-fuel Energy; Green building techniques. Sustainable Materials: Supplementary Cementitious Materials (No/Low Cement Concrete), Recycled and Manufactured Aggregates, GGBS Concrete, High performance concrete, High volume Fly ash Concrete, Geopolymer Concrete, Green Concrete, Ferro-cement, etc., Case Studies.				
Module 3	**Performance Rating of Green Buildings and Indoor Air Quality**	Quiz	Interpretation	**15 Sessions**
Topics: Introduction, Role of Quality Control and durability in Green Buildings, Green Building Certifications, LEED (Leadership in Energy and Environmental Design) ,GRIHA and IGBC certifications; Zero Energy Building –Introduction, design and construction, Case Studies. Indoor Air Quality, Indoor Air pollution –Causes, Sources , Consequences and Health Hazards, List of pollutants and their limits, Ventilation –Types; Control of Energy use in Buildings-Role of insulation, thermal properties of construction materials. Influence of moisture content and modeling.				
Targeted Application & Tools that can be used: Professionally Used Software: MS office, Autodesk Insight 360, Autodesk Revit, and Autodesk FormIt 360**.**				
Text Book T1 Charles J. Kibert, *Sustainable Construction: Green Building Design and Delivery*", Wiley Publication. 2016. T2 K. S. Jagadeesh, B. V. Venkatarama Reddy & K. S. Nanjunda Rao, *Alternative building material and technology,* New Age International Publishers. 2017.				
References R1 Traci Rose Rider, "Understanding Green Building Guidelines: For Students and Young Professionals", W.W Norton and Company. 2010. R2 D S Chauhan, S K Sreevastava, "Non-conventional Energy resources", New age international publishers. 2017. Web Resources: https://nptel.ac.in/courses/105/102/105102195/ Web Resources: https://onlinecourses.nptel.ac.in/noc19_ce40/preview E book link R1: https://web.s.ebscohost.com/ehost/detail/detail?vid=3&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d# E book link R1: https://web.s.ebscohost.com/ehost/detail/detail?vid=4&sid=cbc51846-7bf7-482b-8aac-fbd99ab97ee4%40redis&bdata=JnNpdGU9ZWhvc3QtbGl2ZQ%3d%3d#				
Topics relevant to development of " Entrepreneurial Skills ": Regulatory bodies: GBC (Indian Green Building Council), United States Green Building Council (USGBC), TERI (The Energy and Resources Institute), Construction Site visits for developing **Entrepreneurial Skills** through **Participative Learning techniques. This is attained through assessment component mentioned in course handout.**				
Catalogue prepared by	Ms. Shwetha A / Dr. Venkatesh Raju / Dr. Jagdish Godihal			
Recommended by the Board of Studies on	BoS No. 14 held on 30 July 2022			

Date of Approval by the Academic Council	Academic Council Meeting No. 18 held on 03 August 2022

Course Code: RES5001	**Course Title: Research Methodology** **Type of Course:** Open Elective and Theory only	**L-T-P-C**	3	0	0	3
Version No.	1.1					
Course Pre-requisites	NIL					
Anti-requisites	NIL					
Course Description	The course will impart the capability to select suitable research type, to design research question and to devise the research design. The aspirants will be fortified to construct own research process, to identify source and collect the data relevant to the research question. This course prepares the candidate to demonstrate the abilities to review the literature, to document and to publish without plagiarism. Participants will be enabled to sketch requirement of tools for creative research, to analyse the data using optimization techniques, and to exhibit and summarize the findings. The course also aims for the competencies needed to evaluate the results, to infer scientific truth and generate models using modern software.					
Course Objectives	The objective of the course is to familiarize the learners with the concepts of **Research Methodology** and attain **Skill Development** through **Problem Solving** methodologies.					
Course Out Comes	On successful completion of the course the students shall be able to: 1. Apply the knowledge of review of literature in research problem definition 2. Analyse the methodology referring to hypothesis, strategies and approach of research 3. Develop the key the rationale for research ethics, plagiarism.					
Course Content:						
Module 1	Introduction to research methodology	Assignment	Data Collection/ Programming	**12 Sessions**		
Topics: Philosophy and approach to research, Research Process overview and framing research problems. Literature survey in research: Resources for information and literature, Critical review of available literature.						

Module 2	Research Hypotheses, Approach and Strategies	Case Study	Programming	**16 Sessions**
Topics: Hypothesis: meaning, nature, kinds, importance, Variables, formulating etc. Approach: background, qualitative and quantitative, mixed etc. Strategies: Selection, case studies, experiments, action etc. Research documentation and presentation: Scientific writing and report writing, Tables and illustrations, Concept of a research proposal, Seminar presentation, research paper writing, cite and list literature in documents.				
Module 3	Data, Ethics, Plagiarism	Minor projects	Data Collection/ Analysis/ Smart solutions	**12 Sessions**
Topics: Data Collection Methods, Interpretation, sampling methods, Ethics in research, Importance of ethics in research, plagiarism, originality in research, conflict of interest.				
Targeted Application & Tools that can be used: Application areas: Decision Support for systems problem definition, Research Hypotheses, Approach and Strategies **Professionally used software/Platform**: SAS / R / SPSS				
Text Books T1. "Research Methodology: Methods and Techniques", Kothari, C.R., 1990. New Age International. T2. Introducing Research Methodology: A Beginner's Guide to Doing a Research Project by Uwe Flick Second Edition, e-book				
References "How to Write and Publish a Scientific Paper", Day, R.A. Cambridge University Press, 1992. **Additional web-based resources** Swayam course https://www.classcentral.com/course/swayam-introduction-to-research-5221/course/swayam-introduction-to-research-5221 (Web) https://swayam.gov.in/nd1_noc20_ge22/preview. https://presiuniv.knimbus.com/user#/viewDetail?searchResultType=ECATALOGUE_BASED&unique_id=SPRINGER_OPEN_1_06082022_1083 https://search.ebscohost.com/login.aspx?direct=true&db=e000xww&AN=503632&site=ehost-live				
Topics relevant to "Skill Development": Research Hypotheses, Approach and Strategies, Data, Ethics, Plagiarism for **Skill Development** through **Problem Solving methodologies. This is attained through assessment component mentioned in course handout.**				
Catalogue prepared by	Prof. Jagdish H Godihal			
Recommended by the Board of Studies on	BoS No. 12 held on 07 August 2021			
Date of Approval by the Academic Council	Academic Council Meeting No. 16 held on 23 October 2021			