



## **SCHOOL OF CIVIL ENGINEERING**

### **HANDBOOK**

### **M. Tech. in Construction Technology and Management**

**2022-24**

**Rukmini Knowledge Park,**

**Rukmini Educational  
Charitable Trust**

**Kattigenahalli, Yelahanka, Bangalore - 560 064**

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## Chancellor's Message

“Education is the most powerful weapon which you can use to change the world.”

- Nelson Mandela.

There was a time when survival depended on just the realization of physiological needs. We are indeed privileged to exist in a time when ‘intellectual gratification’ has become indispensable. Information is easily attainable for the soul that is curious enough to go look for it. Technological boons enable information availability anywhere anytime. The difference, however, lies between those who look for information and those who look for knowledge. It is deemed virtuous to serve seekers of knowledge and as educators it is in the ethos at REVA University to empower every learner who chooses to enter our portals. Driven by our founding philosophy of ‘Knowledge is power’, we believe in building a community of perpetual learners by enabling them to look beyond their abilities and achieve what they assumed impossible. India has always been beheld as a brewing pot of unbelievable talent, acute intellect and immense potential. All it takes to turn those qualities into power is a spark of opportunity. Being at a University is an exciting and rewarding experience with opportunities to nurture abilities, challenge cognizance and gain competence.



For any University, the structure of excellence lies in the transitional abilities of its faculty and its facility. I'm always in awe of the efforts that our academic board puts in to develop the team of subject matter experts at REVA. My faculty colleagues understand our core vision of empowering our future generation to be ethically, morally and intellectually elite. They practice the art of teaching with a student-centric and transformational approach. The excellent infrastructure at the University, both educational and extra-curricular, magnificently demonstrates the importance of ambience in facilitating focused learning for our students.

A famous British politician and author from the 19th century - Benjamin Disraeli, once said ‘A University should be a place of light, of liberty and of learning’. Centuries later this dictum still inspires me and I believe, it takes team-work to build successful institutions. I welcome you to REVA University to join hands in laying the foundation of your future with values, wisdom and knowledge.

**Dr. P. Shyama Raju**  
**The Founder and Hon'ble Chancellor**  
**REVA University**

## Vice-Chancellor's Message

The last two decades have seen a remarkable growth in higher education in India and across the globe. The move towards interdisciplinary studies and interactive learning have opened up several options as well as created multiple challenges. India is at a juncture where a huge population of young crowd is opting for higher education. With the tremendous growth of privatization of education in India, the major focus is on creating a platform for quality in knowledge enhancement and bridging the gap between academia and industry.



A strong believer and practitioner of the dictum “Knowledge is Power”, REVA University has been on the path of delivering quality education by developing the young human resources on the foundation of ethical and moral values, while boosting their leadership qualities, research culture and innovative skills. Built on a sprawling 45 acres of green campus, this ‘temple of learning’ has excellent and state-of-the-art infrastructure facilities conducive to higher teaching-learning environment and research. The main objective of the University is to provide higher education of global standards and hence, all the programs are designed to meet international standards. Highly experienced and qualified faculty members, continuously engaged in the maintenance and enhancement of student-centric learning environment through innovative pedagogy, form the backbone of the University.

All the programs offered by REVA University follow the Choice Based Credit System (CBCS) with Outcome Based Approach. The flexibility in the curriculum has been designed with industry-specific goals in mind and the educator enjoys complete freedom to appropriate the syllabus by incorporating the latest knowledge and stimulating the creative minds of the students. Bench marked with the course of studies of various institutions of repute, our curriculum is extremely contemporary and is a culmination of efforts of great think-tanks - a large number of faculty members, experts from industries and research level organizations. The evaluation mechanism employs continuous assessment with grade point averages. We believe sincerely that it will meet the aspirations of all stakeholders – students, parents and the employers of the graduates and postgraduates of Reva University.

At REVA University, research, consultancy and innovation are regarded as our pillars of success. Most of the faculty members of the University are involved in research by attracting funded projects from various research level organizations like DST, VGST, DBT, DRDO, AICTE and industries. The outcome of the

research is passed on to students through live projects from industries. The entrepreneurial zeal of the students is encouraged and nurtured through EDPs and EACs.

REVA University has entered into collaboration with many prominent industries to bridge the gap between industry and University. Regular visits to industries and mandatory internship with industries have helped our students become skilled with relevant to industry requirements. Structured training programs on soft-skills and preparatory training for competitive exams are offered here to make students more employable. 100% placement of eligible students speaks the effectiveness of these programs. The entrepreneurship development activities and establishment of “Technology Incubation Centers” in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

With firm faith in the saying, “Intelligence plus character –that is the goal of education” (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We reiterate our endeavor to provide premium quality education accessible to all and an environment for the growth of over-all personality development leading to generating “GLOBAL PROFESSIONALS”.

Welcome to the portals of REVA University!

**Dr. M. Dhanamjaya**

Vice-Chancellor, REVA University

## Director's Message

M. Tech in Construction Technology and Management is designed keeping in view future developments, both at national and global levels.

Construction technology and management are interlinked with each other. A construction engineer knows everything what that can be helpful build plans and to reshape an existing design. Construction industry has developed very much and has great importance in every society. A construction engineer does all efforts and use creative mind to build an architect. With the help of project management software and mobile technology, an engineer uses his personal experience and knowledge to plan. Technology is playing an important role in delivering quality service to the consumer according to his/ her expectations level. *If someone is interested but have no clear vision what to do and what not do than he/ she should get help from construction technology and management course to get confidence and practical to get opportunities and chances to design something.*



Designing, planning, construction, and management of infrastructures shows the actual potential of a construction engineer. Doing practice on infrastructures such as highways, bridges, airports, railroads, buildings, dams, and utilities shows the worth and creative approach of an expert engineer. People can help for any type of ideas before constructing their homes and other type of architectures. Project manager uses 3D and 4D software to build architectures and houses for the people. Construction Costs Analysis helps a professional to make plans on behalf of available resources and delay the less important items to accomplish tasks early. The construction industry is experiencing technological revolution to make unique and creative plans. Taking more and more interest by the new generations means creating much opportunities and potentials for newbies. People should take admissions to learn to constrictions related courses and professional degrees to become professionals and best engineers

The benefits of choosing this **Programme** are:

Flexibility to choose various fields upon post-graduation.

Opportunity to work on live problems.

Opportunity to work on latest technologies.

Opportunity for designers & planner to plan & design live projects.

I am sure the students choosing M Tech in Construction Technology and Management in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teacher's involvement and guidance. We will strive to provide all needed comfort and congenial environment for their studies. I wish all students pleasant stay in REVA and grand success in their career.

**Dr. Y. Ramalinga Reddy**  
**Director**  
**School of Civil Engineering**

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## **RUKMINI EDUCATIONAL CHARITABLE TRUST**

It was the dream of late Smt. Rukmini Shyama Raju to impart education to millions of underprivileged children as she knew the importance of education in the contemporary society. The dream of Smt. Rukmini Shyama Raju came true with the establishment of Rukmini Educational Charitable Trust (RECT), in the year 2002. Rukmini Educational Charitable Trust (RECT) is a Public Charitable Trust, set up in 2002 with the objective of promoting, establishing and conducting academic activities in the fields of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology, among others. In furtherance of these objectives, the Trust has set up the REVA Group of Educational Institutions comprising of REVA Institute of Technology & Management (RITM), REVA Institute of Science and Management (RISM), REVA Institute of Management Studies (RIMS), REVA Institute of Education (RIE), REVA First Grade College (RFGC), REVA Independent PU College at Kattigenahalli, Ganganagar and Sanjaynagar and now REVA University. Through these institutions, the Trust seeks to fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

Every great human enterprise is powered by the vision of one or more extraordinary individuals and is sustained by the people who derive their motivation from the founders. The Chairman of the Trust is Dr. P. Shyama Raju, a developer and builder of repute, a captain of the industry in his own right and the Chairman and Managing Director of the DivyaSree Group of companies. The idea of creating these top notched educational institutions was born of the philanthropic instincts of Dr. P. Shyama Raju to do public good, quite in keeping with his support to other socially relevant charities such as maintaining the Richmond Road Park, building and donating a police station, gifting assets to organizations providing accident and trauma care, to name a few.

The Rukmini Educational Charitable Trust drives with the main aim to help students who are in pursuit of quality education for life. REVA is today a family of ten institutions providing education from PU to Post Graduation and Research leading to PhD degrees. REVA has well qualified experienced teaching faculty of whom majority are doctorates. The faculty is supported by committed administrative and technical staff. Over 13,000 students study various courses across REVA's three campuses equipped with exemplary state-of-the-art infrastructure and conducive environment for the knowledge driven community.

## ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 27th February, 2013. The University is empowered by UGC to award degrees any branch of knowledge under Sec.22 of the UGC Act. The University is a Member of Association of Indian Universities, New Delhi. The main objective of the University is to prepare students with knowledge, wisdom and patriotism to face the global challenges and become the top leaders of the country and the globe in different fields.

REVA University located in between Kempegowda International Airport and Bangalore city, has a sprawling green campus spread over 45 acres of land and equipped with state-of-the-art infrastructure that provide conducive environment for higher learning and research. The REVA campus has well equipped laboratories, custom-built teaching facilities, fully air-conditioned library and central computer center, the well-planned sports facility with cricket ground, running track & variety of indoor and outdoor sports activities, facilities for cultural programs. The unique feature of REVA campus is the largest residential facility for students, faculty members and supportive staff.

REVA consistently ranked as one of the top universities in various categories because of the diverse community of international students and its teaching excellence in both theoretical and technical education in the fields of Engineering, Management, Law, Science, Commerce, Arts, Performing Arts, and Research Studies. REVA offers 28 Undergraduate **Programmes**, 22 Full-time and 2 Part-time Postgraduate **Programmes**, 18 Ph.D. **Programmes**, and other Certificate/ Diploma/Postgraduate Diploma **Programmes** in various disciplines.

The curriculum of each **Programme** is designed with a keen eye for detail by giving emphasis on hands-on training, industry relevance, social significance, and practical applications. The University offers world-class facilities and education that meets global standards.

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.



REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake

Innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various

Funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Sensor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nano Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much-required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor & Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

The University also has University-Industry Interaction and Skill Development Centre headed by a Senior Professor & Director facilitating skill related training to REVA students and other unemployed students. The University has been recognized as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal Vikas Yojana. The Centre conducts several add-on courses in challenging areas of development. It is always active in facilitating student's variety of Skill Development Training programs.

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Oklahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC2, VMware, SAP, Apollo etc., to facilitate student exchange and teacher-scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitate students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

The University has also given greater importance to quality in education, research, administration and all activities of the university. Therefore, it has established an independent Internal Quality division headed by a senior professor as Dean of Internal Quality. The division works on planning, designing and developing different quality tools, implementing them and monitoring the implementation of these quality tools. It concentrates on training entire faculty to adopt the new tools and implement their use. The division further works on introducing various examination and administrative reforms.

To motivate the youth and transform them to become innovative entrepreneurs, successful leaders of tomorrow and committed citizens of the country, REVA organizes interaction between students and successful industrialists, entrepreneurs, scientists and such others from time to time. As a part of this exercise great personalities such as Bharat Ratna Prof. C. N. R. Rao, a renowned Scientist, Dr. N R Narayana Murthy, Founder and Chairman and Mentor of Infosys, Dr. K Kasturirangan, Former Chairman ISRO, Member of

Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the

Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organizes various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is Shubha Vidaaya, - Graduation Day for the final year students of all the programs, wherein, the outgoing students are felicitated and are addressed by eminent personalities to take their future career in a right spirit, to be the good citizens and dedicate themselves to serve the society and make a mark in their respective spheres of activities. During this occasion, the students who have achieved top ranks and won medals and prizes in academic, cultural and sports activities are also recognized by distributing awards and prizes. The founders have also instituted medals and prizes for sports achievers every year. The physical education department conducts regular yoga class's every day to students, faculty members, administrative staff and their family members and organizes yoga camps for villagers around.

## **Vision**

REVA University aspires to become an innovative university by developing excellent human resources with leadership qualities, ethical and moral values, research culture and innovative skills through higher education of global standards.

### **Mission**

To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers

To provide student-centric learning environment through innovative pedagogy and education reforms

To encourage research and entrepreneurship through collaborations and extension activities

To promote industry-institute partnerships and share knowledge for innovation and development

To organize society development programs for knowledge enhancement in thrust areas

To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

### **Objectives**

Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines

Smooth transition from teacher - centric focus to learner - centric processes and activities

Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position

Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation

Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

## ABOUT SCHOOL OF CIVIL ENGINEERING

The School of Civil Engineering is headed by highly experienced Professor and is supported by well qualified faculty members. The school has the state-of-art class rooms and well-equipped laboratories. It offers B.Tech and M.Tech programs in various specialized streams. The school also has research program leading to doctoral degree. The curriculum of both graduate and post graduate degree programs has been designed to bridge the gap between industry – academia and hence they are industry application oriented. The B.Tech program aims to prepare human resources to play a leading role in the competitive construction field and excel in their endeavors. The Master's Degree programs focus on research and design in the core and Computer Aided Structural Engineering, Construction Technology and Management & Transportation Engineering & Management to supplement and create a sustainable world and to enhance the global quality of life by adopting enhanced techniques of design and application. This is reflected in various core subjects offered within the program. Currently Civil Engineering teaching was limited to planning, analysis, design and execution of different types of infrastructure like buildings, roads, bridges, dams and power plants. However, due to increase of technological sophistication and demand for higher living standards geared up by economic growth and concerns about environmental impact have changed the scope of Civil Engineering. The challenges of today's Civil Engineering infrastructure are much more complex and interdependencies between resources.

Even though there are a large number of institutions in the country which are producing Civil Engineers, there is acute shortage of quality Civil Engineers. The REVA UNIVERSITY would like to offer Civil Engineering **Programme** to produce quality engineers who are effective and efficient in problem solving and providing economical and sustainable infrastructural solutions.

### VISION

“To produce young Engineers of caliber, who would be committed to their profession with ethics, will be able to contribute to Civil Engineering and allied fields in optimizing usage of resources globally making the world eco-friendlier to live in.”

### MISSION

To make the Department centre of excellence for training the undergraduate students.

To promote involvement of staff and students in research and advanced training.

To develop good understanding skills in student communities about Civil Engineering, ethical practices, automation design and society need centric teaching and learning and imparting value addition skills.

## BOARD OF STUDIES COMMITTEE

<b>BOS MEMBERS LIST FOR M TECH CONSTRUCTION TECHNOLOGY AND MANAGEMENT</b>			
Sl. No.	Name, Designation & Affiliation	Status	Correspondence Address
1	Dr. Y. Ramalinga Reddy Director, School of Civil Engineering, REVA University	Chairperson	Rukmini Knowledge Park, REVA University, Yelahanka, Bengaluru-560064 (M): 9448508996 Email: ramalingareddy@reva.edu.in
2	Dr. V. Ramachandra Zonal Head, Technical Services, Ultra Tech Cement Ltd.,	Member	Zonal Head, Technical Services, Ultra Tech Cement Ltd., Industry House, 6th floor, #45, Race Course Road, Bangalore 560 001, (M)97432-47985 Email: ramachandra.v@adityabirla.com
3	Dr. G. Anand Director, APT Consulting Engineering Service,	Member	No. 55/2, 3rd floor, East Park Road, Malleshwaram, Bangalore- 560055 (M): 9845128153 Email: gananda36@gmail.com
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5	Dr. R.V. Ranganath Professor, Department of Civil Engineering, BMS College of Engineering	Member	Professor, Dept. of Civil Engineering, BMS College of Engineering, Bull Temple Road, Bangalore-560 019 (M) 98450-86602 Email: rangarv@yahoo.com
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**BOS MEMBERS LIST FOR M TECH CONSTRUCTION TECHNOLOGY  
AND MANAGEMENT**

Sl. No.	Name, Designation & Affiliation	Status	Correspondence Address
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11	Dr. Seelam Srikanth Reddy Assistant Professor, REVA University	Member (Internal)	School of Civil Engineering, Rukmini Knowledge Park, REVA University, Yelahanka, Bengaluru-560064 (M): 9491303992 Email: srikanths.reddy@reva.edu.in
12	Dr. Kannam Praveen Associate Professor, REVA University	Member (Internal)	School of Civil Engineering, Rukmini Knowledge Park, REVA University, Yelahanka, Bengaluru-560064 (M): 9885351461 Email: kannam.praveen@reva.edu.in
13	Harsha Student, REVA University	Current Student	Rukmini Knowledge Park, REVA University, Yelahanka, Bengaluru-560064

## Program Overview

Designing, planning, construction, and management of infrastructures shows the actual potential of a construction engineer. Without using all these 4 rules not one can get satisfactory response and results as per expectations. Doing practice on infrastructures such as highways, bridges, airports, railroads, buildings, dams, and utilities shows the worth and creative approach of an expert engineer. People can help for any type of ideas before constructing their homes and other type of architectures. Project manager uses 3D and 4D software to build architectures and houses for the people. Construction Costs Analysis helps a professional to make plans on behalf of available resources and delay the less important items to accomplish tasks early. The construction industry is experiencing technological revolution to make unique and creative plans. Taking more and more interest by the new generations means creating much opportunities and potentials for newbies. People should take admissions to learn to constructions related courses and professional degrees to become professionals and best engineers.

Instant Access to Learn and to Seek New Trends & Technological Revolutions in Constructions. Internet can help in great sense to learn and to get awareness from latest technology trends in construction and to adopt new standards of teaching to get qualifications and support from professionals. Online education can help students to get instant access to find all useful resources and professional support to seek latest trends and modern style of education to build unique constructions and to improve current standards. Show your interest and find the best and authentic source of knowledge from you can get knowledge and support to become a perfect construction engineer.

## Program Educational Objectives (PEO's)

The **Programme** educational objectives of the Construction Technology and Management of REVA University is to prepare graduates

- PEO-1 To have successful professional careers in industry, government, academia and military as innovative engineers.
- PEO-2 To Plan, design, construct, operate and maintain safe, cost effective and sustainable construction systems in the context of environmental, economic and social requirements.
- PEO-3 To continue to learn and advance their careers through activities such as research and development, acquiring doctoral degree, participation in national level research **Programmes**, teaching and research at university level etc.,
- PEO-4 To be active members ready to serve the society locally and internationally, may take up entrepreneurship for the growth of economy and to generate employment; and adopt the philosophy of lifelong learning to be aligned with economic and technological development.

## Program Outcomes (POs)

After successful completion of the **Programme**, the graduates shall be able to

PO1. Demonstrate in-depth knowledge of specific discipline or professional area, including wider and global perspective, with an ability to discriminate, evaluate, analyse and synthesize existing and new knowledge, and integration of the same for enhancement of knowledge.

PO2. Analyze complex engineering problems critically, apply independent judgment for synthesizing information to make intellectual and/or creative advances for conducting research in a wider theoretical, practical and policy context.

PO3. Think laterally and originally, conceptualize and solve engineering problems, evaluate a wide range of potential solutions for those problems and arrive at feasible, optimal solutions after considering public health and safety, cultural, societal and environmental factors in the core areas of expertise.

PO4. Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyse and interpret data, demonstrate higher order skill and view things in a broader perspective, contribute individually/in group(s) to the development of scientific/technological knowledge in one or more domains of engineering.

PO5. Create, select, learn and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modelling, to complex engineering activities with an understanding of the limitations.

PO6. Possess knowledge and understanding of group dynamics, recognize opportunities and contribute positively to collaborative-multidisciplinary scientific research, demonstrate a capacity for self-management and teamwork, decision-making based on open-mindedness, objectivity and rational analysis in order to achieve common goals and further the learning of themselves as well as others.

PO7. Demonstrate knowledge and understanding of engineering and management principles and apply the same to one's own work, as a member and leader in a team, manage projects efficiently in respective disciplines and multidisciplinary environments after consideration of economic and financial factors.

PO8. Communicate with the engineering community, and with society at large, regarding complex engineering activities confidently and effectively, such as, being able to comprehend and write effective reports and design documentation by adhering to appropriate standards, make effective presentations, and give and receive clear instructions.

PO9: Recognize the need for, and have the preparation and ability to engage in life-long learning independently, with a high level of enthusiasm and commitment to improve knowledge and competence continuously.

PO10. Acquire professional and intellectual integrity, professional code of conduct, ethics of research and scholarship, consideration of the impact of research outcomes on professional practices and an understanding of responsibility to contribute to the community for sustainable development of society.

PO11. Observe and examine critically the outcomes of one's actions and make corrective measures subsequently, and learn from mistakes without depending on external feedback (SELF learning)



## **Programme Specific Outcomes (PSO's)**

After successful completion of the **Programme**, the graduates shall be able to

An ability to plan, analyse, design, synthesize, execute, and manage complicated infrastructure projects within local and global context in a sustainable manner.

Implant the capacity to apply the concepts of Artificial intelligence, IoT, Advanced data modeling techniques, etc. in the design, development and implementation of application-oriented engineering systems

Review scholarly work by referring journals, define a new problem, design, model, analyse and evaluate the solution and report as a dissertation in the area of construction technology and management.

GA1: Scholarship of knowledge

GA2: Critical thinking

GA3: Problem solving

GA4: Research skill

GA5: Usage of modern tools

GA6: Collaborative and multidisciplinary work

GA7: Project management and finance

GA8: Communication

GA9: Lifelong learning

GA10: Ethical practices and social responsibility

GA11: Independent and reflective learning.

## **Regulations – M Tech. Degree Program Academic Year 2022-24 Batch**

(Framed as per the provisions under Section 35 (ii), Section 7 (x) and Section 8 (xvi) & (xxi) of the REVA University Act, 2012)

### **1. Title and Commencement:**

1.1 These Regulations shall be called “**REVA University Academic Regulations – M Tech. Degree Program 2022-24 Batch subject to amendments from time to time by the Academic Council on recommendation of respective Board of Studies and approval of Board of Management**”

1.2 These Regulations shall come into force from the date of assent of the Chancellor.

### **2. The Programs:**

These regulations cover the following M Tech., Degree programs of REVA University offered during 2022-24

#### **M Tech (Full Time) in:**

Artificial Intelligence  
Computer Science and Engineering  
Computer Aided Structural Engineering  
Construction Technology & Management  
Digital Communication and Networking  
Machine Design  
Power Energy & Systems  
Transportation Engineering and Management  
VLSI and Embedded Systems

#### **Also**

#### **M Tech (Part Time) in:**

Computer Science and Engineering  
VLSI and Embedded Systems

### **3. Duration and Medium of Instructions:**

3.1 **Duration:** The duration of the M Tech degree program shall be **TWO years** comprising of **FOUR** Semesters. A candidate can avail a maximum of 8 semesters - 4 years as per double duration norm, in one stretch to complete M Tech degree. The duration for part time students is **THREE years** and a maximum of 6

years they are required to complete the program.

3.2 The medium of instruction shall be English.

#### 4. Definitions:

**4.1 Course: “Course” means a subject, either theory or practical or both, listed under a Programme;**

Example: “Finite Element Method of Analysis” in M Tech Civil Engineering program, “Advanced Theory of Vibration” in M Tech., Mechanical program are examples of courses to be studied under respective programs.

Every course offered will have three components associated with the teaching-learning process of the course, namely:

<b>L</b>	<b>Lecture</b>
<b>T</b>	<b>Tutorial</b>
<b>P</b>	<b>Practice</b>

Where:

**L** stands for **Lecture** session consisting of classroom instruction.

**T** stands for **Tutorial** session consisting participatory discussion / self-study/ desk work/ brief seminar presentations by students and such other novel methods that make a student to absorb and assimilate more effectively the contents delivered in the Lecture classes.

**P** stands for **Practice** session and it consists of Hands-on Experience / Laboratory Experiments / Field Studies / Case Studies / Project Based Learning or Course end Project/Self Study/ Online courses from listed portals that equip students to acquire the much-required skill component.

#### 4.2 Classification of Courses

**Courses offered are classified as: Core Courses, Open Elective Courses, Project work/Dissertation**

4.2.1 **Core Course:** A course which should compulsorily be studied by a candidate choosing a particular program of study

4.2.2 **Foundation Course:** The foundation Course is a mandatory course which should be completed successfully as a part of graduate degree program irrespective of the program of study

4.2.3 **Hard Core Course (HC) simply core course:** The **Hard-Core Course** is a Core Course in the main branch of study and related branch(es) of study, if any, that the candidates have to complete compulsorily

4.2.4 **Soft Core Course (SC) (also known as Professional Elective Course)**

A Core course may be a **Soft Core** if there is a choice or an option for the candidate to choose a course from a pool of courses from the main branch of study or from a sister/related branch of study which supports the main branch of study

#### 4.2.5 **Open Elective Course (OE):**

An elective course chosen generally from other discipline / subject, with an intention to seek exposure to the basics of subjects other than the main discipline the student is studying is called an **Open Elective Course**

#### 4.2.6 **Project Work / Dissertation:**

Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real-life situation / difficult problem to solve a multivariable or complex engineering problems.

### 5. **Eligibility for Admission:**

5.1. The eligibility criteria for admission to M Tech Program (Full Time) of 2 years (4 Semesters) and (Part Time) of 3 years (6 Semesters) are given below:

Sl. No.	Program	Duration	Eligibility
1	Masters of Technology (M Tech) in Artificial Intelligence	4 Semesters (2 years)	B E / B.Tech. in CSE / ISE / TE / MCA / M. Sc. in Computer Science or Mathematics or Information Science or Information Technology with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
2	M Tech in Computer Science and Engineering	<b>Full Time</b> – 4 Semesters (2 years)	B E / B.Tech. in ECE / IT / EEE / CSE / ISE / TE / MCA / M.Sc. in Computer Science or Mathematics or Information Science or Information Technology with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
		<b>Part Time</b> – 6 Semesters (3 years)	
3	M Tech in Computer Aided Structural Engineering  Construction Technology & Management  Transportation Engineering and Management	4 Semesters (2 years)	BE/ B.Tech. in Civil Engineering with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.

Sl. No.	Program	Duration	Eligibility
4	M Tech in Power Energy & Systems	4 Semesters (2 years)	BE/ B.Tech. in EE/ EEE/ ECE/ CSE/ MS / M.Sc. in Mathematics/Physics/Electronics / Information Technology or Information Science with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.
5	M Tech in Digital Communication and Networking Machine Design	4 Semesters (2 years)	B E / B.Tech. in ECE /TE / EEE / CSE / ISE / Instrumentation Technology / Medical Electronics/M Sc in Electronics with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University/Institution or AMIE or any other qualification recognized as equivalent there to.
6	M Tech in VLSI and Embedded Systems	<b>Full Time</b> – 4 Semesters (2 years)	B E / B.Tech. in ECE /TE / EEE / CSE / ISE / Instrumentation Technology / Medical Electronics/M Sc in Electronics with a minimum of 50% (45% in case of SC/ST) marks in aggregate of any recognized University/Institution or AMIE or any other qualification recognized as equivalent there to.
		<b>Part Time</b> – 6 Semesters (3 years)	
7	M Tech in Machine Design	4 Semesters (2 years)	BE / B.Tech. in Mechanical/Aeronautical / Automobile / Industrial Production Engineering with a minimum of 50% (45% in case of candidate belonging to SC/ST category) marks in aggregate, of any recognized University / Institution or AMIE or any other qualification recognized as equivalent there to.

5.2 Provided further that the eligibility criteria are subject to revision by the Government Statutory Bodies, such as AICTE, UGC from time to time.

## 6. Courses of Study and Credits

6.1 Each course of study is assigned with certain credit value

6.2 Each semester is for a total duration of 20 weeks out of which 16 weeks dedicated for teaching and learning and the remaining 4 weeks for final examination, evaluation and announcement of results

6.3 The credit hours defined as below

In terms of credits, every one-hour session of L amounts to 1 credit per Semester and a minimum of two-hour session of T or P amounts to 1 credit per Semester or a three-hour session of T / P amounts to 2 credits over a period of one Semester of 16 weeks for teaching-learning process.

1 credit = 13 credit hours spread over 16 weeks or spread over the semester

**The total duration of a semester is 20 weeks inclusive of semester-end examination.**

The following table describes credit pattern

<b>Lectures (L)</b>	<b>Tutorials (T)</b>	<b>Practice (P)</b>	<b>Credits (L:T:P)</b>	<b>Total Credits</b>	<b>Total Contact Hour</b>
4	2	0	4:1:0	5	6
3	2	0	3:1:0	4	5
3	0	2	3:0:1	4	5
2	2	2	2:1:1	4	6
0	0	6	0:0:3	3	6
4	0	0	4:0:0	4	4
2	0	0	2:0:0	2	2

- a. The concerned BoS will choose the convenient Credit Pattern for every course based on size and nature of the course

**7. Different Courses of Study:**

Different **Courses of Study** are labeled as follows:

- a. Core Course (CC)
- b. Foundation Course (FC)
- c. Hard Core Course (HC)
- d. Soft Core Course (SC)
- e. Open Elective Course (OE)
- f. Minor Project
- g. Major Project / Dissertation

**The credits for minor projects, major project/Dissertation will be decided by the respective Schools.**

**8. Credit and Credit Distributions:**

- 8.1** A candidate has to earn 72 credits for successful completion of M Tech degree with a distribution of credits for different courses as prescribed by the University.
- 8.2** A candidate can enroll for a maximum of 24 credits per Semester. However, s/he may not successfully earn a maximum of 24 credits per semester. This maximum of 24 credits does not include the credits of courses carried forward by a candidate.
- 8.3** **Only such full-time candidates who register for a minimum prescribed number of credits in each semester from I semester to IV semester and complete successfully 72 credits in 4 successive**

semesters shall be considered for declaration of Ranks, Medals, Prizes and are eligible to apply for Student Fellowship, Scholarship, Free ships, and such other rewards / advantages which could be applicable for all full-time students and for hostel facilities.

**9. Assessment and Evaluation**

9.1 The assessment and evaluation process happen in a continuous mode. However, for reporting purpose, a Semester is divided into 3 components as IA1, IA2 and SEE. The performance of a candidate in a course will be assessed for a maximum of 100 marks as explained below.

**(i) Component IA1:**

The first Component (IA1), of assessment is for 25 marks. This will be based on test, assignment / seminar. During the first half of the semester (i.e., by 8th week), the first 50% of the syllabus (Unit 1&2) will be completed. This shall be consolidated during the first three days of 8th week of the semester. A review test based on IA1 will be conducted and completed in the beginning of the 9th week. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed in the beginning of the 9th week. The academic sessions will continue for IA2 immediately after completion of process of IA1.

**The finer split - up for the award of marks in IA1 is as follows:**

Assignment & Seminars.....	10 marks for the first 20% of the syllabus
Test (Mid-Term) .....	15 marks for the first 30% of the syllabus
Total .....	25 marks

**(ii) Component IA2:**

**The second component (IA2), of assessment is for 25 marks.** This will be based on test, assignment /seminar. The continuous assessment and scores of second half of the semester (9th to 16th week) will be consolidated during 16th week of the semester. During the second half of the semester the remaining units in the course will be completed. A review test based on IA2 will be conducted and completed during 16th week of the semester. In case of courses where test cannot be conducted, the form of assessment will be decided by the concerned school and such formalities of assessment will be completed during 16th week.

The 17th week will be for revision of syllabus and preparation for the semester – end examination.

**The finer split - up for the award of marks in IA2 is as follows:**

Assignment/Seminar.....	10 marks for the second 20% of the syllabus
Review Test (Mid-Term) .....	15 marks for the second 30% of the syllabus

Total .....25 marks

**(iii) Component SEE:**

The Semester End Examination of 3 hours duration for each course shall be conducted during the 18th & 19th week. **This forms the third / final component of assessment (SEE) and the maximum marks for the final component will be 50.**

9.2 The schedule of continuous assessment and examinations are summarized in the following Table below.

Component	Period	Syllabus	Weightage	Activity
IA1	1 <sup>st</sup> Week to 8 <sup>th</sup> Week	First 50% (Two units)	25%	Instructional process and Continuous Assessment
	Last 3 days of 8 <sup>th</sup> Week			Consolidation of IA1
IA2	9 <sup>th</sup> week to 16 <sup>th</sup> week	Second 50% (remaining two units)	25%	Instructional process and Continuous Assessment
	Last 3 days of 16 <sup>th</sup> week			Consolidation of IA2
SEE	17 <sup>th</sup> and 18 <sup>th</sup> week	Entire syllabus	50%	Revision and preparation for Semester end examination
	19 <sup>th</sup> week to 20 <sup>th</sup> week			Conduct of semester end examination and Evaluation concurrently
	21 <sup>st</sup> week			Notification of Final Grades
<b>*Evaluation shall begin very first day after completion of the conduct of examination of the first course and both examination and evaluation shall continue concurrently. The examination results / final grades be announced latest by 21<sup>st</sup> week</b>				

- Note:** 1. Practical examination wherever applicable shall be conducted before conducting of IA2 examination. The calendar of practical examination shall be decided by the respective school.  
2. Finally, **awarding the Grades** be announced latest by 5 days after completion of the examination.

9.3 The Assessment of MOOC and Online Courses shall be decided by the concerned School Board of Studies (BOS).

**9.3.1 For > 3 credit courses**

i	IA-I	25 marks
ii	IA-2	25 marks
iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	50 marks
<b>Total</b>		<b>100 marks</b>

**9.3.2 For 1 & 2 credit courses**

i	IA-I	15 marks
ii	IA-2	15 marks



iii	Semester end examination by the concern school board (demo, test, viva voice etc.)	20 marks
<b>Total</b>		<b>50 marks</b>

9.3.3 The 50 marks meant for Internal Assessment (IA) of the performance in carrying out practical shall further be allocated as under:

i	Conduction of regular practical / experiments throughout the semester	20 marks
ii	Maintenance of lab records / Activities /Models / charts etc.	10 marks
iii	Performance of mid-term test (to be conducted while conducting second test for theory courses); the performance assessments of the mid-term test include performance in the conduction of experiment and write up about the experiment.	20 marks
<b>Total</b>		<b>50 marks</b>

In case of an integrated course 20% marks be earmarked for laboratory work.

**For example:**

During IA1

Laboratory work ..... 10 marks  
 Test (Mid-Term) .....15 marks for the first 50% of the theory syllabus  
 Total .....25 marks

During IA2

Laboratory work ..... 10 marks  
 Test (Mid-Term) .....15 marks for the second 50% of theory syllabus  
 Total .....25 marks

SEE to be conducted for theory portions only and assessed for 50 marks

**10. Setting Questions Papers and Evaluation of Answer Scripts:**

10.1 There shall be three sets of questions papers set for each course. Two sets of question papers shall be set by the internal and one set by external examiner for a course. The Chairperson of the BoE shall get the question papers set by internal and external examiners.

10.2 The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation.

10.3 There shall be double evaluation, viz, first valuation by the internal evaluator who has taught the course and second evaluation shall be an external examiner who is familiar with the course. The average marks of the two evaluations (internal examiner & external examiner) shall be the marks to be considered for declaration of results.

- 10.4 The examination for Practical work/ Field work/Project work will be conducted jointly by two examiners (internal and external). However, in case of non-availability of external examiner or vice versa, the Chairperson BoE at his discretion can invite internal / external examiners as the case may be, if required.
- 10.5 If a course is fully of (L=0): T: (P=0) type, then the examination for SEE Component will be as decided by the BoS concerned.
- 10.6 In case of a course with only practical component a practical examination will be conducted with two examiners and each candidate will be assessed on the basis of: a) Knowledge of relevant processes, b) Skills and operations involved, and c) Results / Products including calculation and reporting.
- 10.7 The duration for Semester-End practical examination shall be decided by the Controller of Examinations.

**11. Evaluation of Minor Project / Major Project / Dissertation:**

Right from the initial stage of defining the problem, the candidate has to submit the progress reports periodically and also present his/her progress in the form of seminars in addition to the regular discussion with the supervisor. At the end of the semester, the candidate has to submit final report of the project / dissertation, as the case may be, for final evaluation. The components of evaluation are as follows:

Component – I	(IA1)	Periodic Progress and Progress Reports (25%)
Component – II	(IA2)	Results of Work and Draft Report (25%)
Component– III	(SEE)	Final Evaluation and Viva-Voce (50%). Evaluation of the report is for 30% and the Viva-Voce examination is for 20%.

12. All assessments must be done by the respective Schools as per the guidelines issued by the Controller of Examinations. However, the responsibility of announcing final examination results and issuing official transcripts to the students lies with the office of the Controller of Examinations.
13. **Requirements to Pass a Course**
- 13.1 A candidate's performance from all 3 components will be in terms of scores, and the sum of all three scores will be for a maximum of 100 marks (25 + 25 + 50). A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful.

13.2 **The Grade and the Grade Point:** The Grade and the Grade Point earned by the candidate in the subject will be as given below:

Marks, P	Grade, G	Grade Point (GP=V x G)	Letter Grade
90-100	10	v*10	O
80-89	9	v*9	A+
70-79	8	v*8	A
60-69	7	v*7	B+
55-59	6	v*6	B
50-54	5.5	v*5.5	C+
40-49	5	v*5	C
0-39	0	v*0	F
ABSENT			AB

*O - Outstanding; A+-Excellent; A-Very Good; B+-Good; B-Above Average; C+-Average; C-Satisfactory; F – Unsatisfactory.*

Here, P is the percentage of marks ( $P=[(IA1+IA2)+SEE]$ ) secured by a candidate in a course which is rounded to nearest integer. v is the credit value of course. G is the grade and GP is the grade point.

**a. Computation of SGPA and CGPA**

The Following procedure to compute the Semester Grade Point Average (SGPA)

The SGPA is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$SGPA (S_i) = \frac{\sum(C_i \times G_i)}{\sum C_i}$$

Where  $C_i$  is the number of credits of the  $i$ th course and  $G_i$  is the grade point scored by the student in the  $i$ th course.

**b. Illustration for Computation of SGPA and CGPA**  
**Illustration No. 1**

Course	Credit	Grade letter	Grade Point	Credit Point (Credit x Grade)
Course 1	3	A	9	3X9=27
Course 2	3	B	8	3X8=24
Course 3	3	C	7	3X7=21
Course 4	3	O	10	3X10=30
Course 5	3	D	6	3X6=18
Course 6	3	O	10	3X10=30
Course 7	2	A	9	2X 9 = 18
Course 8	2	B	8	2X 8 = 16
	22			184

Thus,  $SGPA = 184 \div 22 = 8.36$

**c. Cumulative Grade Point Average (CGPA):**

Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (72) for two year post graduate degree in a specialization is calculated taking into account all the courses undergone by a student over all the semesters of a program, i.e.,

$$CGPA = \frac{\sum(C_i \times S_i)}{\sum C_i}$$

Where  $S_i$  is the SGPA of the  $i$ th semester and  $C_i$  is the total number of credits in that semester.

The SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts.

**Illustration:**

**CGPA after Final Semester**

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	22	8.36	22 x 8.36 = 183.92
2	22	8.54	22 x 8.54 = 187.88
3	16	9.35	16x9.35=149.6
4	12	9.50	12x9.50=114
<b>Cumulative</b>	<b>72</b>		<b>635.4</b>

$$\text{Thus, } CGPA = \frac{22 \times 8.36 + 22 \times 8.54 + 16 \times 9.35 + 12 \times 9.50}{72} = 8.83$$

**13.3 Conversion of Grades into Percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

$$\text{Percentage of marks scored} = CGPA \text{ Earned} \times 10$$

**Illustration:** CGPA Earned  $8.83 \times 10 = 88.30$

**14. Classification of Results**

The final grade point (FGP) to be awarded to the student is based on CGPA secured by the candidate and is given as follows:

CGPA	Grade (Numerical Index)	Letter Grade	Performance	FGP
	G			Qualitative Index
$9 \geq CGPA \geq 10$	10	O	Outstanding	Distinction
$8 \geq CGPA < 9$	9	A+	Excellent	
$7 \geq CGPA < 8$	8	A	Very Good	First Class
$6 \geq CGPA < 7$	7	B+	Good	
$5.5 \geq CGPA < 6$	6	B	Above average	Second Class
$> 5 CGPA < 5.5$	5.5	C+	Average	
$> 4 CGPA < 5$	5	C	Satisfactory	Pass

**Overall percentage=10\*CGPA**

- a. **Provisional Grade Card:** The tentative / provisional Grade Card will be issued by the Controller of Examinations at the end of every Semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average (SGPA)**. This statement will not contain the list of DROPPED courses.
- b. **Final Grade Card:** Upon successful completion of the Post Graduate Degree a Final Grade card consisting of grades of all courses successfully completed by the Candidate will be issued by the COE.

**15. Attendance Requirement:**

- 15.1 All students must attend every lecture, tutorial and practical classes.
- 15.2 In case a student is on approved leave of absence (e.g.: - representing the University in sports, games or athletics, placement activities, NCC, NSS activities and such others) and / or any other such contingencies like medical emergencies, the attendance requirement shall be minimum of 75% of the classes taught.
- 15.3 Any student with less than 75% of attendance in aggregate of all the courses including practical courses / field visits etc., during a semester shall not be permitted to appear to the end semester examination and such student shall seek re-admission

**16. Re-Registration and Re-Admission:**

- 16.1 In case a candidate's class attendance in aggregate of all courses in a semester is less than 75% or as stipulated by the University, such a candidate is considered as dropped the semester and is not allowed to appear for semester end examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.
- 16.2 In such case where in a candidate drops all the courses in a semester due to personal reasons, it is considered that the candidate has dropped the semester and he / she shall seek re-admission to such dropped semester.

**17. Absence during Internal Test:**

In case a student has been absent from an internal test due to the illness or other contingencies he / she may give a request along with necessary supporting documents and certification from the concerned class teacher / authorized personnel to the concerned Director of the School, for conducting a separate internal test. The Director of the School may consider such request depending on the merit of the case and after consultation with course instructor and class teacher, and arrange to conduct a special internal test for such candidate(s) well in advance before the Semester End Examination of that respective semester. Under no

circumstances internal tests shall be held / assignments are accepted after Semester End Examination.

18. **Eligibility to Appear for Semester End Examination (SEE)**

18.1 Only those students who fulfill 75% attendance requirement and who secure minimum 30% marks in IA1 and IA2 together in a course are eligible to appear for SEE examination in that course.

18.2 Those students who have 75% of attendance but have secured less than 30% marks in IA1 and IA2 together in a course are not eligible to appear for SEE examination in that course. They are treated as dropped the course and they will have to repeat that course whenever it is offered.

18.3 In case a candidate secures more than 30% in IA1 and IA2 together but less than 40% in aggregate of IA1, IA2 and SEE in a course is considered as unsuccessful and such a candidate may either opt to DROP that course or appear for SEE examination during the subsequent semesters / years within the stipulated period.

18.4 In such a case wherein he / she opts to appear for just SEE examination, then the marks secured in IA1 and IA2 shall get continued. Repeat SEE examination will be conducted in respective semesters.

19. **Provision for Supplementary Examination**

In case a candidate fails to secure a minimum of 40% (20 marks) in Semester End Examination (SEE) and a minimum of 40% marks overall (IA and SEE together), such candidate shall seek supplementary examination of only such course(s) wherein his / her performance is declared unsuccessful. The supplementary examinations are conducted after the announcement of even semester examination results. The candidate who is unsuccessful in a given course(s) shall appear for supplementary examination of odd and even semester course(s) to seek for improvement of the performance.

20. **Provision to Carry Forward the Failed Subjects / Courses:**

A candidate who secures a minimum of 40% in the SEE and an overall 40% (IA1+IA2+SEE) in a course is said to be successful otherwise considered that the candidate has failed the course. A candidate is required to successfully complete all the courses before submission of major project report or dissertation report. (It means that the candidate has no restrictions on the number of courses that can be carried forward)

21. **Provision for Appeal**

If a candidate is not satisfied with the evaluation of Internal Assessment components (Internal Tests and Assignments), he/she can approach the Grievance Cell with the written submission together with all facts, the assignments, and test papers, which were evaluated. He/she can do so before the commencement of

respective semester-end examination. The Grievance Cell is empowered to revise the marks if the case is genuine and is also empowered to levy penalty as prescribed by the University on the candidate if his/her

submission is found to be baseless and unduly motivated. This Cell may recommend for taking disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the Grievance committee is final.

**22. Grievance Committee:**

In case of students having any grievances regarding the conduct of examination, evaluation and announcement of results, such students can approach Grievance Committee for redressal of grievances.

Grievance committees will be formed by CoE in consultation with VC

For every program there will be one grievance committee. The composition of the grievance committee is as follows: -

- The Controller of Examinations - Ex-officio Chairman / Convener
- One Senior Faculty Member (other than those concerned with the evaluation of the course concerned) drawn from the school / department/discipline and/or from the sister schools / departments/sister disciplines – Member.
- One Senior Faculty Members / Subject Experts drawn from outside the University school / department Member.

23. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellor shall be final.

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

**SCHOOL OF CIVIL ENGINEERING**  
**M. Tech in CONSTRUCTION TECHNOLOGY & MANAGEMENT**  
**(2022-2024)**  
**I SEMESTER**

Sl. No	Course Code	Title of the Course	HC/SC/OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TE0101	Advanced Concrete Technology	HC	B. E / B. Tech. in Civil Engineering	2	1	-	3	4
2	M22TE0102	Building Services	HC		2	1	-	3	4
3	M22TE0103	Construction Economics and Finance	HC		2	1	-	3	4
4	M22TE0104	Contract Management and Arbitration	HC		2	1	-	3	4
5	M22TE0105	Construction Methods and Equipment	HC		2	1	-	3	4
6	M22TE0106	Construction Project Management	HC		2	1	-	3	4
7	M22TE0107	Mini Project-I	Practical/Report		1	0	1	2	3
<b>TOTAL</b>								<b>20</b>	<b>27</b>
<b>Practical</b>									
8	M22TE0108	Advanced Concrete Laboratory	Practical		1	0	1	2	3
<b>TOTAL</b>								<b>02</b>	<b>03</b>
<b>TOTAL SEMESTER CREDITS</b>								<b>22</b>	
<b>TOTAL CUMULATIVE CREDITS</b>								<b>22</b>	
<b>TOTAL CONTACT HOURS</b>								<b>30</b>	



Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

**SCHOOL OF CIVIL ENGINEERING**  
**M. Tech in CONSTRUCTION TECHNOLOGY AND MANAGEMENT**  
**(2022-2024)**  
**II SEMESTER**

Sl. No	Course Code	Title of the Course	HC/SC/OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TE0201	Construction Planning and Control	HC	B. E / B. Tech. in Civil Engineering	2	1	-	3	4
2	M22TE0202	Quality and Safety Management	HC		2	1	-	3	4
3	M22TE0203	Shoring, Scaffolding and Formwork	HC		2	1	-	3	4
4	M22TES211	Modern Construction Materials and Special Concretes	SC		2	1	-	3	4
	M22TES212	Risk Analysis and Decision Making	SC		2	1	-	3	4
	M22TES213	Sustainable Construction Engineering	SC		2	1	-	3	4
5	M22TES221	Quantitative Methods in Construction Management	SC		2	1	-	3	4
	M22TES222	Repair and Rehabilitation of Structures	SC		2	1	-	3	4
	M22TES223	Value Engineering and Management	SC		2	1	-	3	4
6	M22TES231	Applications of IoT in Civil Engineering	SC		2	1	-	3	4
	M22TES232	Disaster Mitigation and Management	SC		2	1	-	3	4
	M22TES233	Environmental Impact Assessment and Management	SC		2	1	-	3	4
7	M22TE0204	Mini Project-II	Practical/ report			1	0	1	2
<b>TOTAL</b>								<b>20</b>	<b>27</b>
<b>Practical</b>									
8	M22TE0205	Construction Software Lab	Practical		1	0	1	2	3
<b>TOTAL</b>								<b>02</b>	<b>03</b>
<b>TOTAL SEMESTER CREDITS</b>								<b>22</b>	
<b>TOTAL CUMULATIVE CREDITS</b>								<b>44</b>	
<b>TOTAL CONTACT HOURS</b>								<b>30</b>	

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

**SCHOOL OF CIVIL ENGINEERING**  
**M. Tech. in CONSTRUCTION TECHNOLOGY AND MANAGEMENT**  
**(2022-2024)**  
**III SEMESTER**

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TEON01	MOOC/SWAYAM Online Course	ON	B. E./ B. Tech. in Civil Engineering	3	1	0	4	--
2	M22TE0301	Internship with Report	Practical/ Term Work and Viva - Voce		2	0	4	6	--
3	M22TE0302	Dissertation Phase-I	Practical/ Report and Viva -Voce		2	0	4	6	--
<b>TOTAL</b>								<b>16</b>	
<b>TOTAL SEMESTER CREDITS</b>								<b>16</b>	
<b>TOTAL CUMULATIVE CREDITS</b>								<b>60</b>	
<b>TOTAL CONTACT HOURS</b>								<b>--</b>	

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

**SCHOOL OF CIVIL ENGINEERING**

**M. Tech in CONSTRUCTION TECHNOLOGY AND MANAGEMENT**

**(2022-2024)**

**IV SEMESTER**

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TE0401	Technical Seminar with Report	Practical/ Term Work		0	0	2	2	--
2	M22TE0402	Dissertation Phase-II	Practical/ Thesis Submission and Viva-Voce		2	0	8	10	--
<b>TOTAL</b>								<b>12</b>	<b>--</b>
<b>TOTAL SEMESTER CREDITS</b>								<b>12</b>	
<b>TOTAL CUMULATIVE CREDITS</b>								<b>72</b>	
<b>TOTAL CONTACT HOURS</b>								<b>--</b>	

## FIRST SEMESTER

<b>M22TE0101</b>	<b>Advanced Concrete Technology</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3
Internal Assessment: 50 Marks		Semester End Examination: 50 Marks (Minimum 20 Marks)			
<b>Prerequisite:</b> Concrete Technology					
<b>COURSE OBJECTIVES:</b> Student will be able					
<ol style="list-style-type: none"> <li>1. To explore special concrete constituents and their alternative materials.</li> <li>2. To learn the development of concrete and its mix design.</li> <li>3. To understand the properties of concrete.</li> <li>4. To learn the testing procedures of concrete specimens.</li> <li>5. To gain knowledge about the structure of concrete.</li> <li>6. To familiarize about special types of concretes and their design.</li> </ol>					
<b>COURSE OUTCOMES:</b>					
After successful completion of this course, the student will be able					
<ol style="list-style-type: none"> <li>1. To identify the constituents of concrete, alternative materials and admixtures.</li> <li>2. To design concrete mix of different grades.</li> <li>3. To explain the properties of concrete.</li> <li>4. To demonstrate the testing of concrete specimens.</li> <li>5. To explain the structure of concrete.</li> <li>6. To categorize and design special types of concretes.</li> </ol>					
<b>UNIT-I</b>					<b>12 HOURS</b>
<b>Concrete constituents and Mix Design:</b> Components of modern concrete and developments in the process, constituent materials: Role of constituents, Alternate replacement materials, Manufacture of Concrete, Delivery of Concrete, Concrete Placing, curing methods, Mix proportioning of Concrete: Principles and methods as per IS: 10262 provisions.					
<b>UNIT-II</b>					<b>12 HOURS</b>
<b>Fresh and Hardened Properties of Concrete:</b> Early-Age Properties of Concrete, Factors influencing concrete properties, Fresh and Hardened concrete properties and Testing methods, Stress–Strain Relationship and Constitutive Equations, Dimensional Stability—Shrinkage and Creep.					
<b>UNIT-III</b>					<b>12 HOURS</b>
<b>Structure of Concrete:</b> Introduction: Concrete as a Structural Material, Characteristics and Types of Concretes, Structural Levels, Structure of Concrete in Nanometer Scale: C–S–H Structure, Transition Zone in Concrete, Micro-structural Engineering.					
<b>UNIT-IV</b>					<b>12 HOURS</b>
<b>Advanced Composite Concrete:</b> Self-Compacting Concrete: Mix design by IS code and Nansu methods, Fresh and hardened properties, Geopolymer concrete: Mix Proportion, fresh and hardened properties					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Neville A.M, “Properties of Concrete” 5 th Edition, Prentice Hall, 2011.</li> <li>2. M. S. Shetty &amp; Jain A.K., “Concrete Technology: Theory And Practice” S Chand Publishing, Eighth edition, 2019.</li> <li>3. P. Kumar Mehta, Paul J.N.Monterio, “CONCRETE: Microstructure, Properties and Materials”-Tata McGraw Hill, New Delhi, 2006.</li> </ol>					

4. A.R.Santhakumar, (2007) "Concrete Technology"-Oxford University Press, New Delhi, 2007.
5. Gambhir "Concrete Technology" 6 th Reprint TMH., 2006.
6. Rixom.R. and Mailvaganam.N., "Chemical admixtures in concrete"- E and FN, Spon London 1999
7. IS 10262: 2019, Concrete Mix Proportioning — Guidelines, Bureau of Indian Standards, New Delhi.

Mapping of Course Outcomes with **Programme** Outcomes

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PS O1	PS O2	PS O3	PSO 4
M22TE0101	CO1			3			2	2	1	1			3			1
	CO2	2	3			3	3	3			3		3			
	CO3	3		3		2	1		3	2		2	3	2		2
	CO4	3		3	3	2	1			3			3	2		2
	CO5	2	3			3	3	3			3		3			
	CO6	3		3	3	3		2	3				3			3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TE0102	Building Services				L	T	P	C
Duration: 16weeks					2	1	0	3

Prerequisite: Building Construction

**COURSE OBJECTIVES:** Student will be able to learn

1. To know the applications of services for different types of buildings
2. To design considerations of the lifts, their locations and sizes
3. To evaluate the air HVAC requirements of a building.
4. To know the general requirements of fire resisting building
5. The Evaluate the electrical services in buildings
6. To evaluate the rain water requirements of a building.

**COURSE OUTCOME:** After successful completion of this course the student will be able to:

1. Design the required services for different types of buildings
2. Design lifts, their locations and sizes
3. Evaluate the air HVAC requirements of a building.
4. Apply fire safety measures in buildings.
5. Design the electrical services in buildings
6. Evaluate the rain water requirements of a building.

**UNIT-I**

**12 HOURS**

Definitions, Objective and uses of services, Applications of services for different types building considering, Classification of building services, Types of services and selection of services, Natural and artificial lighting principles and factors, Arrangement of luminaries, Distribution of illumination, Utilization factors, Necessity of Ventilation Types – Natural and Mechanical Factors to be considered in the design of Ventilation

**UNIT-II**

**12 HOURS**

Introduction of mechanical services, Lift -Definition, Types of Lifts, Design Considerations, Location, Sizes, Component parts- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push, Elevators & Escalators-Different types of elevators and Escalators and

Uses, Uses of different types of elevators Escalators. Dumbwaiters, Different types of Dumb waiters and uses. Conveyors -Different types of Conveyors, Air Conditioning-Definition, Purpose, Principles, Temperature Control,

Air Velocity Control and Distribution system, Types of Air Conditioners, (Central type, Window Type, Split Unit), Humidity Control, Cleaners, Filters, Spray washers, Electric preceptors.

**UNIT-III**

**12 HOURS**

Introduction, causes of fire and Effects of fire, General Requirements of Fire Resisting building as per IS 1646 and National Building Code of India (NBC) Part-4, Characteristics of Fire resisting materials, Maximum Travel Distance, Fire Fighting Installations for Horizontal Exit, Roof Exit /Fire Lifts, External Stairs, Requirement of good Acoustic, Various sound absorbent, Factors to be followed for noise control in residential building.

**UNIT-IV**

**12 HOURS**

Electrical services in the building technical terms and symbols for electrical installations and Accessories of wiring, Systems of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring, Types of insulation, electrical layout for residence, small work shop, show room, school building, etc.

Rain water Harvesting for buildings, Concept of GREEN buildings, Components of GREEN building Introduction and Significance to Grey water, Components of Grey water system, Management of Grey water system.

**REFERENCE BOOKS**

1. Frederick S. Merritt, Jonathan T. Ricketts, Building design and construction Handbook, McGraw-Hill Inc., 5th edition, 1994
2. Fred Hall and Roger Green, Building Services Handbook, Routledge, 7th edition, 2013
3. M. David Egan, Architectural Acoustics, J. Ross Pub., 2007
4. Gurcharan Singh, Jagdish Singh, Water Supply & Sanitary Engineering, Standard Publishers Distributors, 2007
5. Shri V.K. Jain, Fire Safety in Buildings, New age publishers, 2010
6. National Building Code 2016, New Delhi, 2005
7. Shan Wang, Handbook of Air Conditioning and Refrigeration, 2nd Edition, McGraw Hill, 2000

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/ COs	P O1	P O2	P O3	P O4	P O5	P O6	P O7	P O8	P O9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
<b>M22TE0102</b>	<b>CO1</b>	3	3	2	1							3		3	1		3
	<b>CO2</b>	3	3	2	1							3		3	1		3
	<b>CO3</b>	3	3	2	1							3		3	1		3
	<b>CO4</b>	3	2	2								3		3	1		3
	<b>CO5</b>	3	3	2	1							3		3	1		3
	<b>CO6</b>	3	3	2	2							3		3	1		3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0103</b>	<b>Construction Economics and Finance</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3

Prerequisite: Estimation and Costing, Engineering Economics

**COURSE OBJECTIVES:** Student will be able to learn

1. Scope for financial management and supply-demand mechanism
2. Production and cost theory analysis and pricing
3. Capital Budgeting and budgetary control techniques

4. Time value for money and discounted cash flow
5. Accounting information and application in construction industry
6. Cost elements of contract

**COURSE OUTCOME:** After successful completion of this course the student will be able to:

1. Implement financial management and supply-demand mechanism
2. Applications of law of Production and cost theory
3. Analysis of pricing and budgetary control techniques
4. Value for time management and getting discounts
5. Understanding contracts and procedure for bidding process
6. Implementation in the construction industry

**UNIT-I**

**12 HOURS**

**Financial Management:** Meaning and Scope, Economics and Scope, Supply and Demand Mechanism, analysis and forecasting. Balance sheet, profit & loss account, financial statements

**UNIT-II**

**12 HOURS**

**Production and Cost theory, analysis, Pricing;** objectives, determinants, absorption, marginal costing. Financial analysis, Decision making. Capital Budgeting and budgetary control techniques, standard costing and variance, investment appraisal techniques, Practical problems and case studies

**UNIT-III**

**12 HOURS**

**Engineering economics:** Time value of money, discounted cash flow, NPV, ROR, Bases of comparison, Incremental analysis, Benefit-Cost analysis, Replacement analysis, Breakeven analysis, Capital budgeting, Taxation and Inflation, Working capital management, Construction accounting, Income statement.

**UNIT-IV**

**12 HOURS**

**Construction Finance:** Accounting information and application, Financial versus economic evaluation, financial statements and project appraisal. Project yield, taxation and inflation, risk and uncertainty, Turnkey activities; finance and working capital, depreciation and amortization; cost control, performance budgeting, equipment rentals. Bidding and awards, work pricing, cost elements of contracts, letters of credit, financing plans, multiple sources of finance. Qualifying, bidding, bidders, comparing the bids, under-writing. unforeseen revisions, costs and rates escalation, cost progress reporting. Legal aspects

**REFERENCE BOOKS**

1. Blank, L. T. and Tarquin, A. J., "Engineering Economy", Fourth Edition, WCB/McGraw-Hill, 1998.
2. Bose, D. C., "Fundamentals of Financial management", 2nd ed., PHI, New Delhi, 2010.
3. Boyer, C.B. and Merzbach, U. C., "A History of Mathematics", 2nd ed., John Wiley & Sons, New York, 1989.
4. Gould, F.E., "Managing the Construction Process", 2nd ed., Prentice Hall, Upper Saddle River, New Jersey, 2002.
5. Gransberg, D. G., Popescu, C. M. and Ryan, R. C., "Construction Equipment Management for Engineers, Estimators, and Owners, CRC/Taylor & Francis, Boca Raton, 2006.
6. Harris, F, McCaffer, R. and Edum-Fotwe, F., "Modern Construction Management", 6th ed., Blackwell Publishing, 2006.
7. Jha, K. N., "Construction Project Management, Theory and Practice", Pearson, New Delhi, 2011.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PS O4
M22TE0103	CO1	3	3	3		1	2	3	2			2		3		
	CO2	3	3	3		2	3					1	2	3	1	
	CO3	3	3	3	2		3		1					3	2	
	CO4	3	3	3		3		1				3			2	
	CO5	3	3	3		2	3					1	2	3	1	
	CO6	3	3	3		3		1				3			2	

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0104</b>	<b>Contract Management and Arbitration</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Prerequisite: Project management**

**COURSE OBJECTIVES:** Student will be able to learn

1. To develop concepts related with Construction contracts & Tendering which involves Planning, management and Execution of the project with economic development & prosperity.
2. To learn basic principles of Construction contracts, Tendering & Arbitration in the context of various construction aspects.
3. To study principles and specifications for making tender documents.
4. To finalize quantities of items and labour requirement of civil engineering works.
5. To prepare estimate of the civil engineering work & Specification of construction items.
6. To know the co-relation of client, consultant and contractor for the construction project with practical aspects.

**COURSE OUTCOMES:** Student will be able to learn

1. Provide basic understating of the legal aspects of business.
2. Provide a foundation of commercial contracts management, managing legal risk associated with breach of contracts.
3. Adopting the ethical knowledge for making construction contracts & Tenders.
4. The student will get in depth knowledge of special aspect of tender & contract management.
5. Address legal issues in tender and procurement, project financing, infrastructure contracts, and e-contracts, etc.
6. Provide a comprehensive understanding the commercial dispute settlement techniques such as adjudication, arbitration and alternative dispute resolutions.

**UNIT - I**

**12 HOURS**

**Introduction to Contract:** Definition and legal issues in contract, Indian legal system, Essential requirement of a contract as per Indian Contract Act 1872, Characteristics of a good contract, Legal enforceability of contract, Breach & termination of contracts, Major stake holders in construction contracts, Overview of Activities in Contract Management, Laws of Tort.

**Construction Contracts:** Type of construction contracts: Lump sum contracts, Fixed price contracts, Percentage rate contracts, Cost plus contracts, Target contracts, Design-Build contracts, Turn-key contracts, BOT contracts. Parties to a Contract, Contract Formation, Common contract clauses: Notice to proceed, rights and duties of various parties, Contract Duration and Price.

**UNIT - II**

**12 HOURS**



**Stages in Contracting:** Preparation of tender documents estimating, pre-qualification, bid evaluation, award of contract, project financing and contract payments, contracts close out and completion.

**Tendering:** Process of tendering: Tender notice, Expression of Interest (EOI), Request for Quote (RFQ) & Request for Proposal (RFP), Bid security, Prequalification process, Bidding Models and bidding strategy, Tender submission and evaluation, Tender rejection, Security deposits/performance guarantee & Defect liability, Contract agreement & contract documents Performance Parameters: Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination.

**UNIT - III**

**12 HOURS**

**Conditions of Contracts:** General conditions & special conditions, Contract conditions for payments, obligations and responsibilities of the parties, protection and indemnification, bonds and insurance, laws and liens, subsurface conditions, inspection of work, change of work, rejected work and deficiencies. Time delay, Scope changes, Extra claims, Termination of contracts, subcontracting.

Proper record keeping in contract administering, establishment of standard procedures, coordination between various agencies involved, providing data for interpretation of contract clauses.

**UNIT - IV**

**12 HOURS**

**E-Contracts:** Contracts in the information technology era; Importance of E-Contracts; Digital Signatures and contract formation; Asymmetric key encryption, Digital signature certificates; Legal issues involved in control of private key.

**Arbitration:** Adjudication; Arbitration; Conciliation; Mediation; Appointment of Arbitrators, Conditions of Arbitrations, Powers and duties of Arbitrator, Rules of Evidence, Enforcement of Award-costs.

Lok Adalat; Arbitral Tribunals and Arbitral awards; Recourse against arbitral award; Enforcement of foreign awards; Investment Arbitration under BITS, ICSID, etc.

**REFERENCE BOOKS**

1. Explanation of Indian Contract Act: Mulla and Sanjeeva Rao, B.D. Virmani, B.T. Gajaria
2. Handbook of Contracts: Hudson.
3. Construction Contracting, Clough Richarch, John Wiley & Sons, New York, 1986.
4. Construction Contract Management, Prakash V.A., NICMAR, Bombay.
5. Construction Contracts, Keith Collier, Reston Publishing Company, Inc, Reston, Virginia.
6. Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune.
7. Construction Contracts - Law and Management, John Murdoch & Will Hughes, Spon Press, Taylor & Francis Group.
8. Law relating to Building and Engineering Contracts in India, Gajera, G.T., Butterworths.
9. CPWD 7/8: General Conditions of Contracts. Central Public Works Department, Govt of India.

## Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
<b>M22TE0104</b>	<b>CO1</b>	3							3		3		3	2		3
	<b>CO2</b>								2		3			2		3
	<b>CO3</b>								3		3		3			3
	<b>CO4</b>										3					3
	<b>CO5</b>								2		3		3			3
	<b>CO6</b>						2					3				

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0105</b>	<b>Construction Methods and Equipment</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	0	3

Prerequisite: Building Construction

**COURSE OBJECTIVES:** Student will be able to learn

1. Different methods of excavations and equipment's used for excavation
2. Scaffolding and formwork used for high rise structures
3. Various types of cranes and hoisting equipment
4. The construction and erection techniques for bridges
5. Various berthing structures
6. The paving methods and equipment used

**COURSE OUTCOMES:** After successful completion of this course the student will be able:

1. To implement methods of excavations and equipment for the excavations
2. To decide the provision of scaffolding and formwork to be used for high rise structures
3. To understand various types of cranes and hoisting equipment
4. To implement construction and erection techniques for bridges
5. To understand various berthing structures
6. To decide for implementing the different paving methods and equipment

### UNIT-I

**12 HOURS**

**Earth Work:** Methods: Trenching – Excavations - Braced Excavations – Shafts – Embankments – Dewatering Methods – compaction methods – Stabilising vertical cuts and slopes.

**Equipment's:** Compacting equipment's, Scrapers, Dozers, Hydraulic Excavators, Trenching Machines, Graders, Trimmers, Trucks and hauling equipment's - Draglines and Cam Shells.

### UNIT-II

**12 HOURS**

**Foundations and scaffoldings:** Methods and Equipment's for foundations (Raft and pile foundations), well foundations, Shoring, Scaffolding, Formwork, Cranes and hoisting equipment. Slip form technique.

### UNIT-III

**12 HOURS**

**Concrete Bridges** - In-situ and precast construction methods, Balanced cantilever Methods, Span by Span Method, Incremental launching, Steel Bridges, Cable Stayed Bridges and Suspension Bridge.

**UNIT-IV**

**12 HOURS**

**Highway Construction equipment:** Asphalt Plants, Paving Equipment's, Tunnels-stages, methods and lining, Grouting Methods. Ports: Types, Breakwaters – berthing structures, mooring accessories – dredgers and dredging methods.

**REFERENCE BOOKS**

1. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
2. Peurifoy, R.L., Ledbette. W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
3. Ratay, R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984.
4. Koerner, R.M., Construction & Geotechnical Methods in Foundation Engineering, McGraw Hill, 1984.
5. Varma, M., Construction Equipment and its Planning & Applications, Metropolitan Book Co., 1979.
6. Smith, R.C, Andres, C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986.

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M22TE0105	CO1	3	3										3			2
	CO2	3		3						2			3			2
	CO3	3								3			3			1
	CO4	3		3						3			3			2
	CO5	3	3										3			2
	CO6	3		3						2			3			2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0106</b>	<b>Construction Project Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16 weeks</b>		2	1	0	3

Prerequisite: Building Planning and Construction

**COURSE OBJECTIVES:** Student will be able to learn

1. Understand the various management techniques for successful completion of construction projects.
2. Understand to prepare the project feasibility report economic analysis
3. Understand the Importance of Various planning techniques such as CPM and PERT
4. Understand the effect of management for project organization with the application MSP
5. Time cost management, scheduling and monitoring
6. How to perform Resource Planning-Levelling and Allocation

**COURSE OUTCOMES:** After successful completion of this course the student will be able to:

1. Apply the management techniques for the successful completion of the project
2. Prepare the project feasibility report and analyses the economics of the project
3. Prepare various project plans using planning techniques such as Work break down structure (WBS), Bar charts.
4. Implement project organization charts such as bar chart, CPM and PERT
5. To provide time cost management, scheduling and implementation
6. Perform Resource Planning-Levelling and Allocation

**UNIT-I**

**12 HOURS**

**Construction Engineering & Planning for Construction Projects:** Introduction to Planning- Steps Involved in Planning- Objectives of Planning- Principles of Planning- Advantages of Planning- Limitations of Planning- Stages of Planning -Types of Planning. Construction Networks- Types of Networks- Rules for Drawing the Network- Fulkerson's Rule for Numbering the Events. **Project Feasibility Reports:** Introduction- Technical Analysis- Financial Analysis- Economic Analysis-Ecological Analysis-Feasibility Study.

**UNIT-II****12 HOURS**

**Construction Management Through Networks: Introduction – Programme** Evaluation and Review Technique (PERT)- Introduction- Time Estimates- Slack- Critical Path- Probability of Completion Time for A Project. Critical Path Method: Introduction – Difference Between PERT & CPM - Earliest Event Time- Latest Event Time- Float-Criticality and Critical Activity. Related Network Problems.

**UNIT-III****12 HOURS**

**Precedence Network Analysis:** Introduction- Representation of Nodes in A-O-N Networks- Logic of precedence Diagram- Forward pass and Backward pass Calculations- Advantages of Precedence Networks.

**UNIT-IV****12 HOURS**

**Cost-Optimization:** Introduction- Direct Cost- Indirect Cost- Total Project Cost-Optimization of Cost Through Network Contraction- Network Crashing Problems. **Resource Allocation:** Introduction- Resource Smoothing- Resource Levelling.

**REFERENCE BOOKS**

1. S Seetharaman “Construction Engineering and Management”- Umesh Publisher: Delhi- 2000.
2. Chitkara, K.K. “Construction Project Management: Planning, Scheduling and Control”, Tata McGraw-Hill Publishing Company, New Delhi, 1998.
3. Choudhury. S, “Project Management”, McGraw-Hill Publishing Company, New Delhi, 1988.
4. Chris Hendrickson and Tung Au, “Project Management for Construction Fundamental Concepts for Owners, Engineers, Architects and Builders” Prentice Hall, Pittsburgh, 2000.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M22TE0106	CO1		3								2	1	3			2
	CO2															
	CO3	3		3	2				2	3		3	3	3		3
	CO4	3			3	2	1			2	1		3	1	2	3
	CO5															
	CO6	3		3									3	2	3	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TE0107	Mini Project-I	Practical/Report	L	T	P	C
			1	0	1	2

The student is required to carry out a mini project individually on experimental investigation on Special concretes specimens and gain the knowledge on material characteristics

M22TE0108	ADVANCED CONCRETE LABORATORY	L	T	P	C
Duration: 16weeks		1	0	1	2

**Prerequisite:** Concrete Technology, Chemical admixtures

**COURSE OBJECTIVES:** Student will be able to learn

1. To gain experience regarding the determination of properties of different building materials
2. To provide an opportunity to learn how to measure the parameters, which governs the quality of the materials
3. To Perform Nondestructive Testing using Rebound hammer and Ultrasonic apparatus.
4. To study the effect of Mineral and Chemical admixtures of strength properties of hardened concrete.
5. To impart knowledge of mix design of concrete
6. To gain experimental knowledge of using bitumen for the pavements

**COURSE OUTCOME:** After successful completion of this course the student will be able to:

1. Implement good quality construction techniques.
2. Identify the quality of the materials used for construction.
3. Apply the knowledge of Nondestructive Testing apparatus using Rebound hammer and Ultrasonic.
4. Identify the proportion of the mix design.
5. Implement the usage of Mineral and Chemical admixtures to improve the properties of fresh and hardened concrete.
6. Identify the usage of bitumen in the construction of pavements.

**LIST OF EXPERIMENTS:**

1. Tests on basic construction materials
2. Mix Design of Concrete
3. Tests on fresh concrete
4. Tests on hardened concrete
5. In-situ Strength determination by Rebound Hammer and Ultrasonic Pulse Velocity (UPV) method.
6. Pull-Out Tests on concrete
7. Effect of Chemical admixtures on fresh and hardened properties of concrete
8. Effect of mineral admixtures on fresh and hardened properties of concrete
9. Tests on fresh properties of Self Compacting Concrete
10. Tests on fresh and hardened properties of Geopolymer Concrete

**REFERENCE BOOKS:**

- 1) Mehta P.K and Monteiro. P. J. M. " CONCRETE", Microstructure, Properties and Materials, Third Edition, Tata McGraw- Hill Publishing company Limited, New Delhi, 2006
- 2) Shetty M.S., " Concrete Technology, Theory and Practice", Revised Edition, S. Chand & company Ltd., New Delhi,2006
- 3) Neville. A.M., " Properties of Concrete", 4th Edition Longman,1995
- 4) Mindass and Young, " Concrete", Prentice Hall.1998

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
<b>M22TE0108</b>	CO1		3	2	3		2	2	1	1			3	2	3	1
	CO2		3	2	3		2	2	1	1			3	2	3	1
	CO3	3	2	3	3	2	1		3	2		2	3	1	3	2
	CO4	3	3	3	3	2	1			3			3	2	3	2
	CO5	3	3	3	3	2	1			3			3	2	3	2
	CO6	3	2	3	3	3			2	3				3	2	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

**SECOND SEMESTER**

<b>M22TE0201</b>	<b>CONSTRUCTION PLANNING AND CONTROL</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3

**Prerequisite:** Building Planning and Construction, Concrete Technology

**COURSE OBJECTIVES:** Student will be able to learn

1. How to plan for Resource Planning
2. Utilization of actual resources required and tools of measurement of resources
3. Time of purchase and quantity of materials and distribution
4. Time and planning management
5. Quality of materials to be maintained
6. How to prepare Documentation and Reporting

**COURSE OUTCOMES:** After successful completion of this course the student will be able to:

1. Implement Resource Planning and Procurement.
2. Identify actual resources required and tools of measurement of resources
3. Confident in implementing the quantity of materials and distribution
4. Implement time and planning management
5. Strictly adhere to the quality of materials to be maintained
6. To Prepare Sample Report for Quality Control.

**UNIT-I**

**12 HOURS**

**Project Scheduling and Resource levelling:** Introduction – Resource levelling- Resource Allocation- Importance of Project Scheduling – Preparing Invoice Schedule- Schedule of Milestone events- Schedule of Plant and Equipment’s- Schedule of Project Staff- Schedule of Labour Requirements- Schedule of Material Requirements- Schedule of Overheads- Cash Inflow- Cash Outflow.

**UNIT-II**

**12 HOURS**

**Construction Material Management:** Material Procurement Process- Material Management Process-Material Planning- Procurement- Material Accounting- Transportation- Inventory Monitoring and Control-Materials Codification. Inventory Management-Inventory Related Cost-Functions of Inventory-Inventory Policies- Selective Inventory Control- Related Problems.

**UNIT-III**

**12 HOURS**

**Construction Equipment Management:** Introduction- Classification of Construction Equipment’s-Factors behind the Selection of Construction Equipment’s- Factors behind selection of Construction Equipment’s- Plant and Equipment Acquisition- Depreciation- Taxation- Methods of Calculating Depreciation- Straight line Method- Sum of Years Digit Method-Divide and Conquer Method-Decline Balance Method-Sinking Fund Method- Accelerated Depreciation.

**UNIT-IV**

**12 HOURS**

**Project Cost and Value Management:** Project Cost Management-Resources Planning Schedules -Cost Planning-Cost Budgeting- Cost Control- Labour Cost- Material Cost- Plant and Equipment Cost- Subcontractor Cost-Overhead cost- Cost Codes-Cost Statement. Value Management in Construction- Value Engineering. Application in the project.

**REFERENCE BOOKS**

1. Andrew, D, Szilagg, Hand Book of Engineering Management, 1982.
2. Glenn, A. Sea's and Reichard, H Clough, Construction Project Management, John Willey and Sons, Inc.

1979.

3. Harvey, A. Levine, Project Management using Micro Computers, Obsome-McGraw Hill C.A. Publishing Co., Inc. 1988,

4. James, A., Adrain, Qauntitative Methods in Construction Management, American Elsevier Publishing Co., Inc. 1973.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3	PSO 4
M22TE02 01	CO1	3	3	3		2				2		2		3		3
	CO2	3	3	3		2				2		2		3		3
	CO3	3	3	3				2		2		2	3			1
	CO4	3	3	3	2							2		2	3	
	CO5	3	3	3							3	2	3	2		1
	CO6	3	3	3							3	2	3	2		1

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TE0202	<b>QUALITY AND SAFETY MANAGEMENT</b>	L	T	P	C
Duration: 16weeks		2	1	-	3

**Prerequisite:** Estimation and Costing, Engineering Economics

**COURSE OBJECTIVES:** Student will be able to learn

1. Construction quality and its control.
2. Quality assurance, quality management in construction projects.
3. Quality Functions and quality specifications.
4. Safety issues and safety program components.
5. safety procedures, laws for various construction operations.
6. Safety organization and management

**COURSE OUTCOME:** After successful completion of this course the student will be able to:

1. Know the construction quality and control.
2. Know the Quality assurance, quality management in construction projects
3. Understand the Quality Functions and quality specifications.
4. Know the various Safety issues and safety program components.
5. Know the safety procedures, laws for various construction operations.
6. Understand Safety organization and management

<b>UNIT-I</b>	<b>12 HOURS</b>
<b>Construction Quality:</b> Definition- Evolution of Quality- Inspection – Quality Control – Quality Assurance in Construction Projects. Assurance and Quality Control- Total Quality Management- Quality and Contractor	
<b>UNIT-II</b>	<b>12 HOURS</b>
<b>Total Quality Management:</b> Total quality management concepts; ISO9000; QA/QC systems and organizations, Quality Audits; Problem solving techniques; Statistical Quality Control; Quality Function Deployment; Material Quality Assurance; Specifications and Tolerances.	
<b>UNIT-III</b>	<b>12 HOURS</b>

**Safety issues:** Injury accidents and their causes; Safety program components; Role of workers, Supervisors, Managers and Owners; Safety Procedures for various construction operations; Safety audits; Safety laws

**UNIT-IV**

**12 HOURS**

**Safety Organization and Management:** Safety policies, safety organization, safety committees, safety representatives, outside agencies – Govt. intervention, international agreements.

**REFERENCE BOOKS**

1. Levitt, R.E. and Samelson, N.M., Construction Safety Management, Mc. Graw Hill Book Company, Inc., N.Y. 1991.
2. Juran Frank, J.M. and Gryna, F.M., Quality Planning and Analysis Tata McGraw Hill 1982.
3. Raymond Elliot Levitt & Nancy Morse Samelson Construction Safety Management Amazon Second edition.
4. Grant E.L. and Leavensworth Statistical quality Control McGraw Hill 1984.
5. Hutchins G, ISO 9000, Visa Books, New Delhi, 1993. 6. Ron Baden Hellard, Total Quality in Construction Projects, Thomas Telford, London.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
<b>M22TE0202</b>	CO1	3	1	1		2	3	2	3			2			2		
	CO2	3	3	3		1	2	3	2			2			3		
	CO3	3	3	3		2	3					1		2	3	1	
	CO4	3	3	3	2		3		1						3	2	
	CO5	3	3	3		3		1				1	3			2	
	CO6	3	3	3		3		1		2	1	3				2	

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0203</b>	<b>SHORING, SCAFFOLDING AND FORMWORK</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Concrete Technology

**COURSE OBJECTIVES:** Student will be able to

1. Understand the planning of formwork installations.
2. Understand the scheduling of formwork for various elements.
3. Study materials to be used in the form.
4. Design the forms and shoring.
5. Check the inadequacies in shoring and formwork.
6. Determine the location of job mill and storage.

**COURSE OUTCOMES:** Student will be able to

1. Decide the materials to be used in the formworks.
2. Design the forms and shoring.
3. Understand the safety norms for formwork.
4. Implement the planning and scheduling of formwork installations.



5. Understand the special types of forms.
6. Check the detailing of the shoring and scaffolds.

**UNIT - I**

**12 HOURS**

**Formwork – Introduction:** General objectives of formwork, Building and Erecting the Framework, Location of job mill, Storage. Basic simplification, Beam forms, Slab forms, Column forms, Wall forms, Form for Wall footings, Column footings, Giant forms, curved wall forms, Suspended forms, Erection Practices.

**Form materials and pressures on formwork:** Lumber, Types, Finish, Sheathing boards, Plywood – Types and grades, Textured surfaces and strength, Reconstituted wood, Steel, Aluminium, Form lining materials, Hardware and fasteners, Nails in Plywood.

**UNIT - II**

**12 HOURS**

**Pressures on Formwork:** Concrete density, Height of discharge, Temperature, Rates of Placing, Consistency of concrete, Live loads and wind pressure, Working stresses, Repetitive member stress, Vibration, Hydrostatic Adjustment for non-standard condition.

**Formwork – Design:** Allowable stresses, Codal provisions Examples on form designs, Slenderness ratio, Check for deflection, bending and lateral stability.

**Formwork – Safety:** Formwork Failures, Causes of Failures, Case studies, Finish of exposed concrete, Design deficiencies, Safety factors, Stripping sequence, Reshore installation, Advantages of reshoring.

**UNIT - III**

**12 HOURS**

**Formwork – Planning:** Overall Planning, Detailed planning, Standard units, Corner units, Schedule for column formwork, Formwork elements, Planning at Tender stage, Development of basic system, Calculation of labour constants, Costing, planning for maximum reuse, planning examples, Site layout plan, Crane arrangements, recheck plan details, planning for safety, Transporting plant, Wales and ties, Scaffold frames.

**Special forms:** Special Formwork, MIVAN Formwork, Shell forms, Design considerations, Loads, building forms, Strength requirements, Tunnel forming components, Curb and gutter forms, Invert forms, Arch forms.

Slip forms, Principles, Types, Advantages, Functions of various components, Planning, Safety in slip forms, Special structures built with slip form technique, Shuttering for Precast members and continuous casting forms.

**UNIT - IV**

**12 HOURS**

**Shores:** Shores, introduction, Tubular steel shores - Patented shores Horizontal shores, Ellis shores, Dayton sure grip and Baker Roof shores, Rosett Shoring, Safeway Symons shores, Dead shore, Raking and Flying shores.

**Scaffolding:** Introduction to Scaffolds, Basic scaffolding terminology, Scaffold Foundations, Erection and dismantling of scaffolds, Fall Protection, Accepted International Code, types of scaffolds - Putlog and independent scaffold, Single pole scaffolds, Truss suspended, Gantry and system scaffolds, General safety requirements, Safety nets, Precautions against particular hazards.

**REFERENCE BOOKS**

1. Robert L Hurd, M.K., Formwork for Concrete, Special Publication No.4, American Concrete Institute, Detroit, 1996

2. Michael P. Hurst, Construction Press, London & New York, 2003
3. Austin, C.K., Formwork for Concrete, Cleaver – Hume Press Ltd., London, 1996.
4. Peurifoy and Garold D. Oberlender, Formwork for Concrete Structures, McGraw – Hill, 1996.

### Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M22TE0203	CO1	3	3								2		3	2	1	
	CO2	3	3								2		3	2	1	
	CO3	3		3									3	1	2	
	CO4	3	3		3					2	2		3			
	CO5	3		3									3			
	CO6	3		3									3			

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO

<b>M22TES211</b>	<b>MODERN CONSTRUCTION MATERIALS AND SPECIAL CONCRETES</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3

**Prerequisite:** Concrete Technology

**COURSE OBJECTIVES:** Student will be able to learn

1. Properties and specifications of modern construction materials.
2. Different polymeric materials and its mechanism.
3. The knowledge on structural steels and corrosion effects on concrete.
4. Various corrosion removal techniques and polymer concrete composites.
5. Identify the properties and applications of high density and Fiber reinforced concrete
6. Different concreting techniques and types of concretes.

**COURSE OUTCOMES:** After successful completion of this course the student will be able to:

1. Familiar with properties and specifications of modern construction materials.
2. Understand various polymeric materials and its mechanism.
3. Attain knowledge on structural steels and corrosion effects on concrete.
4. Practical implementation of corrosion removal methodology.
5. Illustrate the properties and applications of High density and Fiber reinforced concretes.
6. Explain different concreting techniques and types of concretes.

#### UNIT-I

**12 HOURS**

**Construction Materials:** Classifications of Construction Materials. Consideration of physical, Mechanical, thermo-physical Properties, characteristics behaviour under stress, selection criteria for construction Materials, green building materials, waste products, reuse and recycling.

**Ceramic Materials:** Classification, Refractories, glass, glass wool, mechanical, thermal and electrical properties, fire resistance materials, Uses and application

#### UNIT-II

**12 HOURS**

**Polymeric Materials:** Polymerization mechanism and depolymerization. Rubber and plastics, properties, Effect of temperature on mechanical properties. Uses and application.  
Polymers in Civil Engineering, fibers and composites, Fiber reinforced plastic in Sandwich panels, modeling.

**UNIT-III****12 HOURS**

**Types of structural steels:** special steel, alloy steel, stainless steel, light gauge steel, Corrosion effect on concrete in various environments. Corrosion of reinforcing steel. Electro-chemical process, measures of protection. Structural elastomeric bearings and resilient seating. Moisture barriers, Polymer foams and polymers in Building Physics. Polymer concrete composites.

**UNIT-IV****12 HOURS**

**High density concrete:** Radiation shielding ability of concrete, materials for high density concrete, Fiber reinforced concrete: Fiber materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state.

**High Performance concrete:** constituents, mix proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete, Self Curing Concrete, Reactive powder concrete, Bacterial Concrete.

**REFERENCE BOOKS**

1. Rangawala S.C. Engineering Materials Chortor Publications 1991.
2. S.K. Duggal Building Materials, New Age International Publications 2006.
3. Bruntley L.R Building Materials Technology Structural Performance & Environmental Impact McGraw Hill Inc 1995.
4. R Chudley Construction Technology, Vol I - IV Longman Group Construction Ltd. 1973
5. Neville, A.M., Properties of Concrete, Pearson Education Asia (P) Ltd, England, 2000.
6. Mehta, P.K and Montevecic. P.J., Concrete- Microstructure, Properties and Materials, ICI, 1997.
7. Santhakumar, A.R, Concrete Technology, Oxford University Press, New Delhi, 2007.
8. Jackson, N., Civil Engineering Materials, ELBS, 1983.
9. Diamant, R.M.E., Thermal and Acoustic Insulation, Butterworths, 1986.
10. Vedhikizen Van Zanten, R., (Ed), Gerotextiles and Geomembranes in Civil Engineering.
11. Koerner, R.M., Construction and Geotechnical Methods in Foundation Engineering, McGraw Hill Co., 1985.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
<b>M22TES21 1</b>	CO1	3	3	3		1							2	3	3	3	2
	CO2	3	3	2	2	2							3	3	3	3	2
	CO3	3	3	2	2	2							2	3	3	1	2
	CO4	3	3	3	3	2							3	3	3	2	3
	CO5	3	3	3		2							2	3	3	1	3
	CO6	3	3	3									3	3	3	2	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TES212</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>	<b>RISK ANALYSIS AND DECISION MAKING</b>	<b>2</b>	<b>1</b>	<b>0</b>	<b>3</b>

**Prerequisite:** Basic understanding of probability and/or statistics, Construction project management

**COURSE OBJECTIVES:** Student will be able to learn

1. Identify and manage risks at the project level.

2. Discuss the process for developing a Risk Management Plan.
3. Risk identification and decision-theory tools are used to help select a best strategy and to manage risks throughout the project.
4. A variety of risk analysis concepts, tools and methodologies.
5. The tools and methodologies appropriate for decision making under uncertainty.
6. An up-to-date knowledge of risk management best practices in the AEC industry.

**COURSE OUTCOMES: After successful completion of this course the student will be able to**

1. Explain the key components of the construction industry risk management process
2. Develop actionable risk responses
3. Select an appropriate level of risk assessment based on project complexity
4. Understand techniques for assessing and analyzing risks, both qualitatively and quantitatively.
5. Understand the various risk premium policies
6. Set expectations with senior stakeholders of how risk management will improve cost and schedule performance and increase project predictability

**UNIT - I**

**12 HOURS**

**Introduction to Project Risk Management:** Project Risk Definition, Risk Impacts, Risk Events and Risk Conditions, Risk Management vs. Issues Management, Project Constraints, Managing Uncertainty, Project Manager's Role in Risk Management, Tailoring Risk Management, Sample Project - Case Study. Risk Tolerance, Risk Management Planning Meeting, Risk Categories, Risk Breakdown Structure.

**Risk Management Process:** Introduction to risk management, Owner and contractor perspectives on risk, the risk management process, Applying risk management throughout the project lifecycle, Roles and responsibilities.

**UNIT - II**

**12 HOURS**

**Risk Identification:** Major sources of risk, Risk identification methods – brainstorming, structured interviews, documentation review and risk checklists, Risk Register template Risk Breakdown Structure (RBS), Construction-focused Risk Checklist.

**Risk Response:** Risk Response goals, Using the Risk Characteristics in Risk Response Planning, Risk Responses Tools and Techniques, Developing risk response plans and actions, Examples of actionable risk responses, Project contingency.

**UNIT - III**

**12 HOURS**

**Risk Assessment:** The assessment process for identified risks, Risk Probability of Occurrence, Risk Impacts to Project objectives, selecting an appropriate risk assessment level for each project. Probability Impact Grid (PIG), Assessing Risk using a PIG, Utilizing the Risk Assessment tables, Recording assessment results in the Risk Register.

Qualitative Risk Analysis vs Quantitative Risk Analysis, Quantitative Risk Analysis Tools and Techniques, Sensitivity Analysis, Expected Monetary Value (EMV) Analysis, Decision-Tree Analysis, Decision-making Steps, Evaluating a Decision Tree. Monte Carlo Simulation. Artificial Intelligence (AI) and Other Developments in Decision Analysis.

**UNIT - IV**

**12 HOURS**

**Risk Mitigation:** Mitigation Guidelines, Responses for Opportunities, Risk Triggers, Residual Risks, Secondary Risks, Contingency Reserves, Contingency Reserves vs. Management Reserves.

Coverage of risk through CIDC's MOU with the Actuarial Society of India through risk premium such as Bidding Indemnity Policy (BIP), Delay in meeting obligation by client policy (DIMO), Settlement of claims policy (SOC), Loss of profit policy (LOP). Transit Insurance policy (TI), Loss of performance of construction equipment policy (LOPCE).

**Risk Monitoring:** Trigger Tracking, Trend Analysis, Retiring Risks, Tracking and reporting risks using the Risk Register, monitoring existing risks and execution of risk response plans and actions, Integrating risk status into regular project communications and reporting.

#### REFERENCE BOOKS

1. Managing Risk in Construction Projects, 3rd Edition, Nigel J. Smith, Tony Merna and Paul Jobling, Published February 2014, Wiley-Blackwell, 252 pages. ISBN: 978-1-118-34723-2.
2. Project Risk Analysis and Management Guide, John Bartlett, APM Publishing Limited, 2004 2<sup>nd</sup> Edition.
3. Industrial Engineering and Management of Manufacturing Systems, Dr. Surendra Kumar and Satya Prakashan.
4. RAMP Handbook- Risk Analysis and Management for Projects: A Strategic Framework for Managing Project Risk and Its Financial Implications, Institution of civil engineers and the faculty and institute of actuaries, Thomas Telford Publishing, London.
5. Construction Engineering and Management, Seetharaman. ISBN: 978-9-382-53309-2

#### Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
M22TES212	CO1	2					3		3		3		3			
	CO2				2		3		2		3					
	CO3				2		3		3		3		3		3	
	CO4					3	3				3			3		
	CO5								2				3			
	CO6						3									3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TES213</b>	<b>Sustainable Construction Engineering</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3
Internal Assessment: 50 Marks		Semester End Examination: 50 Marks (Minimum 20 Marks)			

**Prerequisite:** Building Materials and Constructions

**COURSE OBJECTIVES:** Student will be able to

1. Understanding the area of sustainability for research and Traditional Building Materials.
2. To sensitize about the various aspects of sustainable and green building design in the context of global warming and climate change.
3. Having a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from course.
4. Acquire knowledge on various aspects of green buildings and energy efficiency of structures.
5. To provide an insight into various Energy Efficient Materials and Sustainable Construction Technology.
6. Acquire knowledge on traditional Building Construction Technologies

**COURSE OUTCOMES:**

After successful completion of this course the student will be able to:

1. Work in the area of sustainability for research and Traditional Building Materials.
2. Know the various aspects of sustainable and green building design in the context of global warming and climate change.
3. Understand a broader perspective in thinking for sustainable practices by utilizing the engineering knowledge and principles gained from course.
4. Attain knowledge on various aspects of green buildings and energy efficiency of structures.
5. Utilize renewable energy conservation through material usage.
6. Understand the Traditional Building Construction Technologies and Technological interventions

**UNIT-I**

**12 HOURS**

**Introduction:** Need and concept of sustainability, social-environmental and economic sustainability concepts. Passive Design and Material Choice – Traditional Building Materials – Importance of envelope material in internal temperature control – Specification for walls and roofs in different climate – Material and Humidity Control.

**UNIT-II**

**12 HOURS**

**Basic concepts of sustainable habitat:** Green building, green materials for building construction, material selection for sustainable design, green building certification, methods for increasing energy efficiency of buildings, Sustainable cities, sustainable transport.

**Green Building Technologies:** Introduction- Necessity - Concept of Green building. Principles of green building – Selection of site and Orientation of the building – usage of low energy materials – effective cooling and heating systems – effective electrical systems – effective water conservation systems - Certification systems- Green Rating for Integrated Habitat Assessment (GRIHA) and Leadership in Energy and Environmental Design (LEED), case studies

**UNIT-III**

**12 HOURS**

**Recyclable and Renewable Materials:** Concept of Recyclable materials – Sustainable Building Materials – Life Cycle Design of Materials – Biodegradable & Non-Biodegradable Materials – Green rating and Building Materials – Concept of Resource reuse, Recycled content, Regional materials, Rapidly renewable materials – Fly ash bricks, Cement – Recycled Steel, Bamboo based products

**UNIT - IV**

**12 HOURS**

**Energy Efficient Technologies:** Energy Efficient Construction Technology – Filler Slab – Rat trap Bond – Technologies developed by CBRI.

Traditional Building Construction Technologies – Introduction to other Technological interventions to save Energy – Intelligent Buildings.

## REFERENCE BOOKS

1. Allen, D. T and shonamard, D. R., sustainability Engineering: Concepts, Design and Case studies prentice hall.
2. Shahane, V. S, "Planning and Designing Building", Poona, Allies Book Stall, 2004.
3. Tom Woolley, Sam Kimmins, Paul Harrison and Rob Harrison "Green Building Handbook" Volume I, Spon Press, 2001.
4. TERI "Sustainable Building Design Manual- Volume I & II" Tata Energy Research Institute, 2009.
5. Mili Majumdar, "Energy-efficient buildings in India" Tata Energy Research Institute, 2002
6. Thomas E Glavinich: Green Building Construction; Wiley, 2008.
7. Watson Donald, 'Climatic Design: Energy Efficient Building Principles & Practices', Mc Graw Hill Book company, New York, 1993.

## Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2	PSO 3	PSO 4
M22T ES213	CO1	1		3	3	3	2	3					3	3	3	3	2
	CO2	1		3	3	2	2	3					2	3	3	3	2
	CO3	1		3	2	3	2	3					2	3	3	1	2
	CO4	1		3	3	3	2	3					2	3	3	2	3
	CO5	1		3	3	3	2	3					2	3	3	1	3
	CO6	1		3	3	3	2	3					3	3	3	2	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TES221	QUANTITATIVE METHODS IN CONSTRUCTION MANAGEMENT	L	T	P	C
Duration: 16weeks		2	1	0	3
<b>Prerequisite:</b> Building Construction					
<b>COURSE OBJECTIVES:</b> Student will be able to learn					
<ol style="list-style-type: none"> <li>1. To study different methods of optimization</li> <li>2. To get a knowledge of modelling risk</li> <li>3. To get knowledge of optimization techniques</li> <li>4. To know the decision-making strategies related to projects</li> <li>5. To know the techniques for simulation in construction projects</li> <li>6. To know the rules of game theory</li> </ol>					
<b>COURSE OUTCOMES:</b> After successful completion of this course the student will be able to:					
<ol style="list-style-type: none"> <li>1. Formulate and solve the deterministic optimization problems.</li> <li>2. Model risk and uncertainty in construction projects.</li> <li>3. Apply decision theories for Transportation problems</li> <li>4. Apply stochastic optimization techniques for decision making under uncertainty.</li> <li>5. Forecast the data using quantitative methods</li> <li>6. Apply simulation techniques in construction projects</li> </ol>					
<b>UNIT-I</b>					<b>12 HOURS</b>

**Introduction and concepts of probability and statistics:** Probability: Conditional probability, Probability distributions (Normal, Bayesian, Poisson, Exponential), Probability density functions. Linear programming: Formulation of LP problems: Basic variables, constraints, corner points, augmented form, maximization and minimization problems. Solution methods: Graphical method, Algebraic method, Simplex method (Tabular and Matrix form). Integer linear programming.

**UNIT-II**

**12 HOURS**

**Transportation problems:** Transportation problem: Basic feasible solutions using N-W Corner rule, Minimum cost method, Vogel's approximation method. Optimal solutions using Stepping Stone Method, Modified distribution method. Assignment problems: Hungarian algorithm. Decision theory: Decision in certainty: Analytical hierarchy approach, Comparison Matrix, Consistency test, Oil exploration problem, Manpower planning problem. Probabilistic decision making: Expected value approach, sensitivity analysis on payoffs, Optimal decision strategy.

**UNIT-III**

**12 HOURS**

**Forecasting:** Quantitative methods-Time series (average method, moving average method, exponential smoothing, mean square error), Regression analysis. Qualitative methods.

**UNIT - IV**

**12 HOURS**

**Games theory simulations applied to construction:** n x m person zero sum games with finite strategies, Maximin & Minimax strategies, Saddle points, Rule of dominance. Simulation: Monte-Carlo Simulation, Sensitivity Analysis and Analytical Hierarchy Process (AHP).

**REFERENCE BOOKS**

1. Antil J.M., Civil Engineering Construction, McGraw Hill Book Co., 1982.
2. Peurifoy, R.L., Ledbetter, W.B., Construction Planning, Equipment and Methods, McGraw Hill Co., 2000.
3. Ratay, R.T., Hand Book of Temporary Structures in Construction, McGraw Hill, 1984.
4. Koerner, R.M., Construction & Geotechnical Methods in Foundation Engineering, McGraw Hill, 1984.
5. Varma, M., Construction Equipment and its Planning & Applications, Metropolitan Book Co., 1979.
6. Smith, R.C, Andres, C.K., Principles and Practice of Heavy Construction, Prentice Hall, 1986.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M22TES221	CO1	3	3					3	2			1	3			2
	CO2	3		3		3		2		2	1		3			2
	CO3	3					2		3	3	1		3			1
	CO4	3		3		3				3		1	3			2
	CO5	3					2		3	3	1		3			1
	CO6	3		3		3					3		1	3		

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TES222</b>		<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 12 weeks</b>	<b>REPAIR AND REHABILITATION OF STRUCTURES</b>	2	1	-	3
Internal Assessment: 50 Marks		Semester End Examination: 50 Marks (Minimum 20 Marks)			
<b>Prerequisite:</b> Advanced Concrete Technology					
<b>COURSE OBJECTIVES:</b> Student will be able to learn					
<ol style="list-style-type: none"> <li>1. To study the damages, repair and rehabilitation of structures</li> <li>2. To learn about the importance of Quality assurance in concrete</li> <li>3. To learn about effect of corrosion and prevention of corrosion in concrete</li> </ol>					



4. To learn different materials used for repair and maintenance
5. To learn different methods for SHM of civil engineering structures
6. To learn detailed procedure of retrofitting structures

**COURSE OUTCOME:** After successful completion of this course the student will be able to:

1. Explain the importance of maintenance assessment of distressed structures
2. Apply the knowledge on Quality assurance for concrete based on Strength and Durability
3. Identify various repair materials and advancements in concrete
4. Enhance their knowledge on concrete protection methods Structural health monitoring
5. Select Various strengthening and repair methods for different cases
6. Understand systems and methods for health monitoring of structures

**UNIT - I**

**12 HOURS**

**Maintenance and Repair Strategies:** Maintenance, Repair and Rehabilitation, retrofit and strengthening, need for rehabilitation of structures Facets of Maintenance, importance of Maintenance, routine and preventive maintenance, causes of deterioration

**UNIT - II**

**12 HOURS**

**Repair Materials and Special Concretes:** Repair materials-Variou repair materials, Criteria for material selection, Methodology of selection, Health and safety precautions for handling and applications of repair materials, Special mortars and concretes- Polymer Concrete and Mortar, Quick setting compounds, Grouting materials-Gas forming grouts, Sulfoaluminate grouts, Polymer grouts, Acrylate and Urethane grouts, Bonding agents-Latex emulsions, Epoxy bonding agents, Protective coatings-Protective coatings for Concrete and Steel, FRP sheets

**UNIT - III**

**12 HOURS**

**Protection Methods and Structural Health Monitoring:** Concrete protection methods – reinforcement protection methods- self-regulating anode - Corrosion protection techniques – Corrosion inhibitors, concrete coatings-Corrosion resistant steels, Coatings to reinforcement, cathodic protection, Structural health monitoring.

**UNIT - IV**

**12 HOURS**

**Repair, Rehabilitation and Retrofitting of Structures:** Cracks, different types, causes – Effects due to climate, temperature, Sustained elevated temperature, Corrosion Various methods of crack repair, Grouting, Routing and sealing, Stitching, Dry packing, Autogenous healing, Overlays, Repair to active cracks, Repair to dormant cracks. Corrosion of embedded steel in concrete, Mechanism, Stages of corrosion damage, Repair of various corrosion damaged of structural elements (slab, beam and columns) Jacketing, Column jacketing, Beam jacketing, Beam Column joint jacketing, Reinforced concrete jacketing, Steel jacketing, FRP jacketing, Strengthening, Beam shear strengthening, Flexural strengthening

**REFERENCES**

1. R.T. Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
2. Dayaratnam P. and Rao R., "Maintenance and Durability of Concrete Structures", University Press, India, 1997.
3. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
4. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"- Longman Scientific and Technical
5. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL)
6. B. Vidiveli, "Rehabilitation of Concrete Structures", Standard Publishers.

7. B.L. Gupta and Amit Gupta, "Maintenance and Repair of Civil Structures", Standard Publishers.
8. Gahlot and Sharma, "Building Repair and Maintenance Management", CBS Publishers.
9. Daniel Balageas, Claus-Peter Fritzen and Alfredo Guemes Structural Health Monitoring, Published by ISTE Ltd., U.K., 2006.

### Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3	PSO 4
M22TES22	CO1	2	1		2	1	2	3	2		1	3	3	1	1	3
	CO2	2	1		2	1	2	3	2		1	3	3	1	1	3
	CO3	2	1		2	1	2	3	2		1	3	3	1	1	3
	CO4	2			2	1	2	3	2		1	3	3	1	1	3
	CO5	2			2	1	2	3	2		1	3	3	1	1	3
	CO6	2			2	1	2	3	2		1	3	3	1	1	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TES223	<b>VALUE ENGINEERING AND MANAGEMENT</b>	L	T	P	C
Duration: 16weeks		2	1	0	3

**Prerequisite:** Basics of Civil Engineering

**COURSE OBJECTIVES:** Student will be able to learn

1. To prepare value engineering job plan.
2. The basic concept of function analysis for achieving the Value.
3. The knowledge of the life cycle costing of the civil engineering/ Construction projects.
4. To make the students to know about the Cost Control Monitoring and Accounting.
5. To forecast the capital.
6. To carry out value analysis.

**COURSE OUTCOMES:** After successful completion of this course the student will be able to

1. Discuss the concepts of value engineering, identify the advantages, applications.
2. Discuss various phases of value engineering. Analyse the function, approach of function and evaluation of function.
3. Understand the concepts of Value Engineering with emphasis on Functional Analysis and Life-Cycle Costing.
4. Appraise the value engineering operation in maintenance and repair activities.
5. Understand and apply Value Engineering problem solving techniques as a management tool.
6. Understand the use of Value Engineering in the construction industry.

#### UNIT - I

**12 HOURS**

**Introduction:** History of value engineering, Meaning of value, basic and secondary functions, case study discussions. Factor contributing to value such as aesthetic, ergonomic, technical, economic: identifying reasons or unnecessary costs Integrated approach to value and management.

**Value Analysis:** 10 Commandments of value analysis; value analysis team; principles of value analysis, elements of a job plan viz. orientation, Information, presentation. Implementation, follow up action, benefits of value

analysis, various applications; assessing effectiveness of value analysis.

**UNIT - II**

**12 HOURS**

**General Techniques:** Brainstorming Technique, The Gordon Technique, Feasibility Ranking, The Morphological Analysis Technique, ABC Analysis, Probabilistic Approach, Make or Buy Technique, Case Study Discussions.

**Special Techniques:** Function – Cost – Worth Analysis, Function Analysis System Technique - Technically oriented FAST and Customer oriented FAST, Weighted Evaluation Method - Equal Importance Method, Descending Order of Importance Method, Numeric Analysis - Forced Distribution Technique, Quantitative Method, Predetermined Minimum Method. Evaluation Matrix. Break-even Analysis. Life Cycle Cost (LCC), Case Study Discussions.

**UNIT - III**

**12 HOURS**

**Life Cycle Costing:** Cost models, life cycle costs. Forecasting of Capital as well as operating & maintenance costs, time value, present worth analysis, DCF methods, ROR analysis, and sensitivity analysis.

**Team Dynamics:** Team structure and team building, definition of the creative and structured phases of value engineering, the workshop approach to achieving value, target setting, time management, case study discussions.

**UNIT-IV**

**12 HOURS**

**Value Engineering level of Effort:** Value Engineering team, Co-Ordinator, designer, different services, definitions, value engineering case studies.

**Application of Value Engineering to a Construction Project:** Value Engineering during the planning phase of a construction project, Value Engineering during the design phase of a construction project, Value Engineering during the construction phase of a construction project.

**Valuation Report:** Valuation Report, contents, standard formats, Case study of anyone report.

**REFERENCE BOOKS**

1. Value Engineering Concepts, Techniques and Applications, Anil Kumar Mukhopadhyaya, Response Books, 2013.
2. Techniques of Value Analysis and Engineering, Lawrence D. Miles, McGraw-Hill Book Company, 2009.
3. Value Engineering: Analysis and Methodology, Del Younke.
4. Industrial Engineering & Management., O.P. Khanna, Dhanpat Rai Publications.
5. Industrial Organization & Engineering. Economics, T.R. Banga and S.C. Sharma, Khanna Publications.
6. Practical Information for Quantity Surveyors, Property valuers, Architects Engineers and Builders, P.T. Joglekar, Pune Vidyarthi Griha Prakashan, 2008.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3	PSO4
	CO1	3					3		3		2		2			
	CO2				2		2		2		3					

M22TES223	CO3				3		2				2		3		3	
	CO4					3	3				3					
	CO5								2				3			
	CO6						3		2						2	

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TES231	<b>APPLICATIONS OF IoT IN CIVIL ENGINEERING</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3
Internal Assessment: 50 Marks		Semester End Examination: 50 Marks (Minimum 20 Marks)			
<p><b>Prerequisite:</b> Strength of materials, Structural analysis, Concrete Technology</p> <p><b>COURSE OBJECTIVES:</b> Student will be able to learn</p> <ol style="list-style-type: none"> <li>1. Basics of Internet of Things, sensors &amp; their applications.</li> <li>2. Different IoT systems &amp; models</li> <li>3. Basics of networking, M2M communications &amp; programming.</li> <li>4. Broad applications of IoT in civil engineering &amp; construction industry</li> <li>5. Applications of IoT in safety enhancement</li> <li>6. Adoption of IoT in structural health monitoring</li> </ol> <p><b>COURSE OUTCOMES:</b> After successful completion of this course the student will be able to:</p> <ol style="list-style-type: none"> <li>1. Understand the basics of IoT, types of sensors &amp; devices used.</li> <li>2. Understand various IoT systems and models</li> <li>3. Understand the basics of networking for M2M communications &amp; programming</li> <li>4. Interpret the adoption of IoT in various civil engineering activities</li> <li>5. Apply concepts of IoT to enhance safety measures in construction field</li> <li>6. Illustrate the use of IoT &amp; MEMS in structural health monitoring</li> </ol>					
<b>UNIT-I</b>					<b>12 HOURS</b>
Internet of Things: Definition, scope, sensors for IoT applications, structure of IoT, IoT Map device, Industry Sensors: Definitions and Characteristics of first-generation sensors, advanced generation sensors, Integrated IoT sensors, Polytronics systems, Sensor Swarm, Printed Electronics and IoT generation Road Map					
<b>UNIT-II</b>					<b>12 HOURS</b>
Basics of Networking, Communication Protocols, Sensor Networks, Machine to Machine Communications, Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino					
<b>UNIT-III</b>					<b>12 HOURS</b>
Internet of Things devices and sensors for collecting job site data, construction crew management, construction equipment management, IoT adoption to enhance productivity, maintenance, safety and security in construction industry.					
<b>UNIT-IV</b>					<b>12 HOURS</b>
Structural health monitoring using Internet of Things and Microelectromechanical systems (MEMS) – introduction to MEMS, wireless sensor networks, smart sensors, Piezo sensors, Piezo generators & IoT, case studies of IoT & MEMS application in civil infrastructure projects.					
<b>REFERENCE BOOKS</b>					
<ol style="list-style-type: none"> <li>1. Ashwin Pajankar, Internet of Things with Arduino and Bolt, BPB Publications (2018)</li> <li>2. Krishnan Saravanan, Implementation and Deployment of IoT Projects in Smart Cities, IGI Global</li> </ol>					

Publications (2020)

3. Qusay F Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-IEEE Press (2018)
4. ICCCB 2020, Proceedings of the 18<sup>th</sup> International Conference on Computing in Civil and Building Engineering, Springer (2020)

### Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M22TES23 1	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3		2		2		2	2	1		1	3	1	3	2
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

M22TES232	DISASTER MITIGATION AND MANAGEMENT	L	T	P	C
Duration: 16weeks		2	1	-	3
<p><b>Prerequisite:</b> Design of Earthquake resistant structures</p> <p><b>COURSE OBJECTIVES:</b> Student will be able to learn</p> <ul style="list-style-type: none"> <li>• Concept of natural and manmade disasters and risks involved</li> <li>• Phases of disasters and preparedness</li> <li>• Structural Aspects of DPR</li> <li>• Disaster life cycle, planning and preparations</li> <li>• Disaster management scenario in Indian context</li> <li>• Policy guidelines for disaster mitigation</li> </ul> <p><b>COURSE OUTCOMES:</b> After successful completion of this course the student will be able to:</p> <ul style="list-style-type: none"> <li>• Thorough understanding of natural and manmade disasters and risks involved and implementation</li> <li>• Design for preparedness to manage disasters</li> <li>• Master plan the DPR</li> <li>• Plan and prepare for Disaster life cycle</li> <li>• Manage the disasters with available resources in Indian scenario</li> <li>• Design the India's Vulnerability profile</li> </ul>					
<b>UNIT-I</b>					<b>12 HOURS</b>
<p><b>Concepts of Hazard:</b> Vulnerability, Risks, Natural Disasters (earthquake, Cyclone, Floods, Volcanoes), and Man-Made Disaster (Armed conflicts and civil strip, Technological disasters, Human Settlement, Slow Disasters (famine, draught, epidemics) and Rapid Onset Disasters (Air Crash, tidal waves, Tsunami) Risks, Relationship between Disasters and Development and vulnerabilities, different stake holders in Disaster Relief. Refugee operations during disasters, Human Resettlement and Rehabilitation issues during and after disasters, Inter-sectoral coordination during disasters, Models in Disasters.</p>					
<b>UNIT-II</b>					<b>12 HOURS</b>
<p><b>Disaster Risk Reduction Strategies:</b> Disaster Cycle, Phases of Disaster, Preparedness Plans, Action Plans and Procedures, Early warning Systems Models in disaster preparedness, Components of Disaster Relief- (Water, food, sanitation, shelter, Health and Waste Management), Community based DRR, Structural</p>					

nonstructural measures in DRR  
 DRR Master Planning for the Future, Capacity Building, Sphere Standards. Rehabilitation measures and long-term reconstruction. Psychosocial care provision during the different phases of disaster

**UNIT-III**

**12 HOURS**

**Medical Management:** Introduction to disaster medicine, Various definitions in disaster medicine, Disaster life cycle, Disaster planning, Disaster preparation, Disaster recovery in relation to disaster medical management, Medical surge, Surge capacity, Medical triage, National Assessing the nature of hazardous material - Types of injuries caused, Self-protection contaminated area and decontaminated area – Pre hospital medical management of victims – Polytrauma Care - Specific treatment in emergency and Intensive Care Units – allocation of specialists in Local EMS System including equipment, safe use of equipment

**UNIT-IV**

**12 HOURS**

**Hazard and Vulnerability Profile of India:** Disaster Management Indian scenario, India’s vulnerability profile, Disaster Management Act 2005 and Policy guidelines, National Institute of Disaster Management, , National Disaster Response Force (NDRF)National Disaster Management Authority, States Disaster Management Authority, District Disaster Management Authority Cases Studies : Bhopal Gas Disaster, Gujarat Earth Quake, Orissa Super-cyclone, south India Tsunami, Bihar floods, Plague-Surat, Landslide in North East, Heat waves of AP & Orissa, 278 Cold waves in UP. Bengal famine, best practices in disaster management, National Flood Risk Mitigation Project (NFRMP), Mines Safety in India, Indian Meteorological Department, National Crisis Management Committee, Indian National Centre for Oceanic Information System (INCOIS)

**REFERENCE BOOKS**

1. Disaster Management Guidelines. GOI-UNDP Disaster Risk Reduction **Programme** (2009-2012.)
2. Disaster Medical Systems Guidelines. Emergency Medical Services Authority, State of California, EMSA no.214, June 2003
3. Guerisse P. 2005 Basic Principles of Disaster Medical Management. Act Anaesth.Belg;56:395-401
4. Aim and Scope of Disaster Management. Study Guide prepared by Sharman and Hansen. UW-DMC, University of Washington.
5. Sphere Project (2011). Humanitarian Charter and Minimum Standards in Disaster Response.

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PS O1	PS O2	PS O3	PSO 4
M22TES232	CO1	3	3						2		3		3			3
	CO2	3	3	3					2		3		3		1	
	CO3	3	3						2		3		3		2	
	CO4	3	3	3					2		3		3			3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TES233</b>	<b>Environmental Impact Assessment and Management</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		2	1	-	3

**Prerequisite:** Environmental Engineering

**COURSE OBJECTIVES:** Student will be able to learn

1. Concepts of environmental impact assessment
2. Broad components of Environmental Impact Assessment.

3. Unique pollution problems and public participation
4. How to implement methodologies for assessment
5. Measurement of environmental impact and organisation
6. Environmental management, principles and strategies

**COURSE OUTCOMES:** After successful completion of this course the student will be able to:

1. Implement the assessment techniques for environmental impact
2. Quantify impacts for various developmental projects
3. Measure the pollution level and suggest solution to the problems and public participation
4. Organise systematically to implement the methodologies for assessment
5. Understand the phenomena of Impacts on environment
6. Apply the principles and strategies for environmental management

#### UNIT-I

**12 HOURS**

**Environmental impact assessment (EIA):** Introduction, definitions and concepts, rationale and historical development of EIA, EIA for civil engineers.

Broad components of EIA: Initial environmental examination, environmental impact statement, environmental appraisal, environmental impact factors and areas of consideration.

#### UNIT-II

**12HOUR**

**Broad components of EIA:** Pertinent institutional information, unique pollution problems, existing visual quality, public participation techniques, Composite consideration, potential cultural resources, potential visual impacts, geographical study area.

Status of EIA in India: EIA Regulations in India, TOR for Hydropower Projects and other projects. Case studies from hydropower projects, hazardous industries and mining.

#### UNIT-III

**12 HOURS**

**Methodologies:** Measurement of environmental impact, organization, scope and methodologies of EIA pertinent environmental factors. Six generic steps, descriptive checklists, simple interaction matrix, stepped matrix, uniqueness ratio, habitat evaluation system. Public involvement techniques, comprehensive environmental impact study, various project types, archaeological properties, leachate testing, evaluation species, proposing agency, EIA Models.

#### UNIT-IV

**12 HOURS**

**Environmental Management:** Principles, problems and strategies; Review of political, ecological and remedial actions. Future strategies; multidisciplinary environmental strategies, the human, planning, decision-making and management dimensions.

**Environmental audit:** Definitions and concepts, partial audit, compliance audit, methodologies and regulations.

#### **REFERENCE BOOKS**

1. Canter, R.L., "Environmental Impact Assessment", McGraw Hill Inc., New Delhi, 1996.
2. Shukla, S.K. and Srivastava, P.R., "Concepts in Environmental Impact Analysis", Common Wealth Publishers, New Delhi, 1992.
3. John G. Rau and David C Hooten "Environmental Impact Analysis Handbook", McGraw Hill Book Company, 1990.
4. Environmental Assessment Source book, Vol. I, II & III. The World Bank, Washington, D.C., 1991.
5. Judith Petts, "Handbook of Environmental Impact Assessment Vol. I & II", Blackwell Science, 1999.

#### Mapping of Course Outcomes with Programme Outcomes

Course Code	POS/C Os	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PSO 1	PSO 2	PSO 3	PSO 4
<b>M22TES 233</b>	CO1			3			2	2	1	1			3			1
	CO2	2	3			3	3	3			3		3			

	CO3	3		3		2	1		3	2		2	3	2		2
	CO4	3		3	3	2	1			3			3	2		2
	CO5	2	3			3	3	3			3		3			
	CO6	3		3	3	3		2	3				3			3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

<b>M22TE0204</b>	<b>Mini Project-II</b>	<b>Practical/Report</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
			<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>

The student is required to carry out a mini project individually and Project Management on small buildings using MS Project and Primavera software.

<b>M22TE0205</b>	<b>CONSTRUCTION SOFTWARE LAB</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>Duration: 16weeks</b>		<b>1</b>	<b>0</b>	<b>1</b>	<b>2</b>

**Prerequisite:** Construction Project Management, Estimation and Costing

**COURSE OBJECTIVES:** Student will be able to learn

1. Importing and exporting data
2. Project management modules
3. Prepare the resource sheet, assign and level the resource
4. Linking the project management and Contract manager modules
5. Transferring the data to Primavera Contractor users
6. Plot the variance graphs for the given Project

**COURSE OUTCOMES:** After successful completion of this course the student will be able to:

1. To plan the building and scheduling for multi-storeyed building
2. Prepare the resource sheet, assign and level the resource
3. To plan and schedule the road projects
4. To prepare resource sheet and assign the level of resources
5. Transfer the data to Primavera Contractor users
6. Plot the variance graphs for the assigned Projects

**MS PROJECT SOFTWARE:**

1. Basics and application of MS Project Software
2. Planning and Scheduling of single storied and two storied building
3. Planning and scheduling of Road Project

**PRIMAVERA SOFTWARE:**

**Basics and application of Primavera software referring the Primavera Manual and solving the problems as following:**

1. Planning and Scheduling of Multi storeyed building
2. Planning and scheduling of Road Project
3. Prepare the resource sheet, assign and level the resource



4. Preparing different reports available in Primavera
5. Plot the variance graphs for the given Project

**REFERENCE:**

Primavera® P6™ Project Management Reference Manual

**Mapping of Course Outcomes with Programme Outcomes**

Course Code	PO/CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PS O1	PS O2	PS O3	PS O4
M22TE0205	CO1	3	3	2	3		2	2	1	1			3	3	2	1
	CO2	3	3	2	3		2	2	1	1			3	3	2	1
	CO3	3	2	3	3	2	1		3	2		2	3	3	1	2
	CO4	3	3	3	3	2	1			3			3	3	2	2
	CO5	3	2	3	3	3		2	3				3	3	2	3
	CO6	3	2	3	3	3		2	3				3	3	2	3

Where, 1 (Low), 2 (Medium) and 3 (High) represents strength of correlation between CO and PO.

**THIRD SEMESTER**

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TE0N01	MOOC/SWAYAM Online Course	OE	B. E/ B. Tech. in Civil Engineering	3	1	0	4	--
2	M22TE0301	Internship with Report	Practical/Term Work and Viva - Voce		2	0	4	6	--
3	M22TE0302	Dissertation Phase-I	Practical/ Report and Viva - Voce		2	0	4	6	--

1. Students will have to choose an online course offered in MOOC/SWAYAM/COURSERA; this course will enhance additional knowledge studying online course of student's choice
2. Students have to undergo Internship in reputed companies for a minimum period of three months and gain the field related challenges and make himself/herself industry ready
3. During third semester students will be allotted Supervisor/Guide for carrying out dissertation for the full fourth semester term. Identification of dissertation topic, deciding the objectives and Literature review will be done with the discussion with their supervisor/guide.

**FOURTH SEMESTER**

Sl. No	Course Code	Title of the Course	Practical /Term Work / Sessions	Pre requisite	Credit Pattern & Credit Value				Contact Hours
					L	T	P	Total	
1	M22TE0401	Technical Seminar with Report	Practical/Term Work		0	0	2	2	--

2	M22TE0402	Dissertation Phase-II	Practical/ Thesis Submission and Viva-Voce		2	0	8	10	--
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1. The student is required to deliver a seminar and submit a report on the latest development in the construction technology and management
2. Elaborate studies on their dissertation work with regard to experimental/analytical/software-based investigations, preparing the dissertation report as per university regulations and publication of a paper in reputed journals