REVA UNIVERSITY
Bengaluru, India

SCHOOL OF CIVIL ENGINEERING

HANDBOOK

M. Tech. in Computer Aided Structural Engineering

2020-22

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Rukmini Educational
Charitable Trust

www.reva.edu.in

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 inter-disciplinary 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 Centres” 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 endeavour 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

The B. Tech in Civil Engineering is designed keeping in view the current situation and possible future developments, both at national and global levels. This course is designed to give greater emphasis on core Civil Engineering. There are ample number of courses providing knowledge in specialized areas of Structural Engineering, Water Resources Engineering, Transportation Engineering, Geotechnical Engineering, Surveying and Environmental Engineering etc. facilitating students to choose specialized areas of their interest. Adequate attention is given to provide students the basic concepts.

Civil engineering is one of the earliest to start among the core subjects. The structure of the course has undergone a face-lift with the introduction of subjects from latest advanced subjects like Town Planning, Urban Transport Planning, Prestressed & Precast Structures, Solid Waste Management, Industrial Waste Water Treatment etc. Thus the Civil Engineering stream is designed to provide you with several options to choose from for your later years. The Indian government having plans to adopt make in India concept in this major is infrastructure development. Hence Infrastructure development sector offers lots of job opportunities for well qualified graduates.

The program is thus designed to expose students to various subjects having hand on applications in planning, design & construction, through outcome based teaching and learning process which emphasizes practical exposure rather than memorization. A variety of activities such as mini projects, seminars, interaction with industries, cultural activities and social activities are in place to shape the all-round development of students.

If you are interested in any one of the following, then Civil Engineering is the option you should consider.

Structural Engineering- to analyze and design structures, to implement earthquake resisting structures, to maintain quality of construction, to design eco-friendly buildings etc.

Water Resources Engineering - To solve the water for drinking, irrigation etc. To study ground water exploration and recharge.

Transportation Engineering- To resolve the current traffic problems and plan for the future requirements of the society.

Environmental Engineering - To assure and supply the quality drinking water for people and for industries. To protect environment form the air pollution, solid water management and waste water disposal.

Geotechnical Engineering- To study and testing of soils to improve the safe bearing capacity of the soils so that the structure will be safe.

The benefits of choosing Civil Engineering are:

Flexibility to choose various fields upon 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 Computer Aided Structural Engineering in REVA University will enjoy the curriculum, teaching and learning environment, the vast infrastructure and the experienced teachers involvement and guidance The cirruculum caters to and has relevance to local, regional, national, global developmental needs. We will strive to provide all needed comfort and congenial environment for their studies. Maximum number of courses are integrated with cross cutting issues with relevant to professional ethics, Gender, human values, environment and Sustainability. I wish all students pleasant stay in REVA and grand success in their career. 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 fulfil 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 27thFebruary, 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 centre, 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 Censor 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, Nana 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, Counsellors 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 recognised as a Centre of Skill Development and Training by NSDC (National Skill Development Corporation) under Pradhan Mantri Kaushal VikasYojana. 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 facilitates 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 organises 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 recognised 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 centres

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 have 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 endeavours. 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 calibre, who would be committed to their profession with ethics, will be able to contribute to Civil Engineering and allied fields through research and innovation and 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.

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

BOARD OF STUDIES COMMITTEE

BOS MEMBERS LIST FOR M TECH COMPUTER AIDED STRUCTURAL ENGINEERING			
Sl. No.	**Name, Designation & Affiliation**	**Status**	**Correspondence Address**
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13	Vishwas L Student, REVA University	Current Student	Rukmini Knowledge park, REVA University, Yelahanka, Bengaluru-560064 (M): 8197181425 Email: r19mce16@ce.reva.edu.in

Program Overview

M.Tech. Computer Aided Structural Engineering or Master of Technology in Computer Aided Structural Engineering is a two-year postgraduate course. Computer Aided Structural Engineering is an innovative program, focused on the combination of recent advances made in the field of structural engineering. This combination allows structural engineer the flexibility and freedom for a better understanding of structural behaviour with material and geometric non-linearity and loading uncertainties. The course provides an excellent grounding in the fundamentals of structural engineering subjects. The course is suitable for those who want to have in-depth knowledge of mathematical modelling and computational methods in the areas of non-linear, static and dynamic analysis of structures

Employment Areas, Academic Institutions, Design Consultancy, Airports, Highways, Railways, IT Companies, Government jobs and Entrepreneurship

Program Educational Objectives (PEO's)

The programme educational objectives of the Computer Aided Structural Engineering 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 successfully solve engineering problems associated with the lifecycle of Civil Engineering system, in particular structural engineering by communicating effectively either leading a team or as a team member with ethical practices.

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)

On successful completion of the program, the graduates of M.Tech CE (Computer Aided Structural Engineering) program will be able to:

PO1. Demonstrate in-depth knowledge of computer aided structural Engineering, including wider and global perspective, with an ability to discriminate, evaluate, analyze 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 structural 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 computer aided structural Engineering.

PO4. Extract information pertinent to unfamiliar problems through literature survey and experiments, apply appropriate research methodologies, techniques and tools, design, conduct experiments, analyze 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 computer aided structural Engineering.

PO5. Create, select, learn and apply appropriate techniques, resources, and structural 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 structural Engineering 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 economical and financial factors.

PO8. Communicate with the engineering community, and with society at large, regarding complex Structural 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)

On successful completion of the program, the graduates M.Tech CE (Computer Aided Structural Engineering) program will be able to:

PSO-1: Apply knowledge of Structural Engineering and management in real time.

PSO-2: Analyse a system, component or process in the knowledge areas of Structural Engineering in real time problems.

PSO-3: Design a system, component, or process in more than one areas of Structural Engineering.

PSO-4: Conduct investigations and address complex Structural Engineering problems; Utilize and develop innovative tools and techniques that are appropriate in discipline. Structural Engineering.

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 2020-21 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 2020-21 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 2020-21

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:

L	**Lecture**
T	**Tutorial**
P	**Practice**

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 / analysing /exploring a real life situation / difficult problems 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	**Full Time** – 4 Semesters (2 years) **Part Time** – 6 Semesters (3 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.
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.
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	**Full Time** – 4 Semesters (2 years) **Part Time** – 6 Semesters (3 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.
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

Table -2: Credit Pattern

Lectures (L)	Tutorials (T)	Practice (P)	Credits (L:T:P)	Total Credits	Total Contact Hours
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 C**ourses of Study**:

Different C**ourses of Study** are labelled 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 enrol 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 happens 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	1st Week to 8th Week	First 50% (two units)		Instructional process and Continuous Assessment
	Last 3 days of 8th Week		25%	Consolidation of IA1
IA2	9th week to 16th week	Second 50% (remaining two units)		Instructional process and Continuous Assessment
	Last 3 days of 16th week		25%	Consolidation of IA2
SEE	17th and 18th week			Revision and preparation for Semester end examination
	19th week to 20th week	Entire syllabus	50%	Conduct of semester end examination and Evaluation concurrently
	21st week			Notification of Final Grades
***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 21st week**				

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
	Total	**100 marks**

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
	Total	**50 marks**

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 includes performance in the conduction of experiment and write up about the experiment.	20 marks
	Total	**50 marks**

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 (Si) = ∑(Ci x Gi) / ∑Ci

Where Ci is the number of credits of the ith course and Gi is the grade point scored by the student in the ith 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 ÷ 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 = ∑(Ci x Si) / ∑Ci

Where Si is the SGPA of the ith semester and Ci 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
Cumulative	**72**		635.4

Thus, **CGPA** = $\frac{22x8.36+22x8.54+16x9.35+12x9.50}{72}$ = 8.83

13.3 **Conversion of Grades into Percentage:**

Conversion formula for the conversion of CGPA into Percentage is:

Percentage of marks scored = CGPA Earned x 10

Illustration: CGPA Earned 8.83 x 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 >= CGPA 10	10	O	Outstanding	Distinction
8 >= CGPA < 9	9	A+	Excellent	
7 >= CGPA < 8	8	A	Very Good	First Class
6 >= CGPA < 7	7	B+	Good	
5.5> = CGPA < 6	6	B	Above average	Second Class
> 5 CGPA < 5.5	5.5	C+	Average	
> 4 CGPA <5	5	C	Satisfactory	Pass
< 4 CGPA	0	F	Unsatisfactory	Unsuccessful

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 tests 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.

REVA UNIVERSITY
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SCHOOL OF CIVIL ENGINEERING
M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2020-2022)
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	M20TB0101	Advanced Design of foundations	HC	BE / B. TECH in Civil Engineering	2	1	-	3	4
2	M20TB0102	Advanced Design of RC Structures	HC		2	1	-	3	4
3	M20TB0103	Advanced Solid Mechanics	HC		2	1	-	3	4
4	M20TB0104	Computational Structural Dynamics	HC		2	1	-	3	4
5	M20TB0105	Computational Structural Mechanics	HC		2	1	-	3	4
6	M20TB0106	Finite Element Method of Analysis	HC		2	1	-	3	4
7	M20TB0108	Mini Project-I	Practical/ Report		0	0	2	2	2
	TOTAL							**20**	**26**
	Practical								
8	M20TB0107	Structural Engineering Laboratory-I (Concrete Laboratory)	Practical		0	0	2	2	3
	TOTAL							**02**	**03**
	TOTAL SEMESTER CREDITS							**22**	
	TOTAL CUMULATIVE CREDITS							**22**	
	TOTAL CONTACT HOURS							**29**	

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(2020-2022)
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	M20TB0201	Advanced Design of Steel Structures	HC	BE / B. TECH in Civil Engineering	2	1	-	3	4
2	M20TB0202	Structural Health Monitoring	HC		2	1	-	3	4
3	M20TBS211	Advanced Structural Analysis with MATLAB	SC		2	1	-	3	4
	M20TBS212	Design of Bridges	SC		2	1	-	3	4
4	M20TBS221	Design of Tall Structures	SC		2	1	-	3	4
	M20TBS222	Special Concretes	SC		2	1	-	3	4
5	M20TBS231	Applications of IoT in Civil Engineering	SC		2	1	-	3	4
	M20TBS232	Design of Earthquake Resistant Structures	SC		2	1	-	3	4
6	M20TBS241	Advanced Design of Prestressed concrete	SC		2	1	-	3	4
	M20TBS242	Reliability Analysis and Design of Structures	SC		2	1	-	3	4
7	M20TB0204	Mini Project-II	Practical/ Report		0	0	2	2	2
	TOTAL							**20**	**26**
	Practical								
8	M20TB0203	Structural Engineering Laboratory-II(software Lab	Practical		0	0	2	2	3
	TOTAL							**02**	**03**
	TOTAL SEMESTER CREDITS							**22**	
	TOTAL CUMULATIVE CREDITS							**44**	
	TOTAL CONTACT HOURS							**29**	

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SCHOOL OF CIVIL ENGINEERING
M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2020-2022)
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	M20TBON01	MOOC/SWAYAM Online Course	ON	BE / B. TECH in Civil Engineering	3	1	0	4	--
2	M20TB0301	Internship with Report	Practical/ Term Work and Viva - Voce		2	0	4	6	--
3	M20TB0302	Project Phase-I	Practical/ Report and Viva -Voce		2	0	4	6	--
TOTAL								**16**	
TOTAL SEMESTER CREDITS								**16**	
TOTAL CUMULATIVE CREDITS								**60**	
TOTAL CONTACT HOURS								**--**	

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Bengaluru, India

Rukmini Knowledge Park, Kattigenahalli, Yelahanka, Bengaluru-560064

SCHOOL OF CIVIL ENGINEERING

M. Tech in COMPUTER AIDED STRUCTURAL ENGINEERING
(2020-2022)
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	M20TB0401	Dissertation Phase-II	Practical/ Term Work		2	0	6	8	--
2	M20TB0402	Technical Seminar With Report	Practical/ Thesis Submission and Viva-Voce		0	0	4	4	--
TOTAL								**12**	
TOTAL SEMESTER CREDITS								**12**	
TOTAL CUMULATIVE CREDITS								**72**	
TOTAL CONTACT HOURS								**--**	

FIRST SEMESTER

M20TB0101	ADVANCED DESIGN OF FOUNDATIONS	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Geotechnical Engineering

COURSE OBJECTIVES: Student will be able to learn

1. To learn method of estimating bearing capacity and design of shallow foundations
2. To learn to design different types of footing
3. To learn design of raft and pile foundations
4. To learn caisson types and stability of caissons
5. To learn types of machines and foundations
6. To learn the mechanism of liquefaction and design of block foundation

COURSE OUTCOME:

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

1. Estimate bearing capacity and design of shallow foundations
2. Design different types of footing
3. Design of raft and pile foundations
4. Stabilize the caisson foundations with different types
5. Design the machine foundations
6. Implement the mechanism of liquefaction for designs

UNIT-I	12HOURS

Shallow Foundations: Methods for bearing capacity estimation, total and differential settlements of footing and raft, code provisions. Design of individual footings, strip footing, combined footing, rigid and flexible mat, buoyancy raft, basement raft, underpinning.

UNIT-II	12HOURS

Pile Foundations: Estimation load carrying capacity of single and pile group under various loading conditions. Pile load testing (static, dynamic methods and data interpretation), settlement of pile foundation, code provisions, design of single pile and pile groups, and pile caps.

UNIT-III	12HOURS

Well Foundations: Types, components, construction methods, design methods (Terzaghi, IS and IRC approaches), check for stability, base pressure, side pressure and deflection.

UNIT-IV	12HOURS

Soil-Foundation Interaction: Idealized soil, foundation and interface behaviour. Elastic models of soil behaviour; Elastic-plastic and time dependent behaviour of soil. Beams and plates on elastic foundation; numerical analysis of beams and plates resting on elastic foundation.

REFERENCE BOOKS

1. A.P.S. Selvadurai, "Elastic Analysis of Soil-Foundation Interaction", Elsevier Scientific Publishing Company.
2. Braja M. Das, "Principles of Foundation Engineering", PWS Publishing Company.
3. Joseph Bowles, "Foundation Analysis and Design", McGraw-Hill Book Company.
4. V.N.S. Murthy, "Advanced Foundation Engineering", CBS Publishers and Distributors. A joint venture by IISc and IITs, funded by MH

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB0101	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
	CO5	2	1	3				2				2		1	3	2
	CO6	1	2	3		2								1	3	2

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

M20TB0102	ADVANCED DESIGN OF RC STRUCTURES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Design of RCC Structural Elements

COURSE OBJECTIVES: Student will be able to learn

1. To design RC slabs by using yield line analysis by Specified methods.
2. To Analyze RC Slabs for Different shapes with different Edge Condition.
3. To design grid floors, continuous beams and flat slabs.
4. To design chimneys, silos and bunkers.
5. To learn the detailing of Earthquake Resistant Structures and
6. To design Elevated water tanks.

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

1. Is able to design RC slabs by using yield line analysis.
2. Is able to Analyse and design Rectangular and circular RC Slabs for different edge conditions.
3. Is able to design grid floors, continuous beams and flat slabs.
4. Is able to design chimneys, silos and bunkers.
5. Has learnt about the detailing of earthquake resistant structures and.
6. Is able to Analyze and design elevated water tanks by LMS method.

UNIT-I	12 HOURS

Yield line theory for analysis of slabs: Equilibrium and virtual work methods of analysis, yield line patterns.
Analysis of Rectangular slabs with i) with simply supported on all four edge conditions
ii) With all edges fixed conditions
Analysis of Circular slabs with simply supported and fixed end conditions

UNIT-II	12 HOURS

Design of grid floors
Design of continuous beams with redistribution of moments
Design of flat slabs

UNIT-III	12 HOURS

Design of Chimneys
Design of Silos and
Design of Bunkers

UNIT-IV	12 HOURS

Art of detailing earthquake resistant structures, Expansion and contraction joints
Design of elevated water tanks by limit state method

REFERENCE BOOKS

1. Lin, TY and Burns, N H. "**Reinforced Concrete Design**".
2. Kong, KF and Evans, T H. "**Design of Prestressed Concrete Structures**
3. Varghese, "P.C. **Advanced Reinforced Concrete Design**", Prentice-Hall of India, New Delhi, 2005.
4. Punmia, B.C.Ashok Kumar Jain and Arun Kumar Jain, **"Comprehensive RCC Design"**
5. Bhavikatti, "**Advanced design of R C Structures**."

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB0102	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3	1	2		3	3					3	3	3	1	1
	CO3	3		2		2		2	2	1		1	3	1	3	2
	CO4	3		2		2		2	2	1		1	3	1	3	2
	CO5	3		3				2	2			2	3	1	2	2
	CO6	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.

M20TB0103		L	T	P	C
Duration: 16weeks	ADVANCED SOLID MECHANICS	2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Strength of Materials

COURSE OBJECTIVES: Student will be able to learn

1. To analyze stress and strain at a point in Cartesian coordinate system.
2. To analyze stress and strain at a point in polar coordinate system.
3. To learn the application of equilibrium and compatibility equations and boundary conditions for two dimensional problems.
4. To solve 2D problems of elasticity by Airy's stress function approach.
5. To evaluate the failure of materials based on yield criteria.
6. To evaluate the fracture of brittle materials.

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

1. Analyze stress and strain at a point in Cartesian coordinate system.
2. Analyze stress and strain at a point in polar coordinate system.
3. Apply of equilibrium and compatibility equations and boundary conditions for two dimensional problems
4. Solve 2D problems of elasticity by Airy's stress function approach.
5. Evaluate the failure of materials based on yield criteria.
6. Evaluate the fracture of brittle materials.

UNIT-I	12 HOURS

Introduction Assumptions, Applications and Concept of Theory of Elasticity,

Stress and strain at a point, components of stress and strain at a point in Cartesian and polar co-ordinates. Equilibrium, compatibility equations and boundary conditions in 2-D and 3-D cases(Cartesian and Polar Coordinates)

UNIT-II	12 HOURS

Principal stresses and principal strains, invariants of stress and strain, hydrostatic and deviatoric stress, spherical and deviatoric strains, maximum shear strain, strain rosettes.

UNIT-III	12 HOURS

Plane stress and plane strain: Airy's stress function approach to 2-D problems of elasticity, simple problems of bending of beams.
Elementary problems of elasticity in three dimensions, stretching of a prismatic bar by its own weight, twist of circular shafts, torsion of non-circular sections, membrane analogy.

UNIT-IV	12 HOURS

Theory of Plasticity
Stress – strain diagram in simple tension, perfectly elastic, Rigid – Perfectly plastic, Linear work – hardening, Elastic Perfectly plastic, Elastic Linear work hardening materials,
Failure theories, yield conditions, stress – space representation of yield criteria through Westergaard stress space, Tresca and Von-Mises criteria of yielding.

Fracture Mechanics
Introduction, Importance, Quasi brittle materials, Review of concrete behaviour in tension and compression, Linear Elastic Fracture Mechanics – Griffith and Irwin theories

REFERENCE BOOKS

1. Timoshenko & Goodier, "**Theory of Elasticity**", McGraw Hill
2. Srinath L.S., **Advanced Mechanics of Solids**, 10th print, Tata McGraw Hill Publishing company, New Delhi, 1994
3. Sadhu Singh, "**Theory of Elasticity**", Khanna Publishers
4. Verma P.D.S, "**Theory of Elasticity**", Vikas Publishing Pvt. Ltd
5. Chenn W.P and Hendry D.J, "**Plasticity for Structural Engineers**", Springer Verlag
6. Valliappan C, "**Continuum Mechanics Fundamentals**", Oxford IBH Publishing Co. Ltd.
7. Sadhu Singh, "**Applied Stress Analysis**", Khanna Publishers
8. Govindaraju L and Sitharam G, "Applied Elasticity", Interline Publishers
9. XiLu, "Theory of Elasticity", John Wiley.

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	PO 10	PO 11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB 0103	CO1	3	2	2		1			1		1	1	3	3	1	2
	CO2	3	2	2		1			1		1	3	3	3	1	2
	CO3	3	2	2		1			1		1	3	3	3	1	2
	CO4	3	2	2		1			1		1	3	3	3	1	2
	CO5	3	2	2		1			1		1	3	3	2	1	3
	CO6	3	2	2		1			1		1	3	3	1	2	3

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

M20TB0104	COMPUTATIONAL STRUCTURAL DYNAMICS	L	T	P	C
Duration: 16weeks		2	1	-	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)				

Prerequisite: Engineering Mechanics, Structural Analysis II

Course Objectives: Student will be able to learn

1. To learn the concepts and principles of structural mechanics
2. To frame mathematical models of SDOF systems and analyse the corresponding free vibration response of damped and undamped systems
3. To frame mathematical models of MDOF systems and analyse the corresponding free vibration response of damped and undamped systems
4. To frame mathematical models of SDOF systems and analyze the corresponding forced vibration response of damped and undamped systems
5. To frame mathematical models of MDOF systems and analyze the corresponding forced vibration response of damped and undamped systems
6. To learn about principle of vibration-measuring instruments and evaluation of damping

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

1. Has learnt the concepts and principles of structural mechanics
2. Is able to frame mathematical models of SDOF systems and analyse the corresponding free vibration response of damped and undamped systems
3. Is able to frame mathematical models of MDOF systems and analyse the corresponding free vibration response of damped and undamped systems
4. Is able to frame mathematical models of SDOF systems and analyse the corresponding forced vibration response of damped and undamped systems
5. Is able to frame mathematical models of MDOF systems and analyse the corresponding forced vibration response of damped and undamped systems
6. Has learnt about principle of vibration-measuring instruments and evaluation of damping

UNIT-I	12 HOURS

Dynamical problems in Civil Engineering, Concepts of degrees of freedom and vibration, D'Alembert's principle, principle of virtual displacement and energy principles.

Free Vibration of Single-degree-of-freedom systems: Mathematical models of SDOF system, Free vibration response of damped and undamped systems,

UNIT-II	12 HOURS

Free Vibration of Multi-degree freedom systems: Mathematical models of MDOF systems, free vibration of undamped MDOF systems - Natural frequencies and mode shapes – orthogonality conditions,

Free vibration of damped MDOF systems. damping properties, Rayleigh's and Cauchey's damping methods

UNIT-III	12 HOURS

Forced Vibration of SDOF Systems: Response damped and undamped systems to harmonic loading support motion, evaluation of damping, vibration isolation, transmissibility, response to periodic forces.

Numerical methods applied to SDOF, Direct integration and Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

UNIT-IV	12 HOURS

Forced Vibration of MDOF Systems: Equations of Motion and Response to forced excitations, Modal analysis – free and forced vibration with and without damping.

Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions, forced vibrations – response of beams under moving loads, wave propagation in solids

REFERENCE BOOKS:

1. Mario Paz, "**Structural dynamics–Theory and Computation**", CBS Publishers
2. R.W. Clough & J. Penzien, "**Dynamics of Structures**", McGraw Hill
3. Anil K. Chopra, "**Dynamics of Structures**", Prentice Hall of India
4. Timoshenko, S., "**Vibration Problems in Engineering**", VanNostrand Co.,
5. Mukhopadhyaya, "**Vibration and Structural Dynamics**", Oxford &IBH
6. William Thompson, "**Theory of Vibration with Applications**"
7. William Seto, "**Mechanical Vibrations**", McGraw Hill Pub., (Schaum Series)

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
M20TB0104	CO1	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO2	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO3	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO4	3	2	2		1		2	2	1	1	1	3	3	1	2
	CO5	3	2	2		1				1	1	1	3	3		
	CO6	3	2	2		1				1	1	1	3	3		

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

M20TB0105	COMPUTATIONAL STRUCTURAL MECHANICS	L	T	P	C
Duration: 16weeks		2	1	-	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)				

Prerequisite: Structural Analysis I and II

Course Objectives: Student will be able to learn

1. To learn the concepts and principles of structural analysis, develop element stiffness and flexibility matrices.
2. To analyse framed structures, Trusses subjected to direct and indirect loadings by flexibility using force transformation matrices (element approach).
3. To analyse framed structures, Trusses subjected to direct and indirect loadings stiffness methods using displacement transformation matrices (element approach).
4. To learn the analysis of framed structures using standard structural analysis software.
5. To analyse ideal building framed structure, trusses by Flexibilty and stiffness method.
6. To learn an entire system analysis of structures.

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

1. Have learnt the concepts and principles of structural analysis and is able to compute element stiffness and flexibility matrices by elemental approach.
2. Be able to analyse framed structures, trusses subjected to direct and indirect loadings by flexibility method using force transformation matrices (element approach).
3. Be able to analyse framed structures, trusses subjected to direct and indirect loadings by stiffness method using displacement transformation matrices (element approach)
4. Be able to analyse framed structures, trusses by Flexibility and Stiffness system approach
5. Have learnt the analysis of framed structures using standard structural analysis software
6. Be able analyse every component of a structure

UNIT-I	12HOURS

Static and Kinematic indeterminacy, Concepts of stiffness and flexibility, Energy concepts, Principles of minimum potential energy and minimum complementary energy.

Development of element flexibility and element stiffness matrices for bar, truss, beam, plane frame elements

UNIT-II	12 HOURS

Flexibility method: Force- transformation matrix – Development of global flexibility matrix for continuous beams, plane trusses and plane rigid frames (not more than 6 x 6 structure flexibility matrix)

Stiffness Method: Displacement- transformation matrix – Development of global stiffness matrix for continuous beams, plane trusses and rigid plane frames (not more than 6x6 structure stiffness matrix)

UNIT-III	12 HOURS

Analysis of continuous beams, plane trusses by flexibility method (not more than 3x3 structure flexibility matrix) using force-transformation matrix.

Analysis of Plane rigid frames by flexibility method (not more than 3x3 structure flexibility matrix) using flexibility-transformation matrix.

UNIT-IV	12 HOURS

Analysis of continuous beams, plane trusses by Stiffness method (not more than 3x3 structure stiffness matrix) using displacement-transformation matrix.

Analysis of Plane rigid frames by Stiffness method (not more than 3x3 structure stiffness matrix) using displacement-transformation matrix.

REFERENCE BOOKS:

1. S.Rajasekaran, "Computational Structural Mechanics", PHI, New Dehi 2001.
2. C.S.Reddy, "Basic Structural Analysis", TMH, New Delhi 2001.
3. W.Weaver and J.H.Gere, "Matrix Analysis of Framed Structures", Van Nastran, 1980.
4. A.K.Jain "Advanced Structural Analysis with Computer Application",Nemchand and Brothers, Roorkee, India.
5. M.F.Rubinstein "Matrix Computer Methods of Structural Analysis "Prentice - Hall.
6. Devdas Menon, "Advanced Structural Analysis", Narosa Publishers

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
M20TB0105	CO1	3	3	3	1	2		2	2	1		1	3	3	1	2
	CO2	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO3	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO4	3	3	2	1	2		2	1				3	3	1	1
	CO5	3	3	3	1	2		2	1	1		1	3	3	1	2
	CO6	3	3	3	1	2		2	1	1		1	3	3	1	2

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

M20TB0106	FINITE ELEMENT METHOD OF ANALYSIS	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Structural Analysis – II, Theory of Elasticity

COURSE OBJECTIVES: Student will be able to learn

1. To learn about the basic concepts and principles of structural mechanics, FDM, RRM and GM.
2. To learn about the advantages and disadvantages of FEM, with different types of finite elements used in FEA and their properties.
3. To derive properties of various elements used in FEA and analysis of continuous beams and plane trusses.
4. To understand the concepts of Isoparametric elements and numerical integration.
5. To learn dynamic analysis using FEM.
6. To understand importance of FEA software packages.

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

1. Has learnt about the basic concepts and principles of structural mechanics, FDM, RRM and GM.
2. Has learnt about the basic analysis procedure, advantages and disadvantages of FEM, along with different types of finite elements used.
3. Is able to derive the properties of various finite elements and solve problems of continuous beams and plane trusses.
4. Has learnt the importance of isoparametric elements & numerical integration.
5. Is able to apply FEM for solving dynamic analysis problems.
6. Has understood the use of FEA software packages.

UNIT-I	12HOURS

Introduction, Historical background, Principles of virtual displacement and minimum potential energy, Concepts of Finite Difference Method, Rayleigh-Ritz method and Galerkin method, Advantages and disadvantages of FEM, Basic analysis procedure of FEM for structural problems.

Finite elements for 1-D, 2-D and 3-D problems, Natural coordinates, Displacement and Shape functions for standard
elements – Bar elements, Beam elements, Truss elements, Triangular elements, Rectangular elements, Quadrilateral elements –Higher order Elements. C^0, C^1 and C^2 Continuity functions, Lagrangian, Hermitian Polynomials, Serendipity and Lagrangian family of elements, Pascal's triangle, Convergence requirements, Patch test, Static condensation.

UNIT-II	12HOURS

Derivation of element stiffness matrices for Bar, Beam, Truss and Frame elements (planar), Linear static analysis of one dimensional problems using Linear and Quadratic bar elements, Treatment of boundary conditions – Elimination approach and Penalty approach. Linear static analysis of continuous beams using beam elements. Linear static analysis of pin jointed plane trusses.

Two dimensional problems, Derivation of element stiffness matrices and equivalent nodal force vectors for CST element.

UNIT-III	12HOURS

Concept of Iso-parametric elements, sub and super parametric elements, Convergence requirements for Iso-parametric elements, Iso-parametric formulation of 4-noded quadrilateral element, Numerical Integration – Gauss quadrature.

Dynamic analysis, Consistent and Lumped mass matrices in local and global coordinate systems, Evaluation of Eigen values and Eigenvectors, Free vibration analysis.

UNIT-IV	12HOURS

Modelling considerations and Use of software – Mesh generation and refinement, Element selection, Material properties, Loads and reactions, Connections in structures, Boundary conditions, Symmetry and anti-symmetry, Stress concentrations, Sub-structuring, Common mistakes in modelling.

Organization of Computer Program for FEM – flowcharts, Desired features of Pre and Post Processors. Commonly used commercial software packages, Use of Software to analyse Bar, Beam, Frame and Plane Stress/Strain problems.

REFERENCE BOOKS

1. Finite element analysis Theory and Programming, C S Krishnamurthy, McGraw Hill
2. Fundamental of finite Element Analysis, David V Hutton, McGraw Hill
3. Introduction to Finite Element Method, Desai & Abel, CBS Publishers
4. Bhatti, M.A., Fundamental Finite Element Analysis and Applications: with Mathematical and MAT lab Computations, Wiley, 2005.
5. Reddy, J. N., An Introduction to the Finite Element Method, 3rd Edition, McGraw-Hill Science/Engineering/Math, 2005.
6. Logan D. L., A First Course in the Finite Element Method, Thomson- Engineering, 3rd edition, 2001.
7. The Finite Element Methods and its basics and fundamentals , Zienkiewicz & Taylor, Elsevier Publications

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
M20TB0106	CO1	3	3	3	1	2							3	3	1	2
	CO2	3	3	3	1	2							3	3	1	2
	CO3	3	3	3	1	2							3	3	1	2
	CO4	3	3	3	1	2							3	3	1	2
	CO5	3	3	3	1	2							3	3	1	2
	CO6	2	2	2	2	3	1	2	1	2	1		3	3	2	3

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

M20TB0107	STRUCTURAL ENGINEERING LABORATORY (CONCRETE LABORATORY)	L	T	P	C
Duration: 16weeks		0	0	2	2

Internal Assessment: 20 Marks	Semester End Examination: 30 Marks (Minimum 8 Marks)

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, prevailing the quality of the materials.
3. To impart knowledge of mix design of concrete.
4. To gain experience regarding testing quality of produced concrete in Fresh and hardened state.
5. To gain experimental knowledge of testing specimens in loading frame.
6. To gain experimental knowledge of testing specimens subjected to vibration/dynamics.

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

1. Implement good quality construction techniques.
2. Identify quality of Concrete for Construction practices and implement changes if essential.
3. Identify the quality of the materials used for construction by testing as per IS specifications
4. Identify the proportion of the mix design
5. Perform testing on loading frame
6. Perform testing of specimens on shake Table.

EXPERIMENTS TO BE CARRIED OUT

1. Determination of workability of concrete by Slump Cone Test
2. Determination of flow properties concrete and mortar by Flow Table Test
3. Determination of degree of workability of concrete by Compaction Factor Test
4. Determination of workability of concrete by Vee-Bee Consistometer
5. Determination of Compressive Strength of Cement Concrete
6. Determination of Flexure Test on Hardened Concrete
7. Determination aggregate properties by Shape Test (Elongation Index)
8. Determination of aggregate properties by Shape Test (Flakiness Index)
9. Impact Test on coarse aggregates
10. Water Absorption Test on Coarse Aggregate
11. Mix design of concrete: design for a particular strength and verify whether the desired strength is achieved at 28 days
12. Demonstration on Loading frame
13. Demonstration on Shake Table

REFERENCE BOOKS

1. "Laboratory Manual on Concrete Technology" Sood, Hemant, Mittal L N and Kulkarni P D, CBS Publishers, New Delhi, 2002.
2. Gambhir M L Concrete Manual Laboratory testing for quality control of concrete 4th edition Dhanpat Rai and Sons Delhi 1992
3. IS 10262-2012 Code for Mix design of concrete

Mapping of Course Outcomes with programme Outcom

Course Code	POS/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB0107	CO1	3	2		2	2	1		1			1	3	1	2	2
	CO2	3	2		2	2	1		1			1	3	1	2	2
	CO3	3	2		2	2	1		1			1	3	1	2	2
	CO4	3	2		2	2	1		1			1	3	1	2	2
	CO5	3	2		2	2	1		1			1	3	1	2	2
	CO6	3	2		3	3	1		1			1	2	3		3

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

M20TB0108	**Mini Project-I**	**Practical/ Report**		0	0	2		2	2

The student is required to carry out individually a mini Project which is essentially an experimental investigation on special concretes. This mini project will enhance the knowledge on material characteristics

SECOND SEMESTER

M20TB0201	ADVANCED DESIGN OF STEEL STRUCTURES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Design of Steel structures

COURSE OBJECTIVES : Student will be able to learn

1. To recognize functional requirements of steel structures for industry oriented.
2. To familiarize with industrial structures such as gantry girder, crane girder.
3. To familiarize types, analyse and design of Power Plant structures.
4. To understand the design concept of cooling towers, bunkers and silos.
5. To familiarize with transmission towers.
6. To familiarize the design of chimneys.

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

1. Understand and apply the concept of planning and functional aspects of Industrial structures
2. Design independently gantry girders, crane girders which are compulsorily used in manufacturing industries
3. Able to know the concept of analysis and design of power plants, containment structures
4. Able to know the concept of analysis and design of cooling towers, bunkers and silos
5. Able to analyze and design transmission towers
6. Able to analyze and design chimneys

UNIT-I	**12HOURS**

PLANNING AND FUNCTIONAL REQUIREMENTS
Classification of Industries and Industrial structures - planning for Layout Requirements regarding Lighting, Ventilation and Fire Safety - Protection against noise and vibration, Guidelines of Factories Act.

UNIT-II	**12HOURS**

INDUSTRIAL BUILDINGS: Steel Gantry Girder, Crane Girders –
Design of Corbels and Nibs

UNIT-III	**12HOURS**

POWER PLANT STRUCTURES: Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting structures

UNIT-IV	**12HOURS**

TRANSMISSION LINE STRUCTURES AND CHIMNEYS: Analysis and design of transmission line towers - Sag and Tension calculations, testing of towers – Design of self supporting chimney, Design of Chimney bases.

REFERENCE BOOKS

1. Jurgen Axel Adam, Katharria Haussmann, Frank Juttner, Klauss Daniel, Industrial Buildings: A Design Manual, Birkhauser Publishers, 2004.

2. Manohar S.N, Tall Chimneys - Design and Construction, Tata McGraw Hill, 1985

3. Santhakumar A.R. and Murthy S.S., Transmission Line Structures, Tata McGraw Hill, 1992

4. Srinivasulu P and Vaidyanathan.C, Handbook of Machine Foundations, Tata McGraw Hill

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
M20TB0201	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
	CO5	3		2		2		2	2	1		1	3	1	3	2
	CO6	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

M20TB0202		L	T	P	C
Duration: 16weeks	STRUCTURAL HEALTH MONITORING	2	1	-	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)				

Prerequisite: Design of Reinforced Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

1. To learn the causes for deterioration of concrete and Non-Destructive Tests
2. To learn about effect of corrosion and prevention of concrete
3. To learn different maintenance and repair strategies
4. To learn detailed procedure of evaluating damaged structures
5. To learn about maintenance of concrete structures
6. To learn different methods for SHM of civil engineering structures

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

1. Understand the causes for deterioration of concrete and Non-Destructive Tests **1**
2. Diagnose for serviceability and durability aspects of concrete
3. Suggest repairs and maintenance strategies for the structure
4. Know the procedures for evaluating a damaged structure
5. Know the materials and techniques used for repair of structures
6. Understand systems and methods for health monitoring of structures

UNIT-I	12HOURS

General: Introduction, Cause of deterioration of concrete structures, Diagnostic methods & analysis,preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling and other instrumental methods.

Quality assurance for concrete construction as built concrete properties strength, permeability, thermalproperties and cracking.

Influence on Serviceability and Durability: Effects due to climate, temperature, chemicals, wear anderosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking,
Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

UNIT-II	**12HOURS**

Maintenance and Repair Strategies: Definitions: Maintenance, repair and rehabilitation, Facets of Maintenance, importance of Maintenance, Preventive measures on various aspects. Inspection,

Assessment procedure for evaluating a damaged structure causes of deterioration - testing techniques.

UNIT-III	**12HOURS**

Materials for Repair: Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, Ferro cement, Fibre reinforced concrete.
Techniques for Repair: Rust eliminators and polymers coating for rebar during repair foamed concrete, mortar and dry pack, vacuum concrete, Gunite and Shot Crete Epoxy injection, Mortar repair for cracks, shoring and underpinning.

UNIT-IV	**12HOURS**

Introduction to Structural Health Monitoring (SHM) : Definition & motivation for SHM, SHM - a way for smart materials and structures, SHM and bio mimetic - analog between the nervous system of a man and a structure with SHM, SHM as a part of system management, Passive and Active SHM, NDE, SHM and NDECS, basic components of SHM, materials for sensor design.
Application of SHM in Civil Engineering: Introduction to capacitive methods, capacitive probe for cover concrete, SHM of a bridge, applications for external post- tensioned cables, monitoring historical buildings.

REFERENCES

1. Sidney, M. Johnson "Deterioration, Maintenance and Repair of Structures".
2. Denison Campbell, Allen & Harold Roper, "Concrete Structures – Materials, Maintenance and Repair"-Longman Scientific and Technical
3. R.T.Allen and S.C. Edwards, "Repair of Concrete Structures"-Blakie and Sons
4. Raiker R.N., "Learning for failure from Deficiencies in Design, Construction and Service"- R&D Center (SDCPL)
5. B.Vidiveli, "Rehabilitation of Concrete Structures", Standard Publishers.
6. B.L.Gupta and Amit Gupta, "Maintenance and Repair of Civil Structures", Standard Publishers.
7. Gahlot and Sharma, "Building Repair and Maintenance Management", CBS Publishers.
8. 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/COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB0202	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.

M20TBS211		L	T	P	C
Duration: 16weeks	ADVANCED STRUCTURAL ANALYSIS WITH MATLAB	2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Strength of materials, Structural analysis

COURSE OBJECTIVES: Student will be able to learn

1. To analyse curved beams for circumferential and radial stresses.
2. To analyse bending stresses in beams subjected to unsymmetrical bending.
3. To study the deflections of straight beams subjected to unsymmetrical bending.
4. To outline the concepts of shear centre in thin walled sections and tension coefficient method for the analysis of trusses.
5. To understand the theoretical concept of beams on elastic foundations.
6. To gain the knowledge on Basics of MATLAB for structural engineering problems.

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

1. Analyse curved beams for circumferential and radial stresses.
2. Analyse bending stresses in beams subjected to unsymmetrical bending.
3. Calculate the deflections of straight beams subjected to unsymmetrical bending.
4. Understand the concept of the shear centre in thin walled sections and tension coefficient method for the analysis of trusses
5. Understand the theoretical concept of beams on elastic foundations.
6. Formulate solutions for structural engineering problems using MATLAB®.

UNIT-I	12 HOURS

Curved Beams: Introduction, Circumferential stress in a curved beam, Radial stresses in curved beams, Correction for circumferential stresses in curved beams having I, T, or similar cross sections,

Deflections of curved beams, Statically indeterminate curved beams, Closed ring subjected to concentrated load.

UNIT-II	12 HOURS

Non symmetrical Bending of Straight Beams: Definition of shear centre in bending, Symmetrical and non-symmetrical bending, Bending stresses in beams subjected to unsymmetrical bending,

Deflections of straight beams subjected to unsymmetrical bending, Sensitivity of deep I sections.

UNIT-III	12 HOURS

Shear Centre for Thin-Wall Beam Cross Sections: Approximation employed for shear in thin wall beam cross sections, Shear flow in thin-wall beam cross sections, Shear centre for a channel, I and angle sections.

Method of Tension Co-Efficient: General principles, Analysis of three-dimensional trusses and frames

UNIT-IV	12 HOURS

Beams on Elastic Foundations: General theory, Infinite beam subjected to concentrated load, Boundary conditions, Infinite beam subjected to a distributed load segment, Semi-infinite beam subjected to loads at its end, Semi-infinite beam with concentrated load near its end, Short beams.

Basics of MATLAB®, general commands, arithmetic operations, matrix operations, MATLAB® solutions for structural engineering problems of statics, analysis of trusses, curved members, continuous beams and frames.

REFERENCE BOOKS

1. Srinivasan Chandrasekaran (2019), Advanced Structural Analysis with MATLAB®, CRC Press, Taylor & Francis Group.
2. Boresi, A.P. and Sidebottom, O.M. (1985), Advanced Mechanics of Materials, Fourth Edition, John Wiley and Sons, New York.
3. Junnarkar, S.B. and Shah, H.J. (1996), Mechanics of Structures, Vol. III, Charotar Publications, Char House
4. Gere, G.M. and Timoshenko, S.P. (2000), Advanced Mechanics of Materials, Second Edition, CBS Publishers, New Delhi.
5. Ugural, A.C. and Fenster, S.K. (1981), Advanced Strength of Material and Applied Elasticity, Arnold Publishers.

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**	**PO10**	**PO11**	**PSO 1**	**PSO 2**	**PSO 3**	**PSO 4**
M20TBS211	CO1	3	2	2		2			1	1		1	3	3	1	2
	CO2	3	2	2		2			1	1		1	3	3	1	2
	CO3	3	2	2		2			1	1		1	3	3	1	2
	CO4	3	2	2		2			1	1		1	3	3	1	2
	CO5	3	2	3									3	1	2	
	CO6	3	3	1		3							3	2	3	

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

M20TBS212	DESIGN OF BRIDGES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Design of RC Structural Elements, Design of Prestressed Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

1. To learn about the historical developments, site selection for bridges
2. To learn about the design of box culvert
3. To learn about the design of T beam slab
4. To learn about the different IRC loading cases
5. To design the slab culvert
6. To design T- beam bridge slab

COURSE OUTCOME:

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

1. Has learnt about the historical developments, site selection for bridges
2. Has learnt about the classification, components
3. Has learnt forces acting on bridges
4. Has learnt about the different IRC loading cases
5. Is able to design the slab culvert
6. Is able to design T- beam bridge slab

UNIT-I	12HOURS

Introduction: Historical Developments, Site Selection for Bridges, Classification of Bridges Forces on Bridges. Different Loading Cases IRC Class AA Tracked, Wheeled and Class A Loading, Abutments, Piers and Wing walls

Design of a slab culvert for Class AA tracked and Class A wheeled loading

UNIT-II	12HOURS

Box Culvert: Working out the worst combination of loading, moment distribution, calculation of BM & SF, structural design of slab culvert with reinforcement details.

T Beam Bridge Slab Design: Proportioning of Components Analysis of interior Slab & Cantilever Slab Using IRC Class AA Tracked, Wheeled Class A Loading, Structural Design of Slab, with Reinforcement Detail.

UNIT-III	12HOURS

T Beam Bridge Cross Girder Design: Analysis of Cross Girder for Dead Load & Live Load Using IRCClass AA Tracked, Wheeled Class A Loading A Loads, Structural Design of Beam, with Reinforcement Detail.

T Beam Bridge Main Girder Design: Analysis of Main Girder for Dead Load & Live Load Using IRCClass AA Tracked, Wheeled Class A Loading Using COURBON'S Method, Analysis of Main Girder Using HENDRY-JAEGER and MORICE-LITTLE Method for IRC Class AA Tracked vehicle only, BM & SF for different loads, Structural Design of Main Girder With Reinforcement Details

UNIT-IV	12HOURS

PSC Bridges: Introduction to Pre and Post Tensioning, Proportioning of Components, analysis and structural design of slab, analysis of main girder using COURBON's Method for IRC Class AA tracked vehicle, Calculation of pre-stressing force, cable profile and calculation of stresses, Design of End block and detailing of main girder.

Balanced Cantilever Bridge: Introduction and proportioning of components, Design of simply supported portion and design of cantilever portion, design of articulation.

REFERENCE BOOKS

1. **"Essentials of Bridge Engineering**"- D Johnson Victor, Oxford & IBH Publishing Co New Delhi
2. **"Design of Bridges"-** N Krishna Raju, Oxford & IBH Publishing Co New Delhi
3. **"Principles and Practice of Bridge Engineering"-** S P Bindra Dhanpat Rai & Sons New Delhi
4. IRC 6 – 1966 "**Standard Specifications And Code Of Practice For Road Bridges"-** Section II Loads and Stresses, The Indian Road Congress New Delhi
5. IRC 21 – 1966 "**Standard Specifications And Code Of Practice For Road Bridges"-**Section III Cement Concrete (Plain and reinforced) The Indian Road Congress New Delhi
6. IS 456 – 2000 "**Indian Standard Plain and Reinforced Concrete Code of Practice"-** (Fourth Revision) BIS New Delhi
7. IS 1343 – "**Indian Standard Prestressed Concrete Code of Practice"-** BIS New Delhi
8. Raina V.K., "**Concrete Bridge Practice**"- Tata McGraw Hill
9. Bakht B & Jaeggar, "**Bridge Analysis Simplified**"- McGraw Hill
10. Ponnuswamy . S, "**Bridge Engineering**"- Tata McGraw Hill.

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
M20TBS212	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
	CO5	3		2		2		2	2	1		1	3	1	3	2
	CO6	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.

M20TBS221	DESIGN OF TALL STRUCTURES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Analysis and Design of RCC and Steel Structures

COURSE OBJECTIVES: Student will be able to learn

1. To introduce various systems of Tall buildings.
2. To obtain the Knowledge on materials for Tall buildings.
3. To know about different types of loads, materials for the design of tall structures.
4. To understand the behaviour of structural members and frames.
5. To impart knowledge about static, dynamic and stability analysis of various systems.
6. To evaluate Secondary Effects on tall structures.

COURSE OUTCOME:

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

1. Develop various systems of Tall buildings.
2. Knowledge on materials for Tall buildings.
3. Understand different types of loads, materials for the design of tall structures.
4. Understand the behaviour of structural members and frames.
5. Design stable structures.
6. Evaluate Secondary Effects on tall structures.

UNIT-I	12HOURS

INTRODUCTION

Design Philosophy - History - advantages and disadvantages - Vertical city concepts - essential amenities - fire safety - water supply - drainage and garbage disposal - service systems - structural and foundation systems. Factors affecting height, growth and form - Human comfort criteria.

UNIT-II	12HOURS

LOADS AND MATERIALS

Gravity loading - Dead and Live load - calculation - Impact and construction loads. Wind loading - static and dynamic approach - Analytical and wind tunnel experimental method. Earthquake loading - Equivalent lateral force, Modal analysis - combination of loading in various design philosophies. Materials for tall buildings - High strength concrete - Light weight concrete - Fibre reinforced concrete Composite Materials.

UNIT-III	12HOURS

STRUCTURAL SYSTEMS

Behavior of High Rise structures - Different system for load distribution in steel and concrete - Vertical and horizontal load resistant systems - Rigid frames - braced frames - infilled frames - shear walls - wall frames - tubular systems - outrigger braced systems - Mega systems.

UNIT-IV	12HOURS

ANALYSIS AND DESIGN

Analysis and Design principles of various horizontal load transfer systems - approximate methods - Modelling for accurate analysis - 3D analysis - Member forces - displacements. Analysis for various

secondary effects - Creep, shrinkage and temperature. Stability Analysis - Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity loading, P - effect and various

methods of analysis - influence of foundation instability, out of plumb effects - Elastic Deformations. Dynamic Analysis - Principles of design of tall braced frames for earthquake and blast resistant design.

REFERENCE BOOKS

1. Schuller.W.G., "High Rise Building Structures", John Wiley & sons, 1977
2. Lynn.S. Beedle, "Advances in Tall Buildings", CBS Publishers and Distributors, New Delhi, 1996
3. LinT.Y. and Burry D.Stotes, " Structural Concepts and Systems for Architects and Engineers ", John Wiley, 1994.
4. Gupta.Y.P.,(Editor), "Proceedings of National Seminar on High Rise Structures - Design and Construction Practices for Middle Level Cities", New Age International Limited, New Delhi,1995.
5. Lecture Notes on "Tall Buildings" - Short Term Course organized by Civil Engineering Department, SRM Engg college, Kattankulathur. June 2002
6. Smith .B.S. and Coull .A., "Tall Building Structure", 'Analysis and Design', John Wiley & Sons, Inc., 1991
7. Taranath .B.S., "Structural Analysis and Design of Tall Buildings", Mc Graw Hill Co. 1988

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
M20TBS221	CO1	3	1	2		2		2	2	1		1	3	1	3	2
	CO2	3	2		1		2						2	1	1	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
	CO5	3		2		2		2	2	1		1	3	1	3	2
	CO6	3	3	2		2	3	3		2	2		3	2	3	3

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

M20TBS222		L	T	P	C
Duration: 16weeks	SPECIAL CONCRETES	2	1	-	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)				

Prerequisite: Concrete Technology

COURSE OBJECTIVES: Student will be able to learn

1. To learn the various types of alternative cement materials and admixtures
2. To understand the knowledge of light weight concrete and its mix design.
3. To know about High Density concrete and Ferro-cement
4. To gain knowledge about fibre reinforced concrete and its properties
5. To learn about High performance concrete, properties and applications
6. To familiarise about other special types of concretes

COURSE OUTCOME:

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

1. To identify the constituents of cement, other cementitious materials and admixtures
2. To enumerate the concept of light weight concrete and demonstrate its mix design
3. To explain about High Density concrete and Ferro-cement
4. To describe about fibre reinforced concrete and its properties
5. To explain High performance concrete, properties and applications
6. To categorise special types of concretes.

UNIT-I	**12HOURS**

Components of modern concrete and developments in the process and constituent materials: Role of constituents, Development in cements and cement replacement materials, pozzolona, fly ash, silica fume, rice husk ash, recycled aggregates, chemical admixtures.

Mix proportioning of Concrete: Principles and methods.

Light Weight concrete: Introduction, classification, properties, strength and durability, mix proportioning and problems.

UNIT-II	**12HOURS**

High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

Ferro cement: Ferrocement materials, mechanical properties, cracking of ferrocement, strength and behaviour in tension, compression and flexure, Design of ferrocement in tension, ferrocement constructions, durability, and applications.

UNIT-III	**12HOURS**

Fibre reinforced concrete: Fibre materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state

Strength and behaviour in tension, compression and flexure of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications.

UNIT-IV	**12HOURS**

High Performance concrete: constituents, mix proportioning, properties in fresh and hardened states q,applications and limitations.

Ready Mixed Concrete, Self Compacting Concrete, Self Curing Concrete, Reactive powder concrete, Bacterial Concrete.

REFERENCE BOOKS

1. Neville A.M, “Properties of Concrete” Pearson Education Asis, 2000
2. P. Kumar Mehta, Paul J.N.Monterio, CONCRETE, “Microstructure, Properties and Materials”-Tata McGraw Hill
3. A.R.Santhakumar, (2007) “Concrete Technology”-Oxford University Press, New Delhi, 2007.
4. Short A and Kinniburgh.W, “Light Weight Concrete”- Asia Publishing House, 1963
5. Aitcin P.C. “High performance concrete”-E and FN, Spon London 1998
6. Rixom.R. and Mailvaganam.N., “Chemical admixtures in concrete”- E and FN, Spon London 1999

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TBS222	CO1	1	1			1	2	3		2		1	2	1		
	CO2	1	3		3	1		3		2		1	2	3	2	2
	CO3	2	2			1		3				1	2	2		2
	CO4	2	2		1	1	1	3				1	2	3		2
	CO5	2	2			1	1	3				1	2	2		2
	CO6	1	3		1	1	3	3		2		1	2	3		2

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

M20TBS231		L	T	P	C
Duration: 16weeks	**APPLICATIONS OF IoT IN CIVIL ENGINEERING**	2	1	-	3
Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)				

Prerequisite: Strength of materials, Structural analysis, Concrete Technology

COURSE OBJECTIVES: Student will be able to learn

1. Basics of Internet of Things (IoT) and sensors.
2. Applications of IoT and sensors and Basics of networking.
3. Machine to machine communications & programming using IoT.
4. Broad applications of IoT in civil engineering & construction industry.
5. Enhancement of various aspects of construction projects using IoT.
6. Adoption of IoT in structural health monitoring.

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

1. Understand the basics of IoT, types of sensors & devices used.
2. Understand the applications of IoT and sensors with basics of networking.
3. Understand machine to machine communications & programming using IoT.
4. Interpret the adoption of IoT in various civil engineering activities.
5. Understand use of IoT in enhancing various aspects of construction projects.
7. Understand the use of IoT in structural health monitoring.

UNIT-I	12 HOURS
Internet of Things, promises, 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	
UNIT-II	12 HOURS
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	
UNIT-III	12 HOURS
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.

UNIT-IV	12 HOURS

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.

REFERENCE BOOKS

1. Ashwin Pajankar, Internet of Things with Arduino and Bolt, BPB Publications (2018)
2. Krishnan Saravanan, Implementation and Deployment of IoT Projects in Smart Cities, IGI Global
3. Publications (2020)
4. Qusay F Hassan, Internet of Things A to Z: Technologies and Applications, Wiley-IEEE Press (2018)
5. ICCCBE 2020, Proceedings of the 18th International Conference on Computing in Civil and Building Engineering, Springer (2020)

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
M20TBS231	CO1	3	1	1		2		2	2	1			3	1	1	2
	CO2	3		1		2		2	2	1			3	1	1	2
	CO3	3	1	1		2		2	2	1			3	1	1	2
	CO4	3		1		2		2	2	1			3	1	1	2
	CO5	3		1	2	2		1	2	1	1		3	1	2	2
	CO6	3		2	2	2		1	2	2			3	2	1	2

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

M20TBS232	DESIGN OF EARTHQUAKE RESISTANT STRUCTURES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Design of RCC

COURSE OBJECTIVES: Student will be able to learn

1. To familiarize with causes of earthquake and its history
2. To understand the principles of seismic design
3. To evaluate seismic forces as per IS Specifications
4. To learn response spectrum method and time acceleration method
5. To analyse and design shear wall to resist seismic forces
6. To learn Earthquake resistant design of masonry buildings

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

1. Is able to gain complete knowledge of history of seismicity
2. Is able to use codal provisions for the analysis and design of structures to resist seismic forces
3. Is able to understand the provisions of IS 1893:2002.
4. Is able to understand response spectrum method and time acceleration method
5. Is able to design and detail shear walls in accordance to- IS 13920-1993 –
6. Is able to design earthquake resistant masonry buildings

UNIT-I	**12HOURS**

Elements of Earthquake Origin

Elements of Seismology - Earthquakes -Structure of the Earth -History of the Earth -Earthquake Mechanism - Propagation of Seismic Waves -Earthquake Phenomena -Earthquake Measurements -Definitions of magnitude, intensity, epicentre, Plate tectonics, seismographs, liquefaction, Types, effects and controlling factors seismic zoning map of India, Peak ground motion parameters.

UNIT-II	**12HOURS**

Principles of Seismic Design

Codal provision for design – IS 1893-2002 - aspects in planning and layout -Principles of design – choice of materials – ductility based design –Effect of Structural Irregularities on seismic performance of RC buildings- Vertical irregularity and plan configuration problems, Seismic resistant building architecture – lateral load resistant systems, building characteristics.

UNIT-III	**12HOURS**

Earthquake Resistant Design

Principles of Earthquake Resistant Design - Response spectrum theory. Time – Acceleration method Application of response spectrum theory to seismic design of structures.

Computation of seismic forces in multi-storied buildings – using procedures (Equivalent lateral force and dynamic analysis) as per IS-1893.Codal provision for detailing for earthquake resistance- IS 13920-1993 – shear wall design and detailing

UNIT-IV	**12HOURS**

Earthquake resistant design of masonry buildings

Elastic properties of structural masonry, lateral load analysis, Design of two storeyed masonry buildings.

REFERENCE BOOKS

1. Earthquake Resistant Design of Structures, Pankaj Agrawal, Manish Shrikhande, PHI Learning
2. Dynamics of Structures: Theory and Applications to Earthquake Engineering, AK Chopra, Prentice Hall
3. Dynamics of Structures, R.W. Clough and Joseph Penzien, McGraw-Hill Education
4. Structural Dynamics by Mario & Paz, Springer.
5. Earthquake Resistant Design by David J. Dowrick, Wiley India Pvt Ltd

6. Elements of Earthquake Engg by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, South Asian Publishers.
7. IS 1893-2002 Indian Standard Criteria for Earthquake Resistant Design of Structures.
8. IS 4326-1993 2002 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
9. IS 13920-1993 2002 Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces.

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TBS232	CO1	2	1	1			1		1				3	1		2
	CO2	2	2	2		3	1		1		1		3	1	2	2
	CO3	3	2	2		1	1		1		1		3	1	2	2
	CO4	3	2	2		1	1		1		1		3	1	2	2
	CO5	3	2	2		1	1		1		1		3	1	2	2
	CO6	3	2	2		1	1		1		1		3	1	2	3

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

M20TBS241	ADVANCED DESIGN OF PRESTRESSED CONCRETE	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Design of Prestressed Concrete Structures

COURSE OBJECTIVES: Student will be able to learn

1. To impart the knowledge about behavior, analysis and design of end blocks of post tensioned members.
2. To study the shear and Torsional resistance of pre stressed members
3. To analyze and design the pre stressed concrete tension, compression members and composite beams for subjected to flexure and shear.
4. To develop an understanding of the design of continuous beams and simple portal frames.
5. To study the analysis and design of pre stressed slabs and grid floors.
6. To study the precast elements such as pre stressed concrete poles, railway sleepers and wall panels.

COURSE OUTCOME:

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

1. Design anchorage zones of pre stressed concrete members.
2. Calculate the shear and Torsional resistance of pre stressed members
3. Develop skills in the analysis and design of pre-stressed tension and compression members and as well as composite beams.
4. Design the pre stressed statically indeterminate structures.
5. Analyse and design the pre stressed slabs and grid floors.
6. Understand the concepts and techniques of various precast elements.

UNIT-I	12HOURS

Anchorage zone stresses in post-tensioned members: Introduction, stress distribution in end block, investigations on Anchorage zone stresses, Magnel and Guyon's Methods, Comparative Analysis, Anchorage zone reinforcement.

Shear and torsion resistance: Shear and principal stresses, ultimate shear resistance, design of shear reinforcement, Torsion, Design of reinforcement for torsion.

UNIT-II	12HOURS

Tension members: Introduction, Ties, Pressure pipes – fabrication process, analysis, design and specifications. Cylindrical containers- construction techniques, analysis, design and specifications.

Compression members: Introduction, Columns, short columns, long columns, biaxially loaded columns, Design specifications.

Composite beams: Introduction, types of composite beams, analysis for stresses, differential shrinkage, serviceability limit state. Design for flexural and shear strength.

UNIT-III	12HOURS

Statically indeterminate structures: Introduction, Advantages of continuous members, effect of pre-stressing in indeterminate structures, methods of analysis for secondary moments, concordant cable profile, Guyon's theorem, Ultimate load analysis, Design of continuous beams and portal frames.

Slab and grid floors: Types of floor slabs, Design of one way, two way and flat slabs. Distribution of pre-stressing tendons, Analysis and design of grid floors.

UNIT-IV	12HOURS

Precast elements: Introduction, Prestressed concrete poles manufacturing techniques, shapes and cross sectional properties, design loads, design principles. Railway sleepers-classification and Manufacturing techniques, design loads, analysis and design principles. Prestressed concrete pavements, slab and wall panels.

REFERENCE BOOKS

1. Design of Prestressed concrete structures - Lin T.Y. and H. Burns- John Wiley & Sons, 1982.
2. Prestressed Concrete- N. Krishna Raju - Tata McGraw Hill, 3rd edition, 1995.
3. Prestressed Concrete Structures- P. Dayaratnam - Oxford & IBH, 5th Edition, 1991.
4. Prestressed Concrete- G.S. Pandit and S.P. Gupta – CBS Publishers, 1993.
5. Prestressed concrete- N. Rajagopalan; Narosa Publishing House.2nd edition, 2005.
6. Design of Prestressed Concrete- A. Nilson; John Willey & Sons.2nd edition, 1987.
7. IS : 1343 : 1980.

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TBS241	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
	CO5	3		2	1	2		2	2	2		1	3	1	3	2
	CO6	3		2	1	2		2	1	1		1	3	1	3	2

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

M20TBS242	RELIABILITY ANALYSIS AND DESIGN OF STRUCTURES	L	T	P	C
Duration: 16weeks		2	1	-	3

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Basic Concepts of Probability and Statistics

COURSE OBJECTIVES: Student will be able to learn

1. To learn basic concepts of probability and statistics
2. To learn how to interpret the measure of probability
3. To learn basic concepts of random phenomena
4. To learn formulation of Mathematical Modeling using uncertainties
5. To learn the application of reliability measures to a structure
6. To learn how to simulate reliability measures and use as a modeling tool

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

1. Apply the basic concepts of probability and statistics
2. Apply the basic concepts of random phenomena
3. Know how to interpret the measure of probability
4. Apply the formulation of Mathematical Modeling using uncertainties
5. Know the application of reliability measures to a structure
6. Know how to simulate reliability measures and use as a modeling tool

UNIT-I	12HOURS

Preliminary Data Analysis: Graphical representation- Histogram, frequency polygon, Measures of central tendency- grouped and ungrouped data, measures of dispersion, and measures of asymmetry.

Curve fitting and Correlation: Fitting a straight line, curve of the form $y = ab^x$ and parabola, Coefficient of correlation.

UNIT-II	12HOURS

Probability Concepts: Random events-Sample space and events, Venn diagram and event space, Measures of probability-interpretation, probability axioms, addition rule, multiplication rule, conditional probability, probability tree diagram, statistical independence, total probability theorem and Baye's theorem.

Random variables: Probability mass function, probability density function, Mathematical expectation, Chebyshev's theorem.

UNIT-III	12HOURS

Probability distributions: Discrete distributions- Binomial and poison distributions, Continuous distributions- Normal, Log normal distributions.

Reliability Analysis: Measures of reliability-factor of safety, safety margin, reliability index, performance function and limiting state. Reliability Methods-First Order Second Moment Method (FOSM), Point Estimate Method (PEM), and Advanced First Order Second Moment Method (Hasofer-Lind's method)

UNIT-IV	12HOURS

System Reliability: Influence of correlation coefficient, redundant and non-redundant systems-series, parallel and combined systems, Uncertainty in reliability assessments- Confidence limits, Bayesian revision

of reliability.

Simulation Techniques: Monte Carlo simulation- Statistical experiments, sample size and accuracy, Generation of random numbers- random numbers with standard uniform distribution, continuous random variables, discrete random variables

REFERENCE BOOKS

1. Ranganath, R. (1999). "Structural Reliability Analysis and design"- Jaico publishing house, Mumbai, India.
2. Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"- Volume –I, John Wiley and sons, Inc, New York.
3. Ang, A. H. S., and Tang, W. H. (1984). "Probability concepts in engineering planning and design"- Volume –II, John Wiley and sons, Inc, New York.
4. Milton, E. Harr (1987). "Reliability based design in civil engineering"- Mc Graw Hill book Co.
5. Nathabdndu, T., Kottegoda, and Renzo Rosso (1998). Statistics, "Probability and reliability for Civiland Environmental Engineers"- Mc Graw Hill international edition, Singapore.
6. Achintya Haldar and Sankaran Mahadevan (2000). "Probability, Reliability and Statistical methodsin Engineering design"- John Wiley and Sons. Inc.
7. Thoft-christensen, P., and Baker, M., J., (1982), "Structural reliability theory and its applications"- Springer-Verlag, Berlin, NewYork.
8. Thoft-christensen, P., and Murotsu, Y. (1986). "Application of structural systems reliabilitytheory"- Springer-Verlag, Berlin, NewYork.

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
M20TBS242	CO1	3	3									1	2		2	
	CO2	3	3	2				2					3			
	CO3	3	3										1	3	2	
	CO4	3		3									1		3	2
	CO5	3	3	3				2					1	1		3
	CO6	3		3									1			3

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

M20TB0204	**Mini Project-II**	**Practical/ Report**		0	0	2	2	2

The student is required to carry out a mini project individually on Analysis and Design of Special structures using STAAD PRO, ETABS

M20TB0203	**STRUCTURAL ENGINEERING LABORATORY-II**	**L**	**T**	**P**	**C**
Duration: 16weeks		0	0	2	2

Internal Assessment: 50 Marks	Semester End Examination: 50 Marks (Minimum 20 Marks)

Prerequisite: Structural analysis and design

COURSE OBJECTIVES: Student will be able to learn

1. Basics of STAAD-Pro with creation of nodes, elements, members, loads, support.
2. Modelling and analysis of beams and frames using STAA-Pro
3. Analysis and design of steel structures using STAAD-Pro
4. Basics of ETABS with creation of nodes, elements, members, loads, supports
5. Modelling of building structures using ETABS
6. Analysis & design of building structures using ETABS

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

1. Create nodes, elements & members with loads & supports using STAAD-Pro
2. Analyse beams and frames using STAAD-Pro
3. Analyse and design steel structures using STAAD-Pro
4. Model elements and members with loads and supports using ETABS
5. Model building structures using ETABS
6. Analyse and design building structures using ETABS

EXPERIMENTS TO BE CARRIED OUT

STAAD PRO

1. Overview of Structural Analysis and Design Calculating Shear Force and Bending Moment values for various supports and load types
2. Introduction- Co-ordinate Systems, Global Vs Local Model Generation, Creating Nodes & Members Select Menu
3. Model Editing Tools, Connect Beams Along, Stretch Selected Members, Intersect Selected Members, Merge Selected Members, Renumber, Split Beam, Break Beams at Selected Nodes Creating Models by using Structure Wizard, Mini Project
4. Support Specification- Member Property Specification, Member Offset, Material Specification, Group Specification Loading, Creating a Primary Load, Adding Self weight
5. Loading, Nodal Load, Member Load, Uniform Force and Moment, Concentrated Force and Moment –
6. General Guidelines for Design, Concrete Design in STAAD.PRO, Column Design ,Beam Design

ETABS

1. Basics about the ETABS.

2. Introduction to various commands of ETABS and their applications in detail.
3. 2D model, analysis and design for Trusses, Beams and Frames

4. 3D model and analysis for Steel and RC Buildings.
5. Earthquake load application to RC and steel structures along with the design.
6. Members grouping

7. Design Grouping in Steel structures
8. Application of different building codes in the design of concrete and steel structures

REFERENCE BOOKS

1. Manual of STAAD PRO
2. Manual of ETABS

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	PO10	PO11	PSO 1	PSO 2	PSO 3	PSO 4
M20TB0204	CO1	3	3	3	2	3	1		1	1	1		3	3	3	1
	CO2	3	3	3	2	3	1		1	1	1		3	3	3	1
	CO3	3	3	3	2	3	1		1	1	1		3	3	3	1
	CO4	3	3	3	2	3	1		1	1	1		3	3	3	1
	CO5	3	3	3	2	3	1		1	1	1		3	3	3	1
	CO6	3	3	3	2	3	1		1	1	1		3	3	3	1

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

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	M20TBON01	MOOC/SWAYAM Online Course	OE	BE / B. TECH in Civil Engineering	3	1	0	4	--
2	M20TB0301	Internship with Report	Practical/ Term Work and Viva - Voce		2	0	4	6	--
3	M20TB0302	Project 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.

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	M20TB0401	Dissertation Phase-II	Practical/ Thesis Submission and Viva-Voce		2	0	6	8	--
2	M20TB0402	Technical Seminar With Report	Practical/ Term Work		0	0	4	4	--

1. The student is required to deliver a seminar and submit a report on the latest development in Structural Engineering

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