REVA UNIVERSITY
Bengaluru, India

SCHOOL OF CIVIL ENGINEERING

B.Tech. in Civil Engineering

HANDBOOK

2016 - 20

Rukmini Knowledge Park,
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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-centered 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 Centers" in the University extend full support to the budding entrepreneurs to nurture their ideas and establish an enterprise.

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

Welcome to the portals of REVA University!

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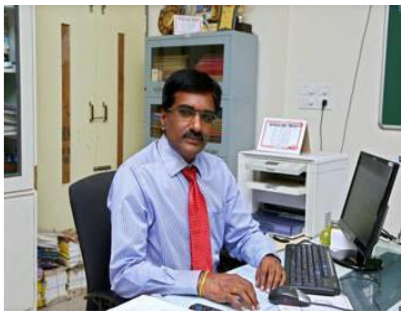
Dr.S.Y. Kulkarni

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 B Tech in Civil 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 fulfill its vision of providing world class education and create abundant opportunities for the youth of this nation to excel in the areas of Arts, Architecture, Commerce, Education, Engineering, Environmental Science, Legal Studies, Management and Science & Technology.

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

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

ABOUT REVA UNIVERSITY

REVA University has been established under the REVA University Act, 2012 of Government of Karnataka and notified in Karnataka State Gazette No. 80 dated 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, Counselors and Placement Officers.

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

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, 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 everyday 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

Misson

- To create excellent infrastructure facilities and state-of-the-art laboratories and incubation centers
- To provide student-centric learning environment through innovative pedagogy and education reforms
- To encourage research and entrepreneurship through collaborations and extension activities
- To promote industry-institute partnerships and share knowledge for innovation and development
- To organize society development programs for knowledge enhancement in thrust areas
- To enhance leadership qualities among the youth and enrich personality traits, promote patriotism and moral values.

Objectives

- Creation, preservation and dissemination of knowledge and attainment of excellence in different disciplines
- Smooth transition from teacher - centric focus to learner - centric processes and activities
- Performing all the functions of interest to its major constituents like faculty, staff, students and the society to reach leadership position
- Developing a sense of ethics in the University and Community, making it conscious of its obligations to the society and the nation
- Accepting the challenges of globalization to offer high quality education and other services in a competitive manner

ABOUT SCHOOL OF CIVIL ENGINEERING

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

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

VISION

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

BoS

Sl. No.	Name, Designation & Affiliation	Status	Correspondence Address
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B Tech (Civil Engineering) Program

Programme Overview

- Civil Engineering is a professional engineering discipline that deals with the design, construction, and maintenance of the physical and naturally built environment, including works such as roads, bridges, canals, dams, airports, sewerage systems, pipelines, and railways. In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to military engineering. The first engineering school, The National School of Bridges and Highways, France, was opened in 1747.

- The modern day civil engineering graduate should have wider knowledge of civil engineering- surveying grading design, drainage, pavement, water supply, sewer service, dams, electric and communications supply and preparations of construction plans. Civil engineers must possess technical knowledge of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering as applied to residential, commercial, and industrial and public works projects of all sizes and levels of construction. In addition, present day civil engineers should be able to use CAD/CAE and Virtual reality tools for design and visualization of complex civil engineering structures. If they possess knowledge of IoT and Artificial intelligence will be an added advantage for maintenance and monitoring of infrastructural projects.

- Employment of civil engineers is projected to grow 11 percent over the next ten years, faster than the average for all occupations. Government of India is investing on infrastructure development to rebuild, repair, and upgrade bridges, roads, levees, dams, airports, buildings, railways, metros and other structures.

- A growing population and urbanization means more buildings, new water systems, roads, waste treatment plants leading to increased demand for Civil Engineers.

- The work of civil engineers will be needed for renewable-energy projects. Thus, as these new projects gain approval, civil engineers will be further involved in overseeing the construction of structures such as wind farms and solar arrays.

- Prospects for Civil Engineers are expected to be good. They will be best for those with training in the latest software tools, particularly for computational design and simulation. Such tools allow engineers and designers to take a project from the conceptual phase till the end. Engineers who have experience or training in three-dimensional printing of concrete structures also will have better job prospects.

- **The School of Civil Engineering at REVA UNIVERSITY offers B. Tech., Civil Engineering –an undergraduate programme** to create motivated, innovative, creative and thinking graduates to fill the roles of civil engineers who can work on various infrastructure projects including construction of buildings.

- The B. Tech., in Civil Engineering curriculum developed by the faculty at the **School of Civil Engineering**, is outcome based and it comprises required theoretical concepts and practical skills in the domain. By undergoing this programme, students develop critical, innovative, creative thinking and problem solving abilities for a smooth transition from academic to real-life work environment. In addition, students are trained in interdisciplinary topics and attitudinal skills to enhance their scope. The above mentioned features of the programme, advanced teaching and learning resources, and experience of the faculty members with their strong connections with infrastructure sector makes this programme unique.

Program Educational Objectives (PEO's)

The programme educational objectives of the Civil Engineering of REVA University is to prepare graduates

1. Have successful careers based on their understanding of formal and practical methods of Civil Engineering.

2. Demonstrate, analytical and design skills including the ability to generate creative solutions and foster team-oriented, professionalism through effective communication in their careers.

3. Exhibit effective work ethics and be able to adapt to the challenges of a dynamic job environment.

Program Outcomes (POs)

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals for the solution of complex problems in civil Engineering.

2. **Problem analysis**: Identify, formulate, research literature, and analyze engineering problems to arrive at substantiated conclusions using first principles of mathematics, natural, and engineering sciences.

3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6**. The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7**. Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice

9. **Individual and team work**: Function effectively as an individual, and as a member or leader in teams, and in multidisciplinary settings.

10. **Communication**: Communicate effectively with the engineering community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give **and receive clear instructions.**

11. Project management and finance: Demonstrate knowledge and understanding of engineering and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSO)

After successful completion of the programme, the graduates shall be able to

- PSO1: Apply knowledge of Construction Engineering, Environmental Engineering, Geotechnical Engineering, Structural Engineering, Surveying, Transportation Engineering and Water Resources Engineering in real time.
- PSO2: Analyse a system, component or process in the knowledge areas of civil engineering in real time problems.
- PSO3: Design a system, component, or process in more than one areas of Civil Engineering.
- PSO4: Conduct investigations and address complex civil engineering problems; utilize and develop innovative tools and techniques that are appropriate in civil engineering discipline.

ADVISORY BOARD

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CBCS (CHOICE BASED CREDIT SYSTEM) AND CAGP (CONTINUOUS ASSESSMENT AND GRADING PATTERN) OF EDUCATION AND ITS ADVANTAGES

CBCS is a proven, advanced mode of learning in higher education. It facilitates students to have freedom in making their own choices for acquiring a Degree / Masters Degree program. It is more focused towards the student's choice in providing a wide range of modules available in a single campus across various disciplines offered by experts in the subjects. It leads to quality education with active teacher-student participation.

Studying under CBCS has following advantages:

- Students may undergo training in cross-disciplinary and multi-disciplinary subjects and acquire more focused and preferred knowledge.
- Students may get more skills from other subject(s) which are required for the career path in addition to their regular subject knowledge.
- Students may get ample opportunities to use the laboratories and gain practical exposure to the much needed modules available in other departments/schools for want of scientific inputs.
- Courses are conducted by subject experts identified on the basis of their experiences. Courses taught by such experts may provide in-depth information and clear understanding of the modules.
- Students may get an opportunity to study courses with other students of different programs and exchange their views and knowledge in a common class room.
- CBCS provides a cross-cultural learning environment.
- Students may benefit much from selecting the right options to successfully face the public service examinations like UPSC, KPSC, IES wherein the knowledge of additional subjects become mandatory for general or optional papers.
- Students are exposed to the culture of universal brotherhood during their campus life.
- Students are allowed to practice various methods of learning a subject.

Summary of REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Four Year Graduate Degree Programs, 2015

1. **Teaching and Learning Process:**

The Teaching & Learning process under CBCS – CAGP of education in each course of study will have three components, namely**:** L:T:P.

- L= Lecture (ii) T= Tutorial (iii) 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 that equip students to acquire the much required skill component.

2. **Courses of Study and Credits**

a. The study of various subjects in B Tech degree program are grouped under various courses. Each of these course carries credits which are based on the number of hours of teaching and learning.

b. 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.

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

d. **A course shall have either or all the four components.** That means a course may have only lecture component, or only practical component or combination of any two or all the three components.

e. The total credits earned by a student at the end of the semester upon successfully completing the course are L + T + P.

3. **Courses of Study**

Different C**ourses of Study** are labeled and defined as follows:

a. **Core Course:**
A course which should compulsorily be studied by a candidate as a core-requirement is termed as a Core course. The CORE courses of Study are of THREE types, viz – (i) Foundation Course, (ii) Hard Core Course, and (iii) Soft Core Course.

b. **Foundation Course (FC):**
The foundation Course is a core course which should be completed successfully as a part of graduate degree program irrespective of the branch of study.

c. **Hard Core Course (HC):**
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.

d. **Soft Core Course (SC):**
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.

e. O**pen 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 O**pen Elective Course.**

f. **Project Work / Dissertation:**
Project work / Dissertation work is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A project work carrying **FOUR or SIX** credits is called **Minor Project** work / **Dissertation.** A project work of **EIGHT, TEN, TWELVE or SIXTEEN** credits is called **Major Project** work / **Dissertation**. **A Minor Project work may be a hard core or a Soft Core as decided by the BoS / concerned. But the Major Project shall be Hard Core.**

3. **Scheme, Duration and Medium of Instructions:**

3.1 B Tech degree program is of 8 semesters - 4 years duration. A candidate can avail a maximum of 16 semesters - 8 years as per double duration norm, in one stretch to complete B Tech degree, including blank semesters, if any. Whenever a candidate opts for blank semester, he/she has to study the prevailing courses offered by the School when he/she resumes his/her studies.

3.2 The medium of instruction shall be English

4. **Minimum Credits to be Earned**

4.1 **A candidate has to earn 192 credits for successful completion of B Tech degree** with the distribution of credits for different courses as prescribed by the university. A candidate can enroll for a maximum of 32 credits and a minimum of 20 credits per Semester. However he / she may not successfully earn a maximum of 32 credits per semester. This maximum of 32 credits does not include the credits of courses carried forward by a candidate.

4.2 Only such full time candidates who register for a minimum prescribed number of credits in each semester from I semester to VIII semester and complete successfully 192 credits in 8 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.

4.3. Add- on Proficiency Certification:

To acquire **Add on Proficiency Certification** a candidate can opt to complete a minimum of 4 extra credits either in the same discipline /subject or in different discipline / subject in excess to 192 credits for the B Tech Degree program.

4.3.1. Add on Proficiency Diploma:

To acquire **Add on Proficiency Diploma,** a candidate can opt to complete a minimum of 18 extra credits either in the same discipline /subject or in different discipline / subject in excess to 192 credits for the B Tech Degree program.

The A**dd on Proficiency Certification / Diploma** so issued to the candidate contains the courses studied and grades earned.

5. Scheme of Assessment and Evaluation

5.1. The Scheme of Assessment and Evaluation will have two parts, namely;

i. Internal Assessment (IA); and
ii. Semester End Examination (SEE)

5.2. Assessment and Evaluation of each Course shall be for 100 marks. The Internal Assessment (IA) and Semester End Examination (SEE) of UG Engineering programs shall carry 40:60 marks respectively (i.e., 40 marks internal assessment; 60 marks semester end examination).

5.3. The 40 marks of internal assessment shall comprise of:

Internal Test	= 30 marks
Assignments / Seminars / Model Making etc.	= 10 marks

5.4. There shall be three internal tests conducted as per the schedule given below. The students have to attend all the three tests compulsorily.

- 1st test for 15 marks at the end of 5th week of the beginning of the semester;
- 2nd test for 15 marks at the end of the 10th week of the beginning of the semester; and
- 3rd test for 15 marks at the end of the 15th week of the beginning of the semester.

5.5. The coverage of syllabus for the said three tests shall be as under:

- For the 1st test syllabus shall be 1st unit of the course;
- For the 2nd test it shall be 2nd unit and 1st half of the 3rd unit;
- For the 3rd test the syllabus will be 2nd half of the 3rd unit and complete 4th unit.

5.6. Out of 3 tests, the highest marks scored in **two tests** are automatically considered while assessing the performance of the students.

5.7. There shall be two Assignments / Seminars each carrying 5 marks ; whereas the number of model designs and the marks for each model design shall be decided by the School well in advance and should be announced before commencement of the Semester to avoid ambiguity and confusion among students and faculty members.

5.8. The Semester End Examination for 60 marks shall be held in the 18th and 19th week of the beginning of the semester and the syllabus for the semester end examination shall be entire 4 units.

5.9. The **duration of the internal test shall be 75 minutes and for semester end examination the duration shall be 3 hours**.

5.10. Summary of Internal Assessment and Evaluation Schedule is provided in the table given below.

Summary of Internal Assessment and Evaluation Schedule

Type of Assessment	Period	Syllabus	Marks	Activity
First Test	2nd half of 5th Week	1st Unit	15	Consolidation of 1st Unit
Allocation of Topics for Assignments / Seminars / Model making*	Beginning of 6th Week	First unit and 1st half of second unit		Instructional process and Continuous Assessment
Submission of Assignments / Conduct of Seminars / Presentation of Model Design*	8th Week	First unit and 1st half of second unit	5	Instructional process and Continuous Assessment

Second Test	2nd half of 10th Week	Second unit and 1st half of third unit	15	Consolidation of 2nd and 3rd Unit
Allocation of Topics for Assignments / Seminars / Model making*	Beginning of 11th Week	3rd unit and 1st half of 4th unit		Instructional process and Continuous Assessment
Submission of Assignments / Conduct of Seminars / Presentation of Model Design*	13th Week	3rd unit and 1st half of 4th unit	5	Instructional process and Continuous Assessment
Third Test	2nd half of 15th Week	Second half of third unit and complete 4th Unit	15	Consolidation of 2nd half of 3rd Unit and entire 4th Unit
Semester end practical examination	16th Week	Entire syllabus	60	Conduct of Semester - end Exams
Preparation for Semester–End Exam	16th , 17th &	Entire Syllabus		Revision and preparation for semester–end exam
Semester End Theory Examination	18th Week & 19th Week	Entire Syllabus	60	Evaluation and Tabulation
	End of 20th Week			Notification of Final Grades

Note: 1. **As per the model making is concerned, the School shall decide about the Marks and the Number of Model Designs and as well the schedule of allocation and presentation of model design(s). If the model design carries 5 marks, there shall be two model designs; and in case of 10 marks, there shall be one model design. However, the decision of the School should be announced in the beginning of the Semester for students to avoid ambiguity and confusion.*

2. Examination and Evaluation shall take place concurrently and Final Grades shall be announced latest by 5 days after completion of the examination.

3. Practical examination wherever applicable shall be conducted after 3rd test and before semester end examination. The calendar of practical examination shall be decided by the respective School Boards and communicated well in advance to the Registrar (Evaluation) who will notify the same immediately.

6. Assessment of Performance in Practical

6.1. The performance in the practice tasks / experiments shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

6.2. The 40 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	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.	10 marks
	Total	**40 marks**

63. The 60 marks meant for Semester End Examination (SEE), shall be allocated as under:

i	Conduction of semester end practical examination	40 marks
ii	Write up about the experiment / practical conducted	10 marks
iii	Viva Voce	10 marks
	Total	**60 marks**

6.4. The duration for semester-end practical examination shall be decided by the concerned School Board.

7. Evaluation of Minor Project / Major Project / Dissertation:

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

8. Provision for Appeal

If a candidate is not satisfied with the evaluation of Internal Assessment components (Mid-term Tests and Assignments), he/she can approach the grievance cell with the written submission together with all facts, the assignments, test papers etc, 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 taking

disciplinary/corrective action on an evaluator if he/she is found guilty. The decision taken by the grievance cell is final.

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

- The Registrar (Evaluation) - 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.

9. Eligibility to Appear for Semester End Examination (SEE)

Only those students who fulfill a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc, as part of the program, as provided in the succeeding sections, shall be eligible to appear for Semester End examination.

10. Requirements to Pass the Semester and to Carry Forward the Failed Subjects / Courses:

10.1 Requirements to Pass a Course

A candidate's performance from IA and SEE will be in terms of scores, and the sum of IA and SEE scores will be for a maximum of 100 marks (IA = 40 + SEE = 60) and have to secure a minimum of 40% to declare pass in the course. However, a candidate has to secure a minimum of 25% (15 marks) in Semester End Examination (SEE) which is compulsory.

10.2 Provision to Carry Forward the Failed Subjects / Courses:

The student who has failed in a maximum of 4 courses in odd and even semesters together shall move to next semester of immediate succeeding year of study. And he / she shall appear for Semester End examination of failed courses of previous semesters concurrently with odd semester end examinations and / or even semester end examinations of current year of study. However, he / she shall have to clear all courses of both odd and even semesters of preceding year to register for next succeeding semester.

Examples:-

a. Student "A" has failed in 1 Course in First Semester and 3 Courses in Second Semester. He / she is eligible to seek admission for Third Semester and appear for Semester end examination of 1 failed Course of First Semester concurrently with Third Semester end

examination. Likewise, he / she is eligible to appear for Semester end examination of 3 failed Courses of Second Semester concurrently with Fourth Semester end examination. However, he / she has to clear all the failed Courses of First and Second Semesters before seeking admission to Fifth Semester.

b. Student "B" has failed in 2 Courses in Third Semester and 2 Courses in Fourth Semester and has passed in all Courses of First and Second Semesters. He / she is eligible to seek admission to Fifth Semester and appear for Semester end examination of 2 failed Courses of Third Semester concurrently with Fifth Semester end examination. Likewise he / she is eligible to appear for Semester end examination of 2 failed Courses of Fourth Semester concurrently with Sixth Semester end examination. However, he / she is not eligible to seek admission to Seventh Semester unless he / she passes in all the failed courses of Third and Fourth Semesters.

c. Student "C" has failed in 4 Courses in Fifth Semester but has cleared all the courses in Sixth Semester. He / She has also passed all the courses of First to Fourth Semesters. Student "C" is eligible to seek admission for Seventh Semester and appear for Semester end examination of 4 failed Courses of Fifth Semester concurrently with Seventh Semester end examination. However, he / she has to pass all the failed courses of Fifth Semester along with Seventh and Eighth Semesters courses to earn B Tech Degree.

d. Student "D" passed in 1to 4 semesters, but failed in 3 courses of 5th Semester and in 1 course of 6th Semester. He / She has also passed all the courses of First to Fourth Semesters. Student "D" is also eligible to seek admission for 7th Semester and appear for Semester end examination of 3 failed courses of 5th Semester concurrently with 7th Semester end examination and one failed course of 6th Semester concurrently with 8th Semester end examination. However, he / she has to pass all the 3 failed courses of Fifth Semester and 1 course Sixth Semester along with Seventh and Eighth Semester courses to earn B Tech Degree.

10.3. Re-Registration and Re-Admission:

a) 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 end semester examination and he / she shall have to seek re-admission to that semester during subsequent semester / year within a stipulated period.

b) 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.

11. Attendance Requirement:

11.1. All students must attend every lecture, tutorial and practical classes.

11.2. 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.

11.3. 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 as provided in 10.3.

11.4. Teachers offering the courses will place the above details in the School Board meeting during the last week of the semester, before the commencement of Semester end examination, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of Semester end examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

11.5. Absence during Internal Test:

In case a student has been absent from a 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 Head of the School, for conducting a separate internal test. The Head 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.

12. Grade Card and Grade Point

12.1. Provisional Grade Card: The tentative / provisional grade card will be issued by the Registrar (Evaluation) at the end of every semester indicating the courses completed successfully. The provisional grade card provides **Semester Grade Point Average** (SGPA).

12.2. Final Grade Card: Upon successful completion of B Tech Degree a Final Grade card consisting of grades of all courses successfully completed by the candidate will be issued by the Registrar

(Evaluation).

12.3. 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 > 90	9	v*9	A+
70 > 80	8	v*8	A
60 > 70	7	v*7	B+
55 > 60	6	v*6	B
50 > 55	5.5	V*5.5	C+
40 > 50	5	v*5	C
0-40	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=[IA + 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.

12.3.1. 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 in a given semester, 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.

Illustration for Computation of SGPA and CGPA

Illustration No. 1

Course	Credit	Grade Letter	Grade Point	Credit Point (Credit x Grade)
Course 1	**4**	**A+**	**9**	**4X9=36**
Course 2	**4**	**A**	**8**	**4X8=32**
Course 3	**3**	**B+**	**7**	**3X7=21**
Course 4	**3**	**O**	**10**	**3X10=30**
Course 5	**3**	**C**	**5**	**3X5=15**
Course 6	**3**	**B**	**6**	**3X6=18**

Course 7	**2**	**O**	**10**	**2X10=20**
Course 8	**2**	**A**	**8**	**2X8=16**
	24			**188**

Thus, **SGPA = 188 ÷ 24 = 7.83**

Illustration No. 2

Course	**Credit**	**Grade letter**	**Grade Point**	**Credit Point (Credit x Grade point)**
Course 1	**4**	**A**	**8**	**4X8=32**
Course 2	**4**	**B+**	**7**	**4X7=28**
Course 3	**3**	**A+**	**9**	**3X9=27**
Course 4	**3**	**B+**	**7**	**3X7=21**
Course 5	**3**	**B**	**6**	**3X6=18**
Course 6	**3**	**C**	**5**	**3X5=15**
Course 7	**2**	**B+**	**7**	**2X7=21**
Course 8	**2**	**O**	**10**	**2X10=20**
	24			**175**

Thus, **SGPA = 175 ÷ 24 = 7.29**

Illustration No.3

Course	**Credit**	**Grade Letter**	**Grade Point**	**Credit Point (Credit x Grade point)**
Course 1	4	O	10	4 x 10 = 40
Course 2	4	A+	9	4 x 9 = 36
Course 3	3	B+	7	3 x 7 = 21
Course 4	3	B	6	3 x 6 = 18
Course 5	3	A+	9	3 x 9 = 27
Course 6	3	B+	7	3 x 7 = 21
Course 7	2	A+	9	2 x 9 = 18
Course 8	2	A+	9	2 x 9 = 18
	24			**199**

Thus**, SGPA = 199 ÷ 24 = 8.29**

12.4. Cumulative Grade Point Average (CGPA):

12.4.1. Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (192) for B. Tech degree in Engineering & Technology 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	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	26	7.40	26 x 7.40 = 192.4
5	26	8.29	26 x 8.29 = 215.54
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222
Cumulative	196		1588.26

Thus, **CGPA** = $\frac{24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25}{196}$ = 8.10

12.4.2. 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 8.10 x 10=81.0

12.5. 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) G	Letter Grade	Performance	FGP 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

Overall percentage=10*CGPA

13. **Challenge Valuation:**

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script(s) of semester end examination by paying the prescribed fee within 10 days after the announcement of the results. He / She can challenge the grade awarded to him/her by surrendering the grade card and by submitting an application along with the prescribed fee to the Registrar (Evaluation) within 10 days after the announcement of the results. **This challenge valuation is only for semester end examination.**

b. The answer scripts for which challenge valuation is sought for shall be evaluated by the external examiner who has not involved in the first evaluation. The higher of two marks from first valuation and challenge valuation shall be the final.

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

List of Codes for Programs and Disciplines / Branch of Study

Program Code	Title of the Program	Discipline Code	Name of the Discipline / Branch of Study
BA	Bachelor of Arts	AE	Advanced Embedded Systems
BB	BBM (Bachelor of Business	AI	Advanced Information Technology
BC	B.Com (Bachelor of Commerce)	AP	Advanced Power Electronics
BR	B. Arch (Bachelor of Architecture)	CA	Computer Aided Structural Engineering
BS	B Sc, BS (Bachelor of Science)	CE	Civil Engineering
BT	B. Tech (Bachelor of Technology)	CH	Chemistry
BP	Bachelor of Computer Applications	CO	Commerce
BL	LLB (Bachelor of Law)	CS	Computer Science and Engineering /
MA	Master of Arts	DE	Data Engineering and Cloud Computing

MB	MBA (Master of Business Administration)	EC	Electronics and Communication Engineering
MC	M.Com (Master of Commerce)	EN	English
MS	M. Sc / MS (Master of Science)	MD	Machine Design and Dynamics
MT	M Tech (Master of Technology)	ME	Mechanical Engineering
MC	Master of Computer Applications	EE	Electrical & Electronics Engineering

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16 F1100	**CO1**	3	3	2	1	2	1							3	1	1	1
	CO2	3	3	2	2	2	2							3	1	1	1
	CO3	3	2	2	2	1	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1
BTCE16 F1200	**CO1**						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
							3	3		3	3		3				
BTCE16 F1300	**CO1**	**3**	**3**		**1**									**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**1**										**3**	**3**	**3**	**3**
	CO3	**3**	**2**					**1**						**3**	**3**	**3**	**3**
BTCE16 F1400	**CO1**	**3**	**2**	**2**	**2**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**1**	**3**			
	CO2	**3**	**3**	**1**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**			
	CO3	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**			

	CO4	**3**	**2**	**2**	**2**	**1**	**1**	-	-	-	-	-	**1**	**3**			
BTCE16F1500	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**2**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO3	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
BTCE16F1600	**CO1**	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
	CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
	CO3	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
BTCE16F1700	**CO1**	**2**	**2**	**2**		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**2**
	CO2	**2**	**3**	**1**		**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**2**
	CO3	**2**	**2**	**1**		**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**2**
	CO4	**2**	**2**	**1**		**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**2**	**1**	**2**
BTCE16F1800	**CO1**	**3**	**2**	**2**	**2**		**1**						**1**	**3**			
	CO2	**3**	**3**	**1**	**2**		**1**							**3**			
	CO3	**3**	**2**	**2**	**1**		**1**							**3**			
	CO4	**3**	**2**	**2**	**2**		**1**						**1**	**3**			
BTCE16F1900	**CO1**	**3**	**3**	**2**	**1**	**1**	**1**			**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
	CO2	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO3	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO4	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
BTCE16F2100	**CO1**	3	2	2	1	1	1							3	1	1	1
	CO2	3	3	2	1	2	1							3	1	1	1
	CO3	3	3	2	2	1	1							3	1	1	1

	CO4	3	3	2	1	2	1							3	2	1	1
BTCE16F2200	**CO1**						3	3		3	3		3				
	CO2						3	3		3	3		3				
	CO3												3				
	CO4						3	3		3	3		3				
BTCE16F2300	**CO1**	**3**	**2**	**3**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO2	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO3	**3**	**3**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**			
	CO4	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**			
BTCE16F2400	**CO1**	3	3	2	1		2	1				1	3	3	2	2	3
	CO2	3	3	3	1		1					1	2	3	3	2	2
	CO3	3	3	2	1		1	1				1	2	3	3	2	2
	CO4	3	3	1	1		2	1				1	3	3	2	2	1
BTCE16F2500	**CO1**	**3**	**2**	**3**	**2**											**1**	**1**
	CO2	**2**	**2**		**2**								**1**		**1**	**1**	
	CO3	**3**	**3**	**2**	**3**	**1**									**1**	**2**	
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**		**2**	**2**	
BTCE16F2600	**CO1**	**1**	**2**		**2**									**1**	**1**	**1**	**1**
	CO2	**1**	**2**		**3**	**3**									**1**	**2**	
	CO3	**2**	**1**	**3**	**3**											**1**	**1**
	CO4	**2**	**2**	**2**	**2**					**3**						**1**	**1**
BTCE16F2700	**CO1**	**2**	**1**	**2**		**1**	**1**			**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**
	CO2	**2**	**1**	**2**		**1**	**1**			**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**
	CO3	**2**	**1**	**2**		**1**	**1**			**2**	**1**	**1**	**2**	**2**	**2**	**2**	**2**

	CO4	**2**	**1**	**2**		**1**	**1**			**2**	**1**	**2**	**2**	**2**	**2**	**2**	**2**
BTCE16F2800	**CO1**	**3**	**2**	**3**	**2**											**1**	**1**
	CO2	**2**	**2**		**2**								**1**		**1**	**1**	
	CO3	**3**	**3**	**2**	**3**	**1**									**1**	**2**	
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**		**2**	**2**	
BTCE16F2900	**CO1**	**2**	**1**			**2**					**1**			**3**	**3**	**1**	**2**
	CO2	**2**	**1**			**1**					**1**			**3**	**3**	**1**	**2**
	CO3	**2**	**1**			**2**	**1**				**1**			**3**	**3**	**1**	**2**
	CO4	**2**	**1**			**3**					**1**			**3**	**3**	**1**	**2**
BTCE16F3100	**CO1**	3	3	2	2	1	1							3	1	1	1
	CO2	3	3	2	2	1	1							3	1	1	1
	CO3	3	2	1	3	2	1							3	1	1	1
	CO4	3	2	2	2	2	1							3	2	1	1
BTCE16F3200	**CO1**	**3**	**3**	**1**	**1**	**1**	**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
	CO2	**3**	**3**	**1**	**2**		**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
	CO3	**3**	**3**	**2**	**2**	**2**	**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
	CO4	**3**	**3**	**2**	**2**	**2**	**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
BTCE16F3300	**CO1**	**3**	**2**	**2**	**3**									**3**	**1**	**1**	**2**
	CO2	**3**	**3**	**2**										**3**	**3**	**1**	**1**
	CO3	**3**	**3**	**2**	**1**									**3**	**3**	**1**	**1**
	CO4	**3**	**3**	**3**	**1**									**3**	**3**	**3**	**2**
BTCE16F3400	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F3500	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**
BTCE16F3600	**CO1**	**3**	**3**	**2**	**1**	**1**	**1**			**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
	CO2	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO3	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO4	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
BTCE16F3700	**CO1**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F3800	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F3900	**CO1**	2	2											-	-	-	-
	CO2		3			2								-	-	-	-
	CO3		3			2				1				-	-	-	-
	CO4		2			3	2	1						-	-	-	-
BTCE16F4100	**CO1**	3	2	1	2	1	1							3	1	1	1
	CO2	3	2	1	2	1	1							3	1	1	1
	CO3	3	3	2	1	2	1							3	1	1	1

	CO4	3	3	2	2	1	1							3	2	1	1
BTCE16F4200	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F4300	**CO1**	**2**	**3**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**	**2**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**3**		**1**	**2**	**1**	**2**		**1**	**2**	**3**	**3**	**2**	**1**
	CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**
BTCE16F4400	**CO1**	**3**	**2**		**3**		**2**	**2**					**2**	**3**	**1**		
	CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
BTCE16F4500	**CO1**	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2
BTCE16F4600	**CO1**	**3**		**2**		**2**	**2**	**3**					**1**	**3**	**2**	**1**	**1**
	CO2	**2**	**3**	**1**	**2**		**2**		**2**	**1**		**1**		**2**	**3**	**3**	**2**
	CO3	**1**	**1**	**3**	**2**	**3**	**3**	**3**			**1**	**2**	**2**	**3**	**2**	**2**	**1**
	CO4	**3**	**2**	**2**	**1**		**2**		**1**		**2**	**3**		**2**	**3**	**3**	**2**
BTCE16F4700	**CO1**	**1**	**2**	**3**	**-**	**-**	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**3**	**3**	**2**	**3**
	CO2	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

	CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	3	3	1
	CO4	3	2	-	2	-	-	1	-	-	-	-	-	3	3	3	2
BTCE16F4800	CO1	3	2	2	-	-	-	-	-	2	-	-	3	3	3	3	3
	CO2	3	2	3	2	-	-	-	-	2	-	-	3	3	3	3	3
	CO3	3	2	3	2	-	-	-	-	2	-	-	3	3	3	3	3
	CO4	3	2	3	1	-	-	-	-	2	-	-	3	3	3	3	3
BTCE16F4900	CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
	CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
	CO3	3	3	3	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO4	3	3	3	3	3	-	3	-	-	-	-	3	3	3	3	3
BTCE16F5100	CO1	3	3				2	3	3	3	3		1	3	3	2	3
	CO2	3	3	3	2	1	2	2	3	2	2			3	2	3	3
	CO3	3	3	3	3		2	3	3	3	3	1	2	3	3	2	2
	CO4	3			3	3	3	3	2	2	3		2	3	3		1
BTCE16F5200	CO1	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2
BTCE16F5310	CO1	3	3	1		2	2	1					2	3	3		2
	CO2	3	3	1										3	3		
	CO3	3	3	1		3	2						2	3	3		3
	CO4	3	3	1		3	2						2	3	3		3
	CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	3	3

BTCE16F5320	**CO2**	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F5330	**CO1**	2	2											-	-	-	-
	CO2		3			2								-	-	-	-
	CO3		3			2				1				-	-	-	-
	CO4		2			3	2	1						-	-	-	-
BTCE16F5340	**CO1**	**3**	**3**		**1**	**3**				**2**	**2**	**3**		**3**	**2**	**1**	**3**
	CO2	**3**	**3**		**1**	**2**				**3**	**2**	**3**		**3**	**2**	**1**	**3**
	CO3	**2**	**3**		**1**	**3**				**2**	**3**	**3**		**3**	**2**	**1**	**3**
	CO4	**3**	**3**		**1**	**1**				**3**	**3**	**3**		**3**	**2**	**1**	**3**
BTCE16F5410	**CO1**					3	2	3	2	2		2	2	3	1	1	3
	CO2	2				2	2	3	1	1		1	2	3	2	1	3
	CO3	2		2	1	1	1	3	1	1			2	3	2	1	3
	CO4	3	1		1	1		3	2	1	1		3	3	2	1	3
BTCE16F5420	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F5430	**CO1**	**3**	**1**				**3**		**2**		**2**		**2**	**3**			**1**
	CO2	**3**	**3**			**2**		**2**	**2**	**3**	**3**			**3**	**3**		**1**
	CO3	**3**	**3**		**2**	**2**	**3**			**3**	**1**	**2**		**3**	**3**	**1**	**2**
	CO4	**3**	**3**		**2**	**2**	**1**	**2**	**3**		**3**		**2**	**3**			**2**
	CO1	3	1	1	2	3			-	2	-	-	3	3	3	3	3

BTCE16F5440	**CO2**	3	3	2	3	2		-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	-	-	-	-	1	-	-	3	3	3	3	3
	CO4	3	3	1	2	3	2	3	-	2	-	-	3	3	3	3	3
BTCE16F5510	**CO1**	**2**	**3**	**1**										**2**	**3**		
	CO2		**2**	**2**										**3**		**1**	**2**
	CO3	**1**	**2**					**1**						**2**		**1**	
	CO4	**1**	**2**	**1**										**2**			**1**
BTCE16F5520	**CO1**	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO2	**3**	**3**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO3	**2**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**2**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
BTCE16F5530	**CO1**	2	1	2	1								2	3	3	2	1
	CO2	3	1	1	2								2	3	3	2	1
	CO3	3	1	1	3								2	3	3	2	1
	CO4	3	1	2	3	2							2	3	3	2	1
BTCE16F5540	**CO1**	**3**	**3**	**2**	**3**	**1**	**1**	**1**		**1**			**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**		**1**			**2**	**3**	**3**	**3**	**3**
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	CO4	**3**	**3**	**2**	**1**	**1**	**2**	**1**		**1**			**3**	**3**	**3**	**3**	**3**
BTCE16F5600	**CO1**	**1**	**2**	**3**	**-**	**-**	**-**	**2**	**1**	**1**	**-**	**-**	**-**	**3**	**3**	**2**	**3**
	CO2	**1**	**2**	**3**	**-**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**
	CO3	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**1**
	CO4	**3**	**2**	**-**	**2**	**-**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

BTCE16F5700	CO1	3	3	1	1	1	2	1	-	1	2	-	2	3	2	2	2
	CO2	3	2	1	2	1	2	1	-	1	2	-	2	3	2	2	2
	CO3	3	2	2	3	1	2	1	-	1	2	-	2	3	2	2	1
BTCE16F5800	CO1	3	3	3	3		2	-	-	-	1	3	3	3	3	3	3
	CO2	3	3	3	3		2	-	-	-	1	3	3	3	3	3	3
	CO3	3	3	3	3		2	-	-	-	1	3	3	3	3	3	3
BTCE16F6100	CO1	3	3											3	3		
	CO2	3	3	3	1	2			2		2		1	3	3	3	1
	CO3	3	3	3	2	3	1	1	1		2		1	3	3	3	2
	CO4	3	3	3	2	3	1	1	1		2		1	3	3	3	2
BTCE16F6200	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO3	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3
BTCE16F6310	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO3	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3
BTCE16F6320	CO1	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2
BTCE16F6330	CO1	3	3				2	3	3	3	3		1	3	3	2	3
	CO2	3	3	3	2	1	2	2	3	2	2			3	2	3	3

	CO3	**3**	**3**	**3**	**3**		**2**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**2**	**2**
	CO4	**3**			**3**	**3**	**3**	**3**	**2**	**2**	**3**		**2**	**3**	**3**		**1**
BTCE16F6340	**CO1**	3	1	1	2	3			-	2	-	-	3	3	3	3	3
	CO2	3	3	2	3	2		-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	-	-	-	-	1	-	-	3	3	3	3	3
	CO4	3	3	1	2	3	2	3	-	2	-	-	3	3	3	3	3
BTCE16F6410	**CO1**	**3**	**3**	**1**		**2**	**2**	**1**					**2**	**3**	**3**		**2**
	CO2	**3**	**3**	**1**										**3**	**3**		
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	CO4	**3**	**3**	**1**		**3**	**2**						**2**	**3**	**3**		**3**
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	CO2	**3**	**3**			**2**		**2**	**2**	**3**	**3**	**1**		**3**	**3**		**1**
	CO3	**3**	**3**		**2**	**2**	**3**	**1**		**3**	**1**	**2**		**3**	**3**	**1**	**2**
	CO4	**3**	**3**		**2**	**2**	**1**	**2**	**3**		**3**		**2**	**3**			**2**
BTCE16F6440	**CO1**	**3**	**3**	**3**	**1**								**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**3**	**2**								**3**	**3**	**3**	**3**	**3**
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	CO4	**3**	**2**	**3**	**2**			**1**					**3**	**3**	**3**	**3**	**3**
BTCE16F6510	**CO1**	**3**	**3**	**1**	**1**	**1**	**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
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	CO3	**3**	**3**	**2**	**2**	**2**	**2**	**1**		**1**	**2**		**3**	**3**	**3**	**3**	**2**
BTCE16F6520	**CO1**	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
BTCE16F6530	**CO1**	**3**	**3**	**1**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**2**	**3**	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
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BTCE16F6540	**CO1**	**2**	**3**	**1**										**2**	**3**		
	CO2		**2**	**2**										**3**		**1**	**2**
	CO3	**1**	**2**					**1**						**2**		**1**	
	CO4	**1**	**2**	**1**										**2**			**1**
BTCE16F6600	**CO1**	**3**	**3**			**3**								**3**	**3**	**2**	**3**
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	CO3	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
	CO4	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
BTCE16F6700	**CO1**	**2**	**1**	**1**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**1**		**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**3**	**1**
	CO4	**2**	**3**	**3**	**1**		**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**3**	**1**
BTCE16F6800	**CO1**	1	2	3	-	-	-	2	1	-	-	-	-	3	3	2	3
	CO2	1	2	3	-	-	-	-	1	-	-	-	-	3	3	3	2

	CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	1
	CO4	3	2	-	-	-	-	1	-	-	-	-	-	3	3	3	2
BTCE16F7100	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**2**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**1**	**3**	**2**	**2**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**1**	**3**	**2**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F7310	**CO1**	**2**	**1**	**1**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
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BTCE16F7330	**CO1**	**1**	**2**	**2**	**2**									**2**	**2**	**2**	**2**
	CO2	**2**	**2**	**3**	**2**									**2**	**2**	**3**	**2**
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	CO4	**2**	**2**	**3**	**2**									**2**	**2**	**3**	**2**
BTCE16F7340	**CO1**	**2**	**1**	**1**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**1**		**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**3**	**1**
	CO4	**2**	**3**	**3**	**1**		**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**3**	**1**
BTCE16F7410	**CO1**	**3**	**3**	**2**	**2**	**2**	**1**	**1**			**1**	**1**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**1**	**1**	**1**		**1**	**1**	**3**	**3**	**3**	**3**	**3**

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	CO4	**3**	**1**	**2**	**1**	**3**	**1**	**2**	**1**			**3**	**3**	**3**	**3**	**3**	**3**
BTCE16F7420	**CO1**	3	3	2	3	3	-	-	-	2	-	-	3	3	3	3	**3**
	CO2	3	3	2	3	2	-	-	-	2	-	-	3	3	3	3	**3**
	CO3	3	3	2	1	2	-	2	-	2	-	-	3	3	3	3	**3**
	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	**3**
BTCE16F7430	**CO1**	**3**	**3**	**3**	**2**						**1**		**1**	**3**	**2**		**3**
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	CO2	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**2**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
BTCE16F7510	CO1	**2**	**2**											**3**	**3**	**3**	**3**
	CO2	**2**	**3**	**2**	**1**	**1**								**3**	**3**	**3**	**3**
	C03	**1**	**3**	**3**	**3**		**2**			**1**				**3**	**3**	**3**	**3**
	CO4	**2**	**3**	**2**	**2**					**1**				**3**	**3**	**3**	**3**
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	CO2	**3**	**2**	**1**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**2**
	CO3	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**1**
	CO4	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**2**
BTCE16F7530	**CO1**	**3**					**3**		**2**		**2**		**2**	**3**			**1**
	CO2	**3**	**3**			**2**		**2**	**2**	**3**	**3**	**1**		**3**	**3**		**1**

	CO3	**3**	**3**		**2**	**2**	**3**	**1**		**3**	**1**	**2**		**3**	**3**	**1**	**2**
	CO4	**3**	**3**		**2**	**2**	**1**	**2**	**3**		**3**		**2**	**3**			**2**
BTCE16 F7540	CO1	3	3	3	2		1			2	2	3	2	3	2	2	3
	CO2	2	3	3	2		1			3	3		3	3	2	2	3
	CO3	3	2	3	2		1			3	3		2	3	2	2	3
	CO4	3	2	3			2			2	2		3	3	2	2	3
BTCE16 F7600	**CO1**	**3**	**3**											**3**	**3**		
	CO2	**3**	**3**	**3**	**1**	**2**			**2**		**2**		**1**	**3**	**3**	**3**	**1**
BTCE16 F7700	**CO1**	**1**	**2**	**3**	**-**	**1**	**-**	**2**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**3**
	CO2	**1**	**2**	**3**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**2**
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	CO4	**3**	**1**	**3**	**-**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**2**
BTCE16 F7800	**CO1**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
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	CO4	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16 F8100	**CO1**	**3**	**2**		**1**	**1**	**1**		**2**	**3**	**2**	**2**		**3**	**3**		**3**
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	CO4	**3**	**3**		**2**	**2**			**3**	**2**	**3**	**2**	**2**	**3**	**3**		**1**
BTCE16 F8210	**CO1**	**1**	**1**	**1**	**-**	**1**	**-**	**2**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**3**
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	CO3	**3**	**3**	**3**	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**1**
	CO4	**3**	**2**	**3**	**1**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

BTCE16F8220	**CO1**	**3**	**2**				**2**	**3**					**2**	**3**	**1**	**3**	**3**
	CO2	**3**	**2**				**2**	**3**	**1**				**2**	**3**	**1**	**3**	**3**
	CO3	**3**	**2**			**1**	**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**
	CO4	**3**	**2**				**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**
BTCE16F8230	**CO1**	**3**	**3**				**2**	**3**	**3**	**3**	**3**		**1**	**3**	**3**	**2**	**3**
	CO2	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**2**			**3**	**2**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**		**2**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**2**	**2**
	CO4	**3**			**3**	**3**	**3**	**3**	**2**	**2**	**3**		**2**	**3**	**3**		**1**
BTCE16F8240	**CO1**	2					3	3	1	1	1	2	2	3	2	1	2
	CO2	2	2	2	1		2	3	1	3		2	3	3	2	3	2
	CO3	2		3	2	3		3	1	3		1	3	3	2	2	2
	CO4	2	2	3	1	2			2	3	2		3	3	2	1	2
BTCE16F8310	**CO1**	**3**	**2**	**3**	**2**		**2**	**1**	**2**		**3**	**2**		**3**	**3**		**3**
	CO2	**3**	**2**	**2**	**3**	**3**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	**3**	**1**	**3**
	CO3	**3**	**3**	**3**	**1**	**3**	**1**	**1**		**1**	**2**	**3**	**2**	**3**	**3**	**1**	**3**
	CO4	**2**	**3**	**3**	**2**	**3**	**2**	**3**	**2**	**1**	**1**	**1**	**2**	**3**	**3**	**3**	**3**
BTCE16F8320	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**2**	**-**	**2**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**2**	**-**	**2**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
BTCE16F8330	**CO1**	**3**	**2**		**1**	**1**	**1**		**2**	**3**	**2**	**2**		**3**	**3**		**3**
	CO2	**3**	**2**		**2**	**2**			**2**	**2**	**2**	**3**		**3**	**2**		**3**
	CO3	**3**	**2**		**3**	**3**	**2**		**2**	**2**	**3**	**2**		**3**	**2**		**2**

	CO4	**3**	**3**		**2**	**2**			**3**	**2**	**3**	**2**	**2**	**3**	**3**		**1**
BTCE16 F8340	**CO1**	**2**	**3**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**	**2**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**3**		**1**	**2**	**1**	**2**		**1**	**2**	**3**	**3**	**2**	**1**
	CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**
BTCE16 F8400	**CO**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Mapping of PEOS with Respect to POs

	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	PS04
PEO1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

B. Tech in Civil Engineering
Scheme of Instructions

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching School/Dept.
				L	T	P	C		
I Semester: Physics Cycle									
1	BTCE16F1100	Civil Engineering Mathematics - I	HC	2	1	0	3	4	Mathematics
2	BTCE16F1200	Technical English - I	FC	2	0	2	2	4	Arts and Humanities
3	BTCE16F1300	Applied Physics	FC	2	1	0	3	4	Physics
4	BTCE16F1400	Basic Electrical and Electronics Engineering	FC	3	1	0	4	5	EEE
5	BTCE16F1500	Building Materials and Construction	HC	3	1	0	4	5	Civil
6	BTCE16F1600	Applied Physics Lab	FC	0	0	3	2	3	Physics
7	BTCE16F1700	Engineering Drawing	FC	1	0	3	2	4	Mech.
8	BTCE16F1800	Basic Electrical Engineering Lab	FC	0	0	3	2	3	EEE
9	BTCE16F1900	Building Materials and Construction Lab	HC	0	0	3	2	3	
Total Credits for the First Semester:							24	35	
II Semester: Chemistry Cycle									
1	BTCE16F2100	Civil Engineering Mathematics – II	HC	2	1	0	3	4	Mathematics
2	BTCE16F2200	Technical English – II	FC	2	0	0	2	4	Arts and Humanities
3	BTCE16F2300	Applied Chemistry	FC	2	1	0	3	4	Chemistry
4	BTCE16F2400	Engineering Mechanics	FC	3	1	0	4	5	Civil

5	BTCE16F2500	Basic Programming in C	HC	3	1	0	4	5	C&IT
6	BTCE16F2600	Applied Chemistry Lab	FC	0	0	3	2	3	Chemistry
7	BTCE16F2700	Civil Workshop Practice	FC	0	0	3	2	3	Civil
8	BTCE16F2800	Basic Programming in C	FC	0	0	3	2	3	C&IT
9	BTCE16F2900	AutoCAD Lab	FC	0	0	3	2	3	Civil
Total Credits for the Second Semester:							**24**	**34**	

III SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours / Week	Teaching School/ Dept.
					L	T	P	Total		
1	BTCE16F3100	Engineering Mathematics – III	HC	16F2100	2	1	0	3	4	Mathematics
2	BTCE16F3200	Strength of Materials	HC	16F2400	3	1	0	4	5	Civil
3	BTCE16F3300	Concrete Technology and Alternative Building Materials	HC	16F1500	2	1	0	3	4	Civil
4	BTCE16F3400	Applied Surveying	HC		2	1	0	3	4	Civil
5	BTCE16F3500	Fluid Mechanics	HC		2	1	0	3	5	Civil
6	BTCE16F3600	Strength of Materials Lab	FC		1	0	1	2	3	LAW
7	BTCE16F3700	Surveying Lab	FC		1	0	1	2	3	Civil
8	BTCE16F3800	Fluid Mechanics Lab	FC		1	0	1	2	3	Civil
9	BTCE16F3900	Architectural Planning and Design of Buildings (Manual Drawing)	Term Work		1	0	2	3	2+ 3	Civil
Total Credits for the Third Semester								**25**	**36**	

IV SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours/ Week	Teaching School/Dept.
					L	T	P	Total		
1	BTCE16F4100	Engineering Mathematics – IV	HC	16F3100	2	1	0	3	4	Mathematics
2	BTCE16F4200	Water Supply and Sanitary Engineering	HC		3	1	0	4	5	Civil
3	BTCE16F4300	Structural Analysis	HC	16F3200	2	1	0	3	5	Civil
4	BTCE16F4400	RCC Design of Structures	HC		2	1	0	3	5	Civil
5	BTCE16F4500	Railways, Airways, Waterways and Tunnels	HC		2	1	0	3	4	Civil
6	BTCE16F4600	Hydrology and Irrigation Engineering	HC	16F3500	2	1	0	3	5	Civil
7	BTCE16F4700	Concrete Technology Lab	FC		1	0	1	2	3	Civil
8	BTCE16F4800	Building Drawing with AutoCAD	FC		1	0	1	2	3	Civil
9	BTCE16F4900	Environmental Engineering Lab	FC		1	0	1	2	3	Placement
Total Credits for the Fourth Semester								**25**	**37**	

V SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours / Week	Teaching School /Dept.
					L	T	P	Total		
1	BTCE16F5100	Highway Engineering	HC	16F4500	3	1	0	4	5	Civil
2	BTCE16F5200	Soil Mechanics And Foundation Engineering	HC		3	1	0	4	5	Civil
3	BTCE16F5310	Advanced Structural Analysis	SC		3	1	0	4	5	Civil
	BTCE16F5320	Industrial Waste Water Treatment								
	BTCE16F5330	Town and Country Planning								
	BTCE16F5340	Principles Of Planning And Construction Management								
4	BTCE16F5410	Design Of Masonry Structures	SC		2	1	0	3	4	Civil
	BTCE16F5420	Air And Noise Pollution								Civil
	BTCE16F5430	Mass Transit Facilities								Civil
	BTCE16F5440	Remote Sensing And GIS								Civil
5	BTCE16F5510	Design Of Earthquake Resistant Structures	SC		2	1	0	3	4	Civil
	BTCE16F5520	Advanced Surveying								

	BTCE16F5530	Water Resources Engineering								
	BTCE16F5540	Non Destructive Testing								
6	BTCE16F5600	Highway Engineering Lab	FC		1	0	1	2	3	Civil
7	BTCE16F5700	Geotechnical Engineering Lab	FC		1	0	1	2	3	Civil
8	BTCE16F5800	Hydraulic Structures Design And Drawing	Term Work		2	0	1	3	2+3	Civil
Total Credits for the Fifth Semester								**25**	**34**	

VI SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours/ Week	Teaching School/Dept.
					L	T	P	Total		
1	BTCE16F6100	Steel Structures	HC		3	1	0	4	5	Civil
2	BTCE16F6200	Prestressed Concrete and Prefabricated Structures	HC	16F4400	3	1	0	4	5	Civil
3	BTCE16F6310	Design of tall structures	SC		3	1	0	4	5	Civil
	BTCE16F6320	Advanced Geotechnical Engineering								
	BTCE16F6330	Pavement Materials and Analysis								
	BTCE16F6340	Applications of GPS								
4	BTCE16F6410	Matrix Methods of Analysis	SC		2	1	0	3	4	Civil
	BTCE16F6420	Ground Improvement Techniques								
	BTCE16F6430	Traffic Engineering								
	BTCE16F6440	Open Channel Hydraulics								
5	BTCE16F6510	Theory of Elasticity	SC		2	1	0	3	4	Civil
	BTCE16F6520	Hydraulic Machinery								
	BTCE16F6530	Occupational Hazard and Industrial Safety								

	BTCE16F6540	Basics of Structural Dynamics								
6	BTCE16F6600	STAAD PRO and ETABS Lab	FC		1	0	1	2	3	Civil
7	BTCE16F6700	RCC Design and Drawing - Manual	Term Work		2	0	1	3	2+3	Civil
8	BTCE16F6800	New / Old Tank Project	FC		1	0	1	2	3	Civil
Total Credits for the Sixth Semester								**25**	**34**	

VII SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours /Week	Teaching School /Dept.
					L	T	P	Total		
1	BTCE16F7100	Solid Waste Management	HC	16F4200	3	1	0	4	5	Civil
2	Open Elective Offered by Other Schools will be Taught	OE	OE		3	1	0	4	5	Other Schools
3	BTCE16F7310	Design of Industrial Structures	SC		3	1	0	4	5	Civil
	BTCE16F7320	Construction Chemicals and Special Concretes								
	BTCE16F7330	Pavement Design and Construction								
	BTCE16F7340	Offshore Structures and Coastal Management								
4	BTCE16F7410	Advanced Prestressed Concrete	SC		2	1	0	3	4	Civil
	BTCE16F7420	Ground Water Engineering								
	BTCE16F7430	Highway Geometric Design								
	BTCE16F7440	Green Buildings and Green Technology								
5	BTCE16F7510	Finite Element Method of Analysis	SC		2	1	0	3	4	Civil

	BTCE16F7520	Structures on Expansive Soils			2	1	0	3	4	Civil
	BTCE16F7530	Urban Transport Planning			2	1	0	3	4	Civil
	BTCE16F7540	Construction Equipments			2	1	0	3	4	Civil
6	BTCE16F7600	Steel Structures Design and Drawing-Manual	Term work		1	0	1	2	2+3	Civil
7	BTCE16F7700	Estimation, Costing and Valuation	Term work		1	0	1	2	2+3	Civil
8	BTCE16F7800	Highway and PHE Project	FC	-	1	0	1	2	3	Civil
9	BTCE16F7900	SEMINAR	FC		1	0	0	1	1	
Total Credits for the Seventh Semester									**24**	**37**

VIII SEMESTER

Sl. No	Course Code	Title of the Course	Course Type	Pre requisite	Credit Pattern & Credit Value				Contact Hours /Week	Teaching School /Dept.
					L	T	P	Total		
1	BTCE16F8100	Financial and Project Management	HC		3	1	0	4	5	Civil
2	BTCE16F8210	Design of Bridges	SC		2	1	0	3	4	Civil
	BTCE16F8220	Hydro Power Engineering								
	BTCE16F8230	Pavement Evaluation and Rehabilitation								
	BTCE16F8240	Disaster Management and Mitigation								
3	BTCE16F8310	Repair and Rehabilitation of Structures	SC		2	1	0	3	4	Civil
	BTCE16F8320	Environmental Impact Assessment								
	BTCE16F8330	Highway Economics and Preparation of Detailed Project Report								
	BTCE16F8340	Plastic Analysis of Structures								
4	BTCE16F8400	PROJECT	SC		0	0	0	10	3	Civil
Total Credits for Eigth Semester									**20**	**16**
Total credits for all Eight semesters									**192**	

B. Tech in Civil Engineering

DETAILED SYLLABUS

(Effective from Academic Year 2016 - 20)

Semester – I

BTCE16F1100	Civil Engineering Mathematics -I	L	T	P	C
Duration:14 Wks		2	1	0	3

Prerequisites:

Basics of Pre University Mathematics.

Course Objectives:

1. Explain the concept of differential equation.
2. Classifies the differential equations with respect to their order and linearity.
3. Learn fundamental concepts of linear algebra.
4. Be familiar with the notion of a linear transformation and its matrix.

Course Outcomes:

1. Solve First Order Differential Equations by converting separable and homogeneous equations to exact differential equations by integrating factors.
2. Find the solution of higher-order linear differential equations.
3. Solve systems of linear equations by using Gaussian elimination to reduce theaugmented matrix to row echelon form or to reduced row echelon form;
4. Find the Eigen values and Eigen vectors of a square matrix using the characteristic of a polynomial and will know how to diagonalize a matrix when this is possible.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1100	CO1	3	3	2	1	2	1							3	1	1	1
	CO2	3	3	2	2	2	2							3	1	1	1
	CO3	3	2	2	2	1	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1

Course Contents:

Unit-I: First Order Differential Equations [12 Hrs]

Separable Equations, Homogeneous & Non-homogeneous Equations, and Exact Differential Equations, Integrating Factor, Civil Engineering Applications, and BernoulliEquation – Deflection of Beams.

Unit-II: Second & Higher Order Differential Equations [12 Hrs]

Linear Dependence and Independence of Solutions, Wronskian, Constant Coefficient Homogeneous Equations, Cauchy-Euler Equation ,Non-homogeneous equations, Method of Variation of Parameter, Method of Inverse Operator, Legendre Equation

Unit-III: Linear Algebra-I [12 Hrs]

Basic Concepts, Rank of Matrix, Linear System of Equations, Conditions of Existence and Uniqueness of Solutions, Solution by Gauss Elimination.

Unit-IV: Linear Algebra-II [12 Hrs]

Cramer's Rule, Linear Dependence and Independence, Eigen Values and Eigen Vectors, Basis, Symmetric, Skew-Symmetric and Orthogonal Matrices, Complex Matrices, Similarity of Matrices, Diagonalization.

Reference Books:

1. B.V.Raman, Higher Engineering Mathematics, 6th Edition, Tata Mc-Graw Hill Publications,2008
2. E.Kreyszig, Advanced Engineering Mathematics, 10thEdition, Johnwilley & Sons Publications, 2011
3. P.V. O'Neil, Advanced Engineering Mathematics, 7th Edition, Thomson Publications 2010
4. Potter & Goldberg, Mathematical Methods, 2nd Edition, Prentice-Hall of India Publications, 2010

BTCE16F1200	**Technical English-I**	L	T	P	C
Duration: 16weeks		2	0	2	2

Prerequisites:

Pre University English.

Course Objectives:

1. To enable learners of Engineering and Technology develop their basic communication skills in English.
2. To emphasize specially the development of speaking skills amongst learners of Engineering

and Technology.

3. To ensure that learners use the electronic media such as internet and supplement the learning materials used in the classroom.
4. To inculcate the habit of reading and writing leading to effective and efficient communication.

Course Outcomes:

1. Speak clearly, confidently, comprehensibly, and communicate with one or many listenersusingappropriate communicative strategies.
2. Write cohesively and coherently and flawlessly avoiding grammatical errors, using a wide
3. Vocabulary range, organizing their ideas logically on a topic.
4. Read different genres of texts adopting various reading strategies.Listen/view and comprehend different spoken discourses/excerpts in different accents.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1200	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				

Course Contents:

UNIT-I **[12 HOURS]**

Classroom Session:Reading - Skimming a reading passage – Scanning for specific information Writing - Free writing on any given topic (My favourite place / Hobbies / School life, etc.) Grammar - Prepositions - Wh-questions - Tenses (Simple); Email communication

Practice Session:Listening - Types of listening - Listening to audio (verbal & sounds);Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family /friend;

Reading - Skimming a reading passage – Scanning for specific information Writing - Free writing on any given topic (My favourite place / Hobbies / School life,etc.) Grammar - Prepositions - Wh-questions - Tenses (Simple)Email communication

UNIT-II **[12 HOURS]**

Classroom Session:Reading Comprehension – Critical reading - Finding key information in a given text; Writing - Process descriptions (general/specific) -Recommendations –Grammar - Subject-verb agreement.

Practice Session: Listening - Listening and responding to video lectures / talks; Speaking - Describing a simple process(filling a form, etc.) - Asking and answering questions - Telephone skills – Telephone etiquette; Reading Comprehension – Critical reading Writing - Process descriptions (general/specific) -Recommendations –Grammar - Subject-verb agreement.

UNIT-III **[12 HOURS]**

Classroom Session: Reading – Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing -Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) Grammar -Tenses (Past)

Practice Session: Listening - Listening to specific task - focused audio tracks; Speaking - Role-play – Simulation -Group interaction - Speaking in formal situations (teachers, officials, foreigners)Reading – Reading and interpreting visual material; Writing - Jumbled sentences - Coherence and cohesion in writing -Channel conversion (flowchart into process) - Types of paragraph (cause and effect / compare and contrast / narrative / analytical) - Grammar -Tenses (Past)

UNIT-IV **[12 HOURS]**

Classroom Session: Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Vocabulary - Single word substitutes – Dialogue Writing Grammar – Direct and indirect speech

Practice Session: Listening - Watching videos / documentaries and responding to questions based on them; Speaking -Responding to questions –Reading - Making inference from the reading passage - Predicting the content of a reading passage; Writing - Interpreting visual materials (line graphs, pie charts etc.) - Essay writing – Different types of essays; Vocabulary - Single word substitutes – Dialogue Writing-Grammar – Direct and indirect speech

REFERENCE BOOKS:

1. Raman, Meenakshi & Sangeetha Sharma., Technical Communication: Principles and Practice. Oxford University Press, New Delhi. 2011
2. Regional Institute of English. English for Engineers. Cambridge University Press, New Delhi. 2006
3. Rizvi, Ashraf. M. Effective Technical Communication. Tata McGraw-Hill, New Delhi.2005
4. Rutherford, Andrea. J Basic Communication Skills for Technology. Pearson, New Delhi.2001
5. Viswamohan, Aysha. English for Technical Communication. Tata McGraw-Hill, New Delhi. 2008
6. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
7. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering.
8. Orient Blackswan, Chennai. 2011

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com

EXTENSIVE Reading (Not for Examination)

1. Kalam, Abdul. Wings of Fire. Universities Press, Hyderabad. 1999.

WEBSITES:

1. http://www.usingenglish.com
2. http://www.uefap.com

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like self-introduction, peer introduction,
- Group poster making, grammar and vocabulary games, etc.
- Discussions
- Role play activities
- Short presentations
- Listening and viewing activities with follow up activities like discussion, filling up worksheets,
- Writing exercises (using language lab wherever necessary/possible) etc.

EVALUATION PATTERN:

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Reviews
- Creative writing

All the four skills are to be tested with equal weightage given to each.

- Speaking assessment: Individual speaking activities, Pair work activities like role play,

- Interview, Group discussions
- Reading assessment: Reading passages with comprehension questions graded from simple to complex, from direct to inferential
- Writing assessment: Writing paragraphs, essays etc. Writing should include grammar and vocabulary.

Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content.

BTCE16F1300	**Applied Physics**	L	T	P	C
Duration: 14weeks		2	1	0	3

Prerequisites:

Basics of Pre University Physics.

Course Objectives:

1. To make a bridge between the physics fundamentals which they studied in schools and their applications which they are going to study in Civil Engineering.
2. To be acquainted with the basic concepts of properties of fluids, pressure and its measurements.
3. To get exposed to basic concepts of elastic properties of solids, vibrations & To Know about the different types of kinematic motions

Course Outcomes:

Understand the Concepts of Kinematics

1. Understand the advanced concepts of Hydraulics and Fluid Machines, Strength of Materials.
2. Understand and demonstrate different applications of pressure measuring gauges.
3. Understands the concepts of Lift, earthquake concepts.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1300	CO1	**3**	**3**		**1**									**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**1**										**3**	**3**	**3**	**3**
	CO3	**3**	**2**					**1**						**3**	**3**	**3**	**3**

Course Contents:

UNIT-I : Properties of Fluids [12 HOURS]

Physical properties of fluids like Density, Specific Weight, Specific Gravity, Specific Volume, Surface Tension, Capillarity, Viscosity, Compressibility and Bulk Modulus, Classifications of Fluids.

Pressure and its Measurements: Pressure, Pascal's law, pressure at a point, hydrostatic Law, atmospheric pressure, absolute pressure, gauge pressure and Vacuum pressure, Manometers'

UNIT-II : Hydrostatics Forces [12 HOURS]

On plane submerged surfaces, Forces on Horizontal surfaces, Vertical Surfaces, Inclined Surfaces Centre of Buoyancy, Forces on Curved Surfaces. Buoyancy and Flotation, Archimedes' Principle, Stability of Immersed and floating bodies, determination of metacentric height.

UNIT-III: Mechanical Properties Of Materials [12 HOURS]

: Stress and Strain, Tensile strength, Stress-Strain- behaviour, Ductile and Brittle Materials, Impact test, Toughness, Hardness test, Fatigue and fatigue test, Creep and Creep test, Fracture. Vibrations: Simple harmonic motion, free vibration, damped vibration and forced vibration, resonance and its importance.

UNIT-IV: Kinematics of Rectilinear Motion [12 HOURS]

Principles of dynamics, differential equation of rectilinear motion, D'Alemberts principle, Momentum and Impulse, Work and Energy, Impact.

Curvilinear Translation:Kinematics of Curvilinear motion, Differential equations of curvilinear motion, motion of projectile, D'Alemberts principles in curvilinear motion, work and energy in curvilinear motion.

REFERENCE BOOKS:

1. Dr.P.N.Modi & Dr.S.M.Seth, Hydraulics and Fluid Mechanics, 15th edition,Standard Book House, 2004
2. A.K. Mohanty,"Fluid Mechanics", 2ndEdition, PHI Learning Private Limited, New Delhi, 2010
3. M.S.Vijaya, G.Rangarajan Material Science, 3rd Edition, Tata Mc Graw Hill, 2006
4. S.Timoshenko, D.H.Young and J.V.RAo, Engineering Mechanics, 4th Edition, McGraw Hill, 2006
5. by I.S.Gujral, Engineering Mechanics, First Edition, Laxmi Publications, 2012
6. James F.Shackeford, Material Science for Engineers,6th Edition, Prentice Hall, 2004

7. A.K.Tayal, Engineering Mechanics,14th Edition, Umesh Publishers, 2010
8. Beer & Johnston, Mechanics of Materials, 6th Edition, McGraw Hill, 2012

BTCE16F1400	Basic Electrical and Electronics Engineering	L	T	P	C
Duration:16Weeks		3	1	0	4

Prerequisites:

Pre University Physics

Course Objectives:

1. To establish a broad concept of various types of generation of electricity.
2. To make students understand the basics of representation of electrical quantities and relationship among them.
3. To provide an overview of various types of electrical apparatus.
4. To introduce the concept of domestic wiring and importance of safety and sensing devices.

Course Outcomes:

1. Describe the operation and control of various types of generation of electricity
2. Describe the principle of operation of electrical apparatus
3. Differentiate between single and three phase systems
4. Solve simple mathematical relationships related to electrical apparatus.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1400	CO1	3	2	2	2	-	1	-	-	-	-	-	1	3			
	CO2	3	3	1	2	1	1	-	-	-	-	-	-	3			
	CO3	3	2	2	1	1	1	-	-	-	-	-	-	3			
	CO4	3	2	2	2	1	1	-	-	-	-	-	1	3			

Course Contents:

UNIT-I **[12 HOURS]**

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Kirchhoff's Laws, Resistive, Inductive, capacitive networks, Series, Parallel circuits and Star-delta and delta-star

transformations, Network Theorems (Superposition, Thevenin's& Norton's) Generationof an alternating Emf–average and rms values of alternating quantity–representation of alternating quantities by phasors–single phase series and parallel circuits (simple problems), three phase systems and power calculations.

UNIT-II [12 HOURS]

DC-Machines: Construction and Principle of operation of DC Machines–Emf & Speed equations-types–applications.

AC-Machines: Principle of operation of single phase transformers–Emf equation–losses–efficiency and regulation-Construction and working principle of induction motors–Slip–torque characteristics–applications-Construction and Principle of operation of alternators-applications.

UNIT-III [12 HOURS]

Instruments: Basic Principle of indicating instruments–PMMC&MI instruments.

Tariff, Protective Devices and Sensors:Tariff schemes, basic concepts of domestic wiring and types, Earthing, protective fuses, MCB, sensors: pressure sensors, strain gage, proximity sensors, displacement sensors, totary encoder and ultrasonic sensors and civil engineering applications.

UNIT-IV [12 HOURS]

Semiconductor Diodes: Introduction, Physical operation of p-n junction diodes, Characteristics of p-n junction diodes, Zener diode, Rectifier circuits (half-wave, full-wave, bridge and peak rectifiers),Light emitting diodes.

Digital Electronic Principles:Introduction, Binary digits, Logic levels and Digital waveforms, Introduction to basic logic operation, Number system, Decimal numbers, Binary numbers, Decimal-to-Binary conversion, Simple binary arithmetic.

REFERENCE BOOKS:

1. David V. Kerns, JR. J. David Irwin, Essentials of Electrical and Computer Engineering, 2nd edition, Pearson, 2004

2. V.K.Mehta, Principles of Electrical and Electronics Engineering, Third Edition, S.Chand & Co. 2014

3. Robert L. Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory , 11th Edition, Pearson Education, 2015

4. Thomas L. Floyd and R.P. Jain, Digital Fundamentals (10th Edition), Pearson Education, 2011

5. Theodore Wildi, "Electrical Machines, Drives, and Power Systems", 5th Edition, Pearson

Education, 2007

4. Hughes, Electrical Technology, 9th Edition, Pearson, 2005

5. Kulshreshtha C, Basic Electrical Engineering , 2nd Edition Tata McGraw Hill, 2011

6. Mittle V.N. and A. Mittal, Basic Electrical Engineering, 2nd Edition, Tata McGraw Hill, 2005

BTCE16F1500	**Building Materials and Construction**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Basics of Science

Course Objectives:

1. To understand the different types, and Properties of Bricks, Stones, Cement and Concrete.
2. To understand the different types of materials and joints in brick and stone masonry.
3. To understand the different types of foundations, damp proofing provided for civil engineering structures and the technical terms and different types of stairs
4. To understand the different types, materials, and uses of plastering and flooring and Maintenance of buildings

Course Outcomes:

1. Identify the types, origin, classification, manufacturing process, qualities, and uses of building elements, of bricks, stones, cement and concrete.
2. Identify the materials, and explain the types of joints in brick and stone masonry.
3. Identify different types of foundations provided for civil engineering structures and explain the technical terms and types of stairs of a building.
4. Know the various types and uses of plastering and flooring materials.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
	CO1	3	3	2	3	3	-	1	-	-	-	-	3	3	3	3	3

Course Contents:																	2
6F150																	
0	CO3	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**

UNIT-I **[12 HOURS]**

Bricks: Brick as a construction material and its importance, materials suitable for manufacture of bricks, methods of brick manufacture, types of bricks, qualities of a good brick, testing of brick, uses of bricks. Stone: Introduction, classification, composition and characteristics, useful Indian Stone, method of quarrying and dressing

Cement: classification, chemical composition, manufacturing of cement, hydration, tests for cement, uses of cement, types of cement, Mortar: Definition, composition and uses of mortar. Concrete: quality of mixing water, workability, factor affecting workability, measurement of workability, segregation, Bleeding, uniformity of mixing, mixing time, vibration of concrete.

UNIT-II **[12 HOURS]**

Concrete: concrete mix design, Admixtures, grade and strength of concrete.

Brick masonry: terminology used, materials used, causes of failure of brick masonry, types of bonds, brick laying, joints in brick work, reinforced brick work, joint between old and new masonry, maintenance of brick work. Stone masonry: terminology used, materials used, cutting and dressing of stones, types of stone masonry-rubble and ashlar, general principals of construction, joints of stones, stone lining, maintenance of stone works, artificial stones, cavity walls: purpose and method of construction.

UNIT-III **[12 HOURS]**

Foundation: Functions and requirements of a good foundation, types of foundation, Preliminary investigation of soil, safe bearing capacity of soil , spread foundations, combined foundations, strap, mat and pile foundations, pier foundations, excavation of Foundation,

Damp proofing: causes and effects, materials used for damp proofing, method of preventing dampness, damp proof course. Stairs: terms used types of stairs, essential requirements, wooden stairs, concrete stairs and metal stairs.

UNIT-IV **[12 HOURS]**

Flooring : types of flooring and their construction – brick, stone, concrete, tile, mosaic, terrazzo, asphalt, Plastering: definition, materials used for plastering, types of plastering, methods of

plastering, defects of remedial measures in plastering. Maintenance of Buildings: causes and prevention of cracks in building, special repair of buildings, annual maintenance.

REFERENCE BOOKS:

1. S. C.Rangawala, Engineering materials, Charotar Publishing House, 2014
2. S.C.Rangawala, Engineering Materials and building construction, Charotar publishing House
3. Sushil Kumar, Building Construction, Standard publishers distributors, New Delhi
4. D.N.Ghose, Material of Construction, TMH Publishing Company Ltd.
5. S K Sharma and B.K.Kaul, A text book of Building Construction, S Chand & Company Limits
6. A M Neville, Properties of Concrete, Low Price Edition

BTCE16F1600	**Applied Physics Lab**	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Applied Physics

Course Objectives:

1. Understand concepts of applied physics to estimate the properties of materials like Young's modulus, Rigidity modulus and Tensile strength.
2. Understand concepts of applied physics to estimate the properties of fluids like Viscosity, Surface Tension and Pressure acting on them.
3. Understand the Newton's Laws and Laws of vibration of a stretched string using sonometer.
4. Understand the concepts of floating bodies and determine the metacentric height.

Course Outcomes:

1. To apply the knowledgeofApplied physics and will be able to estimate the properties of materials like Young's modulus, Rigidity modulus and Tensile strength
2. To apply the knowledgeofApplied physics and will be able to estimate the properties like viscosity, surface tension and pressure acting on fluids.
3. To apply the knowledge of Newton's laws and laws of vibration of a stretched string using sonometer.
4. To apply the knowledge of Metacentric height of floating bodies.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1600	CO1	**3**	**3**	**2**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
	CO2	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**
	CO3	**3**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**3**	**2**	**1**	**-**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**2**	**3**	**1**	**2**

Course Contents:

A student is expected to perform ten experiments from the given below.

List of Experiments:

1. Determination of acceleration due to gravity by Bar/Kater's Pendulum.
2. Determination of Young's Modulus by single cantilever method/Uniform bending method.
3. Determination of Rigidity Modulus by Static Torsion Method.
4. Determination of Moment of Inertia of a Fly Wheel/Mass.
5. Determination of Tensile strength of mild steel materials
6. Determination of viscosity by poiseuille method.
7. Determination of Metacentric height of a floating body.
8. Determination of pressure on a surface by using monometer.
9. Calibration of pressure gauges.
10. Viscosity using a falling ball method.
11. Determination of surface tension of water by capillary rise method.
12. Verification of laws of vibration of a stretched string using sonometer.
13. Newton's Laws of motion.

REFERENCE BOOKS:

1. Dr.P.N.Modi & Dr.S.M.Seth, Hydraulics and Fluid Mechanics, Standard Book House.
2. A.K.Mohanty, Fluid Mechanics, PHI
3. M.S.Vijaya & G.Rangarajan Material Science, Tata McGraw Hill.

BTCE16F1700		**L**	**T**	**P**	**C**

Duration: 14 weeks	Engineering Drawing (Manual)	1	0	3	2

Prerequisites:

Basics of Geometry

Course Objectives:

1. Comprehend general projection theory, with emphasis on orthographic projection to represent in two-dimensional views (principal, auxiliary, sections).
2. Dimension and annotate two-dimensional engineering drawings.
3. Understand the application of industry standards and best practices applied in engineering
4. Emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.

Course Outcomes:

1. Be able to develop independent thinking and problem solving capabilities
2. Be able to express component descriptions as per the commonly practiced standards
3. Be able to produce 2D simple drawings
4. Be able to comprehend industry specific drawings.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F1700	CO1	2	2	2		-	-	-	-	-	-	-	-	3	2	1	2
	CO2	2	3	1		1	-	-	-	-	-	-	-	3	2	1	2
	CO3	2	2	1		1	1	-	-	-	-	-	-	3	2	1	2
	CO4	2	2	1		1	-	-	-	-	-	-	-	3	2	1	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Engineering Drawing: Introduction, Drawing Instruments and their uses, BIS conventions, Drawing sheets, Lettering, Dimensioning, Scales, Methods of drawing simple figures-ellipse, parabola, hyperbola, regular polygons.

Orthographic Projections: Projection – Orthographic Projection – Planes of Projection – Four quadrants – First-angle projection – Third-angle projection.

Projection of points and Straight Lines (First-angle Projection only): Points in different quadrants. Lines inclined to both the planes, True Lengths, traces.

Projection of Planes: Projection of regular Planes- auxiliary planes and projections inclined to both planes.

UNIT-II **[12 HOURS]**

Projection of Solids: Projection of regular solids inclined to both planes – auxiliary views, section and sectional views of right regular solids – prisms, cone – auxiliary views.

Development of Solids: Development of surfaces of right regular solids – prisms, cylinders, pyramid cone and their parts.

UNIT-III **[12 HOURS]**

Isometric Projection:Principles of Isometric projections - Lines and Planes – Isometric Scale – Isometric views – conventions – Isometric views of lines, plane figures, simple and compound solids – Isometric projection of objects having non-isometric lines. Isometric projection of spherical parts.

UNIT-IV **[12 HOURS]**

Transformation of projections:Conversion of Isometric Views to Orthographic views – conventions. Introduction to perspective views – Visual ray method simple drawings.

REFRENCE BOOKS:

1. N.D.Bhatt and V.M. Panchal, Engineering Drawing, 48th Edition, Charotar Publishing House, Gujarat, 2005
2. K.L.Narayan & P.Kannaih, Engineering Drawing
3. K.R. Gopalakrishna, Engineering Graphics, 32nd Edition, Subhas Publishers, 2005
4. P. S. Gill, Engineering Drawing, 11th Edition, S. K. Kataria & Sons, Delhi, 2001

BTCE16F1800	**Basic Electrical Engineering Lab**	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Basic Electrical and Electronics Engineering

Course Objectives:

1. To establish a broad concept of various types of electrical apparatus and instrumentation.
2. To provide hands on experience with electrical apparatus.
3. To train students to read and understand schematics so as to make connection.
4. To train students in collecting and interpreting experimental data.

Course Outcomes:

1. Recognize various symbols in a schematic and make connection as per the schematic
2. Make use of various measuring instruments to collect experimental data
3. Relate experimental results with theoretical analysis.
4. Demonstrate the ability to critically evaluate the performance of an electrical apparatus.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1800	CO1	3	2	2	2		1						1	3			
	CO2	3	3	1	2		1							3			
	CO3	3	2	2	1		1							3			
	CO4	3	2	2	2		1						1	3			

Course Contents:

List of Experiments

1. Electronic tools introduction: ammeter, voltmeter, CRO.(demo)
2. Home electrical wiring demonstration: energy meter, MCB, tube light wiring.
3. Study of mutual induction effect.
4. Home electrical wiring demonstration: short circuit, series and parallel operation of load.
5. Electrical safety training: electrical activities to avoid shocks and importance of earthing, role of fuse, working of MCB.

6. Single phase transformer: study of polarity, turns ratio, losses, open circuit and closed circuit test
7. Diode rectifier applications: half wave & full wave rectifier, ripple factor calculations.
8. Thyristor applications: half wave & full wave rectifier (demo)
9. Sensor experiments: ultrasonic sensor, pressure sensor, LDR, opto coupler.
10. Connection & Measurement of power consumption of a fluorescent lamp.

BTCE16F1900	Building Materials and Construction Lab	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Building Materials and Construction.

Course Objectives:

1. Ability to apply knowledge of mathematics and engineering in calculating the physical properties of bricks such as absorption, strength, shape and size.
2. Assessment of mechanical properties of cement such as soundness and specific gravity.
3. To study the behaviour of aggreagtes under impact load, compression
4. To study the behaviour of mortar under compression and tension.

Course Outcomes:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength, absorption, shape and size.
2. Identify the functional role of cement and able to test of different cement property to specify qualityof cement.
3. Able to test of different aggregate properties
4. Able to test to find the strength of cement mortar

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F1900	CO1	3	3	2	1	1	1			1	2	2	2	3	2	2	2
	CO2	3	2	1	2	1	2			1	2	3	2	2	3	2	2
	CO3	3	2	1	2	1	2			1	2	3	2	2	3	2	2
	CO4	3	2	1	2	1	2			1	2	3	2	2	3	2	2

Course Contents:

List of Experiments:

I. Test on bricks

1. Shape and size
2. Water absorption
3. Compressive strength

II.Test on cement

1. Soundness by lechatliers
2. Specific Gravity
3. Standard consistency by Vicat test
4. Initial and final setting time

III.Test on Fine aggregate

1. Fineness modulus by sieve analysis
2. Specific Gravity
3. Bulking of Fine aggregate
4. Bulk Density of Fine aggregate
5. Moisture Content of Fine aggregate

IV.Test on Coarse aggregate

1. Crushing value of coarse aggregate
2. Fineness modulus by sieve analysis
3. Specific Gravity
5. Bulk Density of coarse aggregate
6. Moisture Content of coarse aggregate

V.Test on mortar

1. Compressive strength of cement mortars
2. Tensile strength of cement mortars

REFERENCE BOOKS:

1. C B Kukreja, Material testing laboratory manual, Standard Publishers, New Delhi.
2. Beer & Johnston, Mechanics of Materials
3. James M. Gere, Mechanics of Materials, 5th Edition, Thomson Learning
4. Strength of Materials, Singer, Harper and Row Publications.
5. Timoshenko and Young , Elements of Strength of Materials, Affiliated East-West Press

SEMESTER II

BTCE16F2100	Civil Engineering Mathematics -II	L	T	P	C
Duration: 14weeks		2	1	0	3

Prerequisites:

Differential Equations and Linear Algebra

Course Objectives:

1. How to solve linear Partial Differential Equations with different methods.
2. Find the magnitude, direction and component form of displacement vectors.
3. To study and understand the application approach of the concepts of Vector calculus.
4. Introduce students to some physical problems in Engineering models that results in partial differential equations.

Course Outcomes:

1. Classify partial differential equations and transform into canonical form.
2. Use vector models for applications of velocity, force, work, finding angles between vectors, and projections.
3. Solve civil engineering problems by using vector concept.
4. Solve linear partial differential equations of both first and second order.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F2100	CO1	3	2	2	1	1	1							3	1	1	1
	CO2	3	3	2	1	2	1							3	1	1	1
	CO3	3	3	2	2	1	1							3	1	1	1
	CO4	3	3	2	1	2	1							3	2	1	1

Course Contents:

UNIT-I **[12 HOURS]**

Partial Derivative and Multiple Integrals: Functions of several variables – Partial derivatives, Homogeneous Functions – Euler's theorem and Jacobians.

Multiple Integrals – Double integrals – Change of order and change of variables. Triple integrals Illustrative examples for change of order and change of variables.

UNIT-II **[12 HOURS]**

Vector Calculus: Differentiation of Vectors , Curves in space, Velocity and Acceleration, Tangential and normal acceleration, Relative velocity and acceleration, Scalar and vector point functions-Vector operator del. Del applied to scalar point functions – Gradient, Del applied to Vector point function – Divergence and Curl.

UNIT-III **[12 HOURS]**

Vector Calculus for Civil Engineering Applications: Line integral – Circulation – work, Surface integral – Flux, Green's Theorem in the Plane, Stokes Theorem, Volume Integral, Divergence Theorem, Green's Theorem, Irrational and Solenoidal Fields, Orthogonal Curvilinear Coordinates.

UNIT-IV **[12 HOURS]**

Partial Differential Equations:Formation of partial differential equations, solutions of non-homogeneous PDE by direct integration, Solutions of homogeneous PDE involving derivatives with respect to one independent variable, solution of Lagranges Linear PDE, Solutions of PDE by product method, Civil Engineering Applications.

REFERENCE BOOKS:

1) B.V.Raman, Higher Engineering Mathematics, Publisher:TMH
2) E.Kreyszig, Advanced Engineering Mathematics, 8thEdition, Publisher: Johnwilleyn&Sons.
3) P.V.O'Neil, Advanced Engineering Mathematics, Publisher: Thomson
4) Potter & Goldberg, Mathematical Methods, Publisher:PHI

BTCE16F2200	Technical English-II	L	T	P	C
Duration: 14weeks		1	0	1	2

Prerequisites:

Technical English-I

Course Objectives:

1. To make learners acquire listening and speaking skills in both formal and informal contexts.
2. To help them develop their reading skills by familiarizing them with different types of reading strategies.
3. To equip them with writing skills needed for academic as well as workplace contexts.
4. To make them acquire language skills at their own pace by using e-materials and language

Course Outcomes:

1. Speak convincingly, express their opinions clearly, initiate a discussion, negotiate, and argue using appropriate communicative strategies.
2. Write effectively and persuasively and produce different types of writing such as narration, description, exposition and argument as well as creative, critical, analytical and evaluative writing.
3. Read different genres of texts, infer implied meanings and critically analyse and evaluate them for ideas as well as for method of presentation.
4. Listen/view and comprehend different spoken excerpts critically and infer unspoken and implied meanings.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F2200	CO1						3	3		3	3		3				
	CO2						3	3		3	3		3				
	CO3												3				
	CO4						3	3		3	3		3				

Course Contents:

UNIT-I **[12 HOURS]**

Classroom Session: Reading - Developing analytical skills, Deductive and inductive reasoning - Extensive reading; Reading Comprehension, Instructions. Grammar Active and passive voice

Practice Session: Listening - Listening to informal conversations and participating; Speaking - Opening a conversation (greetings, comments on topics like weather) - Turn taking - Closing a conversation (excuses, general wish, positive comment, thanks) Grammar - Active and passive voice

UNIT-II **[12 HOURS]**

Classroom Session: Reading - Reading a short story or an article from newspaper, Critical reading, Comprehension skills; Formal Letter (Accepting/ inviting/declining)Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Vocabulary - Homonyms (e.g. can) - Homophones (e.g. some, sum) -Checklist- Group Discussion- Compound words.

Practice Session: Listening - Listening to situation based dialogues; Speaking - Conversation practice in real life situations, asking for directions (using polite expressions), giving directions (using imperative sentences), Purchasing goods from a shop, Discussing various aspects of a film (they have already seen) or a book (they have already read) Formal Letter (Accepting/ inviting/declining)Personal letter (Inviting your friend to a function, congratulating someone for his / her success, thanking one's friends / relatives); Vocabulary - Homonyms (e.g. can) - Homophones (e.g. some, sum). Different models of group discussion -Compound words.

UNIT-III **[12 HOURS]**

Classroom Session: Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes. Note making skills – making notes from books Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation).

Practice Session: Listening - Listening to the conversation - Understanding the structure of conversations; Speaking - Conversation skills with a sense of stress, intonation, pronunciation and meaning - Seeking information – expressing feelings (affection, anger, regret, etc.); Reading - Speed reading – reading passages with time limit - Skimming; Writing - Minutes of meeting – format and practice in the preparation of minutes. Note making skills – making notes from books Types of

reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation)

UNIT-IV **[12 HOURS]**

Classroom Session: Reading - Reading the job advertisements and the profile of the company concerned – scanning; Writing - Applying for a job – cover letter - résumé preparation – vision, mission and goals of the candidate; Interview Skills.

Practice Session: Listening - Listening to a telephone conversation, Viewing model interviews (face-to-face, telephonic and video conferencing); Speaking - Role play practice in telephone skills - listening and responding, -asking questions, -note taking – passing on messages, Role play and mock interview for grasping interview skills; Different forms of résumés- Filling up a résumé / cover letter; Telephonic interview – recording the responses - e-résumé writing. Interview Skills

REFERENCE BOOKS:

1. Department of English, Anna University. Mindscapes: English for Technologists and Engineers. Orient Blackswan, Chennai. 2012
2. Dhanavel, S.P. English and Communication Skills for Students of Science and Engineering. Orient Blackswan, Chennai. 2011
3. Anderson, Paul V. Technical Communication: A Reader-Centered Approach. Cengage. New Delhi. 2008
4. Muralikrishna, &SunitaMishra.Communication Skills for Engineers. Pearson, New Delhi. 2011
5. Riordan, Daniel. G. Technical Communication. Cengage Learning, New Delhi. 2005
6. Sharma, Sangeetha & Binod Mishra. Communication Skills for Engineers and Scientists. PHI Learning, New Delhi. 2009
7. Smith-Worthington, Darlene & Sue Jefferson. Technical Writing for Success. Cengage, Mason USA. 2007

EXTENSIVE Reading (Not for Examination)

1. Khera, Shiv. You can Win. Macmillan, Delhi. 1998.

Websites

1. http://www.englishclub.com
2. http://owl.english.purdue.edu

TEACHING METHODS:

- Lectures
- Activities conducted individually, in pairs and in groups like individual writing and presentations, group discussions, interviews, reporting, etc
- Long presentations using visual aids
- Listening and viewing activities with follow up activities like discussions, filling up worksheets, writing exercises (using language lab wherever necessary/possible) etc
- Projects like group reports, mock interviews etc using a combination of two or more of the language skills

EVALUATION PATTERN:

3 tests of which two are pen and paper tests and the other is a combination of different modes of assessment like

- Project
- Assignment
- Report

Creative writing, etc.All the four skills are to be tested with equal weight age given to each.
Speaking assessment: Individual presentations, Group discussions
Reading assessment: Reading passages with comprehension questions graded following Bloom's taxonomy
Writing assessment: Writing essays, CVs, reports etc. Writing should include grammar and vocabulary.
Listening/Viewing assessment: Lectures, dialogues, film clippings with questions on verbal as well as audio/visual content graded following Bloom's taxonomy.

BTCE16F2300	**Applied Chemistry**	L	T	P	C
Duration:14Weeks		2	1	0	3

Prerequisites:

Pre University Chemistry

Course Objectives:

1. Applied chemistry covers the very basic knowledge required for Civil Engineering students to understand its importance in technology.
2. Sources of water and its treatment for drinking. Different methods of water treatment.
3. Corrosion and metal finishing, explains why and how materials corrode and its Prevention. It also covers the importance of metal finishing in various industries and fabrication of PCB
4. Polymers are all about the properties of various polymeric materials and their Commercial significance. The chapter reveals about technical and commercial Importance of composite materials.

Course Outcomes:

1. The importance of water treatment for drinking.
2. Corrosion phenomenon and precautions to be taken in the selection of materials in controlling corrosion
3. Fabrication of PCB, an important component for electronic industries
4. Properties of polymers and their applications in various field, also that of composite materials in sports, aviation etc.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4

BTCE16F2300	CO1	**3**	**2**	**3**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO2	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO3	**3**	**3**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**			
	CO4	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**			

Course Contents:

UNIT-I [12 HOURS]

Water Technology: Sources of water, Impurities of water, Hardness & its determination(EDTA method), Boiler Troubles & their removal, water softening methods -Lime soda, Zeolite & Ion exchange, Desalination of water — Electro dialysis & Reverse Osmosis method, Chemical analysis of water.

Corrosion: Definition, Examples, Types, Theory of corrosion, Dry corrosion (Direct chemical Attack), Wet corrosion (electrochemical attack), Mechanism of wet corrosion, Factors affecting corrosion, Corrosion Control methods, protective coatings — Metallic & organic type.

UNIT-II [12 HOURS]

Phase Equilibrium: Phase, Components, Degree of freedom, Gibb's phase rule, Phase diagram of one component system: H20, Lever rule, Basic idea of (a) Isomorphism system, (b) Eutectic system (Bi-Cd), (c) Peritectic system, (d) Eutectoid system and (e) Peritectoid system, Binary phase diagrams of Bi-Cd & Fe-C system.

Classification of Engineering Materials: Introduction, classification, internal structure Engineering properties of materials.

Polymers — Types of polymerization, Plastics: Thermosetting and thermoplastics -Differences, engineering applications of Polyethylene, PVC, polystyrene, PMMA, Nylon , Bakelite, Teflon, Polyester & Silicon resins, Elastomers

UNIT-III [12 HOURS]

Ceramics: Types, Structure, Properties, Applications,

Composite Materials: Classification (Based on type of matrix and types of reinforcement), Agglomerated Materials, Cermets, Polymer matrix composite (Glass fibre reinforced plastics, Carbon fibre reinforced plastics and aramid fibre reinforced plastics), Metal matrix composites, Ceramic matrix composite, Hybrid Composite & their applications.

Nano materials: Basic idea, Synthesis of CNT (LASER irradiation & Electric arc-dischargemethod), properties & applications of CNT, applications of other Nano materials in medicine,fuel cell, catalysis (only general idea)

UNIT-IV [12 HOURS]

Metals & Alloys: Physical properties of Cast iron, Wrought iron, Steel, Nickel, Chromium, Tungsten & alloys, Applications, Property of Hardness of metals: Impact characteristics.

Cement: Raw materials required for manufacture, Manufacturing process, Chemical&Physical properties, Special cements, Setting & Hardening, Plaster of Paris, Tests forChemical analysis of Cement.

REFERNCE BOOKS:

1. G.M. Barrow, Physical Chemistry, 6th edition, Tata McGraw Hill, New Delhi.
2. P.W. Atkins, Physical Chemistry, 5th edition Oxford.
3. S.S.Dara, Text Book of Engineering Chemistry, S.Chand& C0.
4. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
5. BalaramPani, Text Book of Engineering Chemistry, Galgotia Publication.
6. R.Gopalan, D.Venkappaya, S.Nagarajan, Engineering Chemistry, Vikas Publication.
7. S.S.Chawla, Text Book of Engineering Chemistry, Dhanpat Rai Pub.Co.

BTCE16F2400	**Engineering Mechanics**	L	T	P	C
Duration: 14weeks		**3**	**1**	**0**	**4**

Prerequisites:

Pre University Physics

Course Objectives:

1. To understand a broad concept of engineering mechanics.
2. To understand the basics of composition of coplanar forces.
3. To understand the concept of equilibrium of coplanar forces.
4. To provide an overview of centroid of plane area & Moment of Inertia of plane area.

Course Outcomes:

1. Describe the moment of force and couples and equivalent force-couple system.
2. Solve numerical problems on composition of coplanar concurrent and non-concurrent force system.
3. Solve numerical problems on equilibrium of coplanar force system.
4. Locate the centroid and moment of inertia of different geometrical Shapes.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F2400	CO1	3	3	2	1		2	1				1	3	3	2	2	3
	CO2	3	3	3	1		1					1	2	3	3	2	2
	CO3	3	3	2	1		1	1				1	2	3	3	2	2
	CO4	3	3	1	1		2	1				1	3	3	2	2	1

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Engineering Mechanics: Basic idealizations - Particle, Continuum and Rigid body; Force and its characteristics, Classification of force systems; Principle of physical independence of forces, Principle of superposition of forces, Principle of transmissibility of forces, Introduction to SI units, Moment of a force, couple, moment of a couple, characteristics of couple, Equivalent force - couple system, Resolution of forces, composition of forces; Numerical problems on moment of forces and couples and equivalent force – couple system.

UNIT-II **[12 HOURS]**

Analysis of Force Systems: Composition of forces - Definition of Resultant, Composition of coplanar -concurrent force system, Parallelogram Law of forces, Principle of resolved parts, Numerical problems on composition of coplanar concurrent force systems, Composition of coplanar - non-concurrent force system, Varignon's principle of moments; Numerical problems on composition of coplanar concurrent force systems.

UNIT-III **[12 HOURS]**

Equilibrium of Coplanar Forces: Definition of static equilibrium and Equilibrant, Conditions of static equilibrium for different coplanar force systems, Lami's theorem, Concept of Free Body Diagram, Numerical problems on equilibrium of coplanar – concurrent and non-concurrent force systems - Types of beams, loads, types of support conditions and simple support reactions problems. Plane trusses: Method of joints and sections.

UNIT-IV **[12 HOURS]**

Centroid: Introduction to the concept, Centroid of plane figures, Locating the centroid of triangle, semicircle, quadrant of a circle and sector of a circle using method of integration, Centroid of composite sections; Numerical problems.

Moment of Inertia: Introduction to the concept, Rectangular and polar moment of inertia, Radius of gyration, Perpendicular axis theorem and Parallel axis theorem, Moment of Inertia of rectangle, circle, semi-circle, quarter circle and triangle from method of integration, Moment of inertia of composite areas, Numerical problems.

REFERENCE BOOKS:

1. M.N.Shesha Prakash and Ganesh.B.Mogaveer, Elements of Civil Engineering and Engineering Mechanics, 3rd Revised edition PHI Learning,
2. A. Nelson, Engineering Mechanics-Statics and Dynamics, Tata Mc-Graw Hill Education Private Ltd, New Delhi, 2009
3. S. S. Bhavikatti, Elements of Civil Engineering, 3rd edition, New Age International Publisher, New Delhi, 2009.
4. S. Timoshenko, D.H. Young and J.V. Rao, Engineering Mechanics, TATA McGraw-Hill Book Company, New Delhi

BTCE16F2500	**Basic Programming in C**	L	T	P	C
Duration: 14weeks		**2**	**1**	**0**	**3**

Prerequisites:

Nil

Course Objectives:

1. Develops basic understanding of computers, the concept of algorithm and algorithmic thinking.
2. Develops the ability to analyze a problem, develop an algorithm to solve it.
3. Develops the use of the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.
4. Introduces the more advanced features of the C language

Course Outcomes:

1. Graduate will demonstrate knowledge of fundamentals of hardware technology relevant to understanding computer science basics.
2. Graduates will be able to demonstrate the ability to design creative solutions to real life problems faced by the industry.
3. Graduates will be able to communicate technical topics in written and verbal forms.
4. Graduates will be able to develop the capability for self-learning.

Mapping of Course Outcomes with programme Outcome

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F2500	CO1	**3**	**2**	**3**	**2**											**1**	**1**
	CO2	**2**	**2**		**2**								**1**		**1**	**1**	
	CO3	**3**	**3**	**2**	**3**	**1**									**1**	**2**	
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**		**2**	**2**	

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Computer System: Brief introduction of computer,Hardware,Functions of OS,Networking,Concept of assembler,Compiler,Loader and linker,Softwares:MS word,Excel sheet,PowerPoint

UNIT-II **[12 HOURS]**

Problem solving techniques: Algorithm, flow chart; Structure of C program, Character set, Identifiers, Keywords, Data Types, Constants and Variables, Input-output statements, relational and logical operators, increment and decrement operators, conditional operator, bit-wise operators, assignment operators, expressions, type conversions, conditional Expressions, precedence and order of evaluation, statements and blocks, if and switch statements.

UNIT-III **[12 HOURS]**

Loops:-while, do-while and for statements, break, continue, go to, programming examples. Arrays-concepts, declaration, definition, accessing elements, two-dimensional and applications of arrays. Designing structured programs: - Functions, parameter passing, user defined functions, recursive functions, storage c1asses- extern, auto, register, static, scope rules.

UNIT-IV **[12 HOURS]**

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, Union, typedef.

REFERENCE BOOKS:

1. E. Balaguruswamy Programming in C, 3rd edition, Tata McGraw Hill
2. Y. Kanetkar, Let us C, 9th edition BPB Publications
3. H. Scheldt, C The Complete Reference, Tata McGraw Hill
4. B.W. Kernighan & D.M. Ritchie, C Programming, Language, PHI.
5. Gotterfried, Schaum Series, C Programming

BTCE16F2600	**Applied Chemistry Lab**	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Pre University Chemistry

Course Objectives:

1. Provide students with practical knowledge of quantitative analysis of materials by classical and instrumental method.
2. Developing experimental skills in building technical competence.
3. To estimate different parameters of the water quality
4. To Study and analysis the quality requirements for domestic waters.

Course Outcomes:

1. Handling different types of instruments for analysis of materials for better accuracy and precision
2. Carrying out different types of titrations for quantitative estimations of materials
3. Analyse various physico-chemical and biological parameters of water quality
4. Assess complete water quality assessment for domestic supplies

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F2600	CO1	**1**	**2**		**2**									**1**	**1**	**1**	**1**
	CO2	**1**	**2**		**3**	**3**									**1**	**2**	
	CO3	**2**	**1**	**3**	**3**											**1**	**1**
	CO4	**2**	**2**	**2**	**2**					**3**						**1**	**1**

LAB EXERCISES

1. Potentiometric estimation of FAS using standard K2Cr2O7
2. Conductometric estimation of an acid mixture using standard NaOH solution
3. Determination of pKa of a weak acid using pH meter
4. Determination of molecular weight of given polymer sample using ostmail's Viscometer
5. Colorimetric estimation of copper
6. Determination of COD of the given industrial waste water sample
7. Determination of total and temporary hardness of water using disodium salt of EDTA
8. Estimation of alkalinity of given water sample using standard HCl solution.
9. Determination of Iron in the given haematite ore solution using potassium dichromate
10. Determination of calcium oxide in the given sample of cement by rapid EDTA method
11. Flame photometric estimation of sodium in the given sample of water
12. Electroplating of copper and nickel

BTCE16F2700	Civil Workshop Practice	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

None

Course Objectives:

1. To understand about the carpentry joints.
2. To understand the basics of plumbing tools & fittings.
3. To understand the use of welding machine to prepare joints.
4. To provide practical knowledge of masonry work.

Course Outcomes:

1. To prepare carpentry joints with the help of tools.
2. To identify the plumbing tools &do the fittings.
3. To prepare joints with the help of welding machine.
4. To know the type of masonry work in wall construction.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F2700	CO1	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO2	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO3	2	1	2		1	1			2	1	1	2	2	2	2	2
	CO4	2	1	2		1	1			2	1	2	2	2	2	2	2

Course Contents:

Carpentry:

1. Handling carpentry tools: Marking, sawing, plaining and chiselling to size
2. Making simple joints: (a) Half lap (b) Dovetail (c) T- joints

Plumbing:

1. Introduction to plumbing tools and cutting thread's on pipe
2. Basic pipe fitting and valves
3. Sanitary fittings
4. Water meter installation

Welding:

Use of welding machine to prepare joints: (a) Butt joint (b) Lap joint (c) Corner joint

Construction Tools:

Handling of Construction Tools, Making of Brick Masonry wall joints. Stretcher Bond, Header Bond, (1Brick Wall) English Bond , Flemish Bond (1Brick Wall and 11/2 Brick Wall)

REFERENCE BOOKS:

Civil Workshop Practice Manual, School of Civil Engineering, REVA University.

BTCE16F2800	**Basic Programming in C Lab**	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Nil

Course Objectives:

1. Introduce the Basic Principles of Problem Solving using a Computer;
2. Present and Provide the Programming Constructs of 'C' Programming Language;
3. Provide the skills required to Design, Demonstrate and Implement Computable Problems / Mini-projects / Projects using 'C' Programming Language;
4. Provide the Arena for Development of Analytical, Reasoning and Programming Skills;

Course Outcomes:

1. Understand the Basic Principles of Problem Solving;

2. Study, understand and identify the Representation of Numbers, Alphabets and other Characters in the memory of Computer System;
3. Understand Analyze, Integrate, Apply and Demonstrate Software Development Tools; like Algorithms, Pseudo Codes and Programming Structures;
4. Study, Understand, Analyze and Categorize the logical structure of a Computer Program, and hence to Apply different programming constructs to develop a Computer Program using 'C' Programming Language.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F2800	CO1	**3**	**2**	**3**	**2**											**1**	**1**
	CO2	**2**	**2**		**2**								**1**		**1**	**1**	
	CO3	**3**	**3**	**2**	**3**	**1**									**1**	**2**	
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**		**2**	**2**	

Course Contents:

C Programming: variables and expression assignment, simple arithmetic. Loops, if else, case statements, break, continue, go to. Single and multidimensional arrays. Functions, recursions, file handling in C. Pointers, address operators, declaring pointers and operations on pointers. Address of an array, structures, pointers to structures, dynamic memory allocation.

Experiment No: 1 (Data types & Operators)

a) Write a C program to read and print the size of different datatypes.

b) Write a C program to perform Addition, Subtraction, Multiplication, Modulo Division and Division operations.

Experiment No: 2 (Control Structures)

a) Write a C program to generate all the prime numbers between 1 and 'n', when 'n' is a value supported by the user.

b) Write a C program to find roots of quadratic equation.

Experiment No: 3 (Loops – for)

a) Write a C program to construct pyramid of numbers.
b) Write a C program to calculate the following Sum:
   Sum = 1 – X2/2! + X4/4! – X6/6! + X8/8! ……. X10/10!

Experiment No: 4 (Loops- while, do-while)

a) Write a C program to identify a given number is palindrome or not.
b) Write a C program to print the reverse of a given number and also find sum of digits of the number.

Experiment No: 5 (Recursive Functions)

a) A Fibonacci series is defined as follows: the first and second terms in the sequence are 0 and 1. Subsequent terms are found by adding the preceding two terms in the sequence. Write a C program to generate the first N terms in the sequence.
b) Write a C program for the following:
   i. To find a factorial of given number.
   ii. To find GCD (Greatest Common Divisor) of two given numbers.

Experiment No: 6 (Arrays and Functions)

a) Write a C program to find both the largest and smallest number in a list of integers.
b) Write a C program that uses functions to perform the following:
   i. Addition of two matrices
   ii. Multiplication of two matrices

Experiment No: 7 (Applications of array – Searching)

a) Write a C program that uses non-recursive function to search for a key value in a given list of integers using linear search.
b) Write a C program that uses non-recursive function to search for a key value in a given list of integers using binary search.

Experiment No: 8 (Structures)

a) Write a C program using structures to perform the following operation:
   i. Reading a complex number
   ii. Writing a complex number
   iii. Addition of two complex numbers
   iv. Multiplication of two complex numbers

Experiment No: 9 (Strings)

a) Write a C program to determine if the given string is palindrome or not.

b) Write a C program to count the lines, words and characters in a given text.

Experiment No: 10 (Files)

a) Write a C program to display the contents of file.

Write a C program which copies one file to another.

REFERENCE BOOKS:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill
2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition; Tata McGraw Hill
3. Reema Thareja, Computer fundamentals and programming in C.
4. Kernighan, Dennis Ritchie, The C Programming Language ,2nd edition, Englewood Cliffs, NJ: Prentice Hall, 1988
5. http://c-faq.com/index.html
6. Paul Deitel, C How to Program, 7th Edition, Deitel How to Series..

BTCE16F2900	AUTO- CAD Lab	L	T	P	C
Duration: 14weeks		0	0	3	2

Prerequisites:

Engineering Drawing

Course Objectives:

1. Students are expected to prepare simple solids and sectional views drawings using Auto CAD software.
2. Students are expected to prepare isometric projections, 3D models and 2D multi-view drawings from 3-D model using Auto CAD software.

Course Outcomes:

1. Understand the usage of Auto CAD software in civil engineering field.
2. Develop Title Block, simple solids and sectional drawing by using CADD software.
3. Drawing isometric projections by using Auto CAD software.
4. Develop 3D model of simple objects and obtaining 2-D multi-views from 3-D model.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F2900	CO1	**2**	**1**			**2**					**1**			**3**	**3**	**1**	**2**
	CO2	**2**	**1**			**1**					**1**			**3**	**3**	**1**	**2**
	CO3	**2**	**1**			**2**	**1**				**1**			**3**	**3**	**1**	**2**
	CO4	**2**	**1**			**3**					**1**			**3**	**3**	**1**	**2**

Course Contents:

Basics of AUTO CAD

DRWAING TOOLS: Lines, Circles, Arc, Polyline, Multi line, Polygon, Rectangle, Square, Spline, Ellipse,

MODIFY TOOLS : Erase, Copy, Mirror, offset, Array, Move, rotate, Scale, Stretch, Lengthen, trim, extend, break, Chamfer and fillet.

USING TEXT: Single line text, Multi Line text, Spelling, Edit text,

SPECIAL FEATURES: View Tools, Layers Concepts, Dimension Tools, Hatching, Customizing tool box, working with multiple drawings,

1. Drawing of a Title Block with necessary text and projection symbol.
2. Drawing of curves like parabola.
3. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc, and dimensioning.
4. Drawing sectional views of prism, pyramid, cylinder, cone, etc,
5. Drawing isometric projection of simple objects.
6. Creation of 3-D models of simple objects and obtaining 2-D multi-view drawings from 3-D model.

REFERENCE BOOKS:

1. Engineering Drawing with AUTO CAD 2009. T.Jeyapavan, Vikas publishing house.
2. Engineering Drawing – N.D.Bhatt and V.M. Panchal, 48th Edition, 2005 – Charotar
3. Publishing House, Gujarat.
4. Engineering Drawing – K.L.Narayan&P.Kannaih

5. Engineering Graphics - K.R. Gopalakrishna, 32nd Edition, 2005 – Subhas Publishers, Bangalore.
6. Engineering Drawing – P. S. Gill, 11th Edition, 2001 – S. K. Kataria& Sons, Delhi.

SEMESTER III

BTCE16F3100	Civil Engineering Mathematics -III	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Partial Differential Equations.

Course Objectives:

1. To impart the Knowledge of Laplace transforms and its applications in the field of engineering.
2. To impart the Knowledge of Inverse Laplace transforms and its applications in the field of engineering.
3. To study and understand the application approach of the concepts of Fourier series and transforms.
4. To study and understand the application approach of the concepts of Numerical methods.

Course Outcomes:

1. Apply the knowledge of Laplace transformation from the time domain to the frequency domain, which transforms differential equations into algebraic equations and convolution into multiplication.
2. Solve Inverse Laplace Transforms by using Convolution statement and Solve Linear Differential Equations by using Laplace Transforms.
3. To apply the concept of Fourier Transforms and Fourier series concepts in various fields of Engineering.
4. To apply the numerical methods to solve various engineering problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3100	CO1	3	3	2	2	1	1							3	1	1	1
	CO2	3	3	2	2	1	1							3	1	1	1
	CO3	3	2	1	3	2	1							3	1	1	1
	CO4	3	2	2	2	2	1							3	2	1	1

Course Contents:

UNIT-I **[12 HOURS]**

Laplace Transforms: Definition, transforms of elementary functions, Properties-transform of e^at f(t) , t^n f(t) and f(t)/t. Laplace transform of derivatives, integrals, periodic functions, unit step function and unit impulse function.

UNIT-II **[12 HOURS]**

Inverse Laplace Transforms: Inverse Laplace Transforms, Inverse Laplace transform of standard functions, convolution theorem (without proof), Solution of linear differential equations using Laplace Transforms.

Applications: Applications of Laplace transforms to civil engineering problems.

UNIT-III **[12 HOURS]**

Fourier Series: Periodic functions, Dirichlet's condition, Fourier Series of periodic functions with period 2π and with arbitrary period 2l. Fourier series of even and odd functions. Half range Fourier Series, practical harmonic analysis-Illustrative examples from engineering field.

Fourier Transforms: Infinite Fourier transforms, Fourier sine and cosine transforms. Inverse Fourier transforms. Applications to civil engineering problems.

UNIT-IV **[12 HOURS]**

Numerical Methods: Numerical solution of algebraic and transcendental equations by Regula- Falsi Method and Newton-Raphson method.

Finite Differences: Forward and backward differences, Newton's forward and backward interpolation formulae. Divided differences- Newton's divided difference formula. Lagrange's interpolation formula and inverse interpolation formula (all formulae without proof)-Problems.

REFERENCE BOOKS :

1. B.S. Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2013.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley Publications, 2012.
3. B.V. Ramana, "Higher Engineering Mathematics", 9th edition, Tata McGraw Hill Publications, 2010.
4. R.K. Jain and S.R.K.Iyengar, Advanced Engineering Mathematics, 4th edition, Narosa Publishing House, 2002.

BTCE16F3200	Strength of Materials	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Physics, and Engineering Mechanics.

Course Objectives:

1. About the basic concepts of simple stresses, strains and elastic constants, composite bars and temperature stresses in simple and compound bars.
2. About bending moment and shear force of various beams
3. About bending and shear stresses in beams subjected to simple bending and deflections in loaded statically determinate beams
4. About torsional stress induced in circular members and critical buckling load of prismatic columns with different end conditions.

Course Outcomes:

1. To has the concepts of simple stresses, strains and elastic constants and able to analyse stresses in composite bars and temperature stresses in simple and compound bars.
2. To compute shear force and bending moment of different types of loadings of various beams
3. To compute bending and shear stresses in beams subjected to simple bending slope and deflection in loaded statically determinate beams
4. To compute torsional stress induced in circular members and critical buckling load of prismatic columns with different end conditions.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B20CE 3200	CO1	3	3	1	1	1	2	1		1	2		3	3	3	3	2
	CO2	3	3	1	2		2	1		1	2		3	3	3	3	2
	CO3	3	3	2	2	2	2	1		1	2		3	3	3	3	2
	CO4	3	3	2	2	2	2	1		1	2		3	3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Simple Stresses and Strains:

Introduction, Properties of Materials, Stress, Strain, Hooke's law, Poisson's Ratio, Stress–Strain Diagram for structural steel and non ferrous materials, Principle of superposition, Total elongation of tapering bars of circular and rectangular cross sections, volumetric strain, expression for volumetric strain, Elastic constants, Relationships among elastic constants, Stresses in composite bars, Thermal stresses in simple and compound bars.

UNIT-II **[12 HOURS]**

Bending moment, shear force and deflections in beams:

Introduction, Types of beams, loadings and supports, Shearing force, Bending moment, Sign convention, Relationships among loading intensity, shear force and bending moment, Shear force and bending moment equations and diagrams for cantilever beams, simply supported beams and overhanging beams considering point loads, UDL, UVL and Couples.

Deflection of beams:

Introduction – Definition of slope, deflection and elastic curve, Derivation of differential equation of flexure (Euler-Bernoulli equation), Sign convention, Slope and deflection of statically determinate beams by the method of singularity functions(Macaulay's method).

UNIT-III **[12 HOURS]**

Bending and shear stresses In beams:

Introduction – Bending stress in beam, Assumptions in simplebending theory, Simple bending equation, section modulus, Flexural rigidity, Modulus of rupture. Expressionfor horizontal shear stress in beam, Shear stress diagram for homogeneous rectangular,symmetrical& unsymmetrical I' and 'T' beam sections. Numerical

UNIT-IV **[12 HOURS]**

Torsion of Circular Shafts:

Introduction – Pure torsion-torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Powertransmitted by shaft of solid and hollow circular sections.

Elastic Stability of Columns:

Introduction – Short and long columns, Euler's theory on columns, Effective length, slenderness ratio, buckling load, Assumptions and derivation of Euler's Buckling load for different end conditions, Limitations of Euler's theory.

REFERENCE BOOKS:

1. Ferdinand P. Beer, E. Russell Johnston and Jr.John T. DeWolf "Mechanics of Materials", Tata McGraw-Hill, Third Edition, SI Units
2. Mechanics of Materials, James M. Gere (5th Edition), Thomson Learning
3. Strength of Materials, Singer, Harper and Row Publications.
4. D.H. Young, S.P. Timoshenko, Elements of Strength of Materials East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
5. B.S. Basavarajaiah, P.Mahadevappa Strength of Materials in SI Units, 3rd Edition, University Press (India) Pvt. Ltd., 2010
6. B.C Punmia Ashok Jain, Arun Jain, Mechanics of Materials, Lakshmi Publications, New Delhi.
7. Subramanyam, Strength of Materials, Edition 2008, Oxford University Press
8. S.S.Bhavikatti, Strength of materials Vikas Publishing House.
9. Vazirani, V N, Ratwani M M. and S K Duggal Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.
10. R K Bansal, A Textbook of Strength of Materials, 4th Edition, Laxmi Publications, 2010

BTCE16F3300	Concrete Technology &	L	T	P	C
Duration: 16weeks	Alternative Building Materials	2	1	0	3

Prerequisites:

Building materials and Construction technology, Strength of materials

Course Objectives:

1. To learn about properties, manufacture and tests on concrete
2. To learn about durability of concrete
3. To carry out mix design of concrete.
4. To learn the properties and uses of alternative building materials

Course Outcomes:

1. Have learnt about properties, manufacture and tests on concrete
2. Be able to assess the durability of concrete
3. Be able to carry out mix design of concrete.
4. Have learnt the properties and uses of alternative building materials

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3300	CO1	**3**	**2**	**2**	**3**									**3**	**1**	**1**	**2**
	CO2	**3**	**3**	**2**										**3**	**3**	**1**	**1**
	CO3	**3**	**3**	**2**	**1**									**3**	**3**	**1**	**1**
	CO4	**3**	**3**	**3**	**1**									**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Hardened concrete:

Factors influencing strength, W/C ratio, gel/space ratio, Maturity concept, testing of hardened concrete

Accelerated curing,

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson's Ratio

Process of manufactures of concrete: Batching, Mixing, Transporting, Placing, Compaction and Curing of RMC concrete.

UNIT-II **[12 HOURS]**

Mix design of Concrete:

Concept of Concrete Mix design, variables in proportioning, exposure conditions, Factors affecting mix design. Selection of Zones of fine aggregates, grading of coarse aggregates, Procedure of mix design as per ACI method, British Code method and IS 10262, Numerical examples of Mix Design based on Indian standards only

UNIT-III **[12 HOURS]**

Durability of concrete:

Durability - definition, significance, permeability, Sulphate attack, Chloride attack, carbonation, freezing and thawing, Factors contributing to cracks in concrete - plastic shrinkage, settlement cracks, construction joints, Thermal expansion, transition zone, and structural design deficiencies..

UNIT-IV **[12 HOURS]**

Alternative building materials:

Energy in building materials, Environmental issues concerned to building materials, Global warming and construction industry, Environmental friendly and cost effective building technologies, different

types of blocks for wall, Alternative for wall construction, Types, Construction method, Masonry mortars

Ferro-cement - materials, techniques of manufacture, properties

REFERENCE BOOKS:

1. M.S.Shetty, Concrete Technology - Theory and Practice, S.Chand and Company.
2. Neville, Properties of Concrete, A.M, ELBS, London
3. A.R. Santhakumar, Concrete Technology, Oxford University Press, 2007
4. N Krishnaraju, Design of Concrete Mixes, Sehgal Educational Consultants & Publishers Pvt. Ltd, Faridabad.
5. Recommended guidelines for concrete mix design- IS:10262,BISPublication.
6. K.S. Jagadish, B.V.Venkatarama Reddy & K S NanjundaRao, Alternative building materials and technologies, New Age International Publishers Ltd, New Delhi.
7. Relevant IS Codes

BTCE16F3400	**Applied Surveying**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basic Mathematics, and Basic science

Course Objectives:

1. To provide basic knowledge about principles of surveying for location, design and construction of engineering projects.
2. To develop skills for using surveying instruments including chains, measuring tapes, leveling instruments, plane tables, theodolite, etc.
3. To educate students about the error sources and the procedures to minimize errors
4. To make students familiar with cooperative efforts required in acquiring surveying data and applying fundamental concepts to eliminate errors and set out the work.

Course Outcomes:

1. Appreciate the need for accurate and thorough note taking in field work to serve as a legal record.
2. Gained the ability to use modern survey equipment to measure angles and distances.

3. Gained the ability to measure differences in elevation, draw and utilize contour plots, and calculate volumes for earthwork.
4. Set out horizontal and vertical curves for various engineering projects, function as a member of a survey party.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3400	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Surveying:

Importance of surveying to Civil Engineering ,Concepts of plane and geodetic surveying Principles of surveying –Plans and maps – Surveying equipments, Meridians, Bearings, Dip, Declination, Local attraction, Calculation of bearings and included angles with numerical examples

UNIT-II **[12 HOURS]**

Plane Table Surveying and Levelling:

Plane table surveying – Methods of plotting – Radiation, Intersection, Traversing and Resection – Two and Three point problem and solutions Levelling – Principles and basic definitions – Types of Levels – Types of adjustments and objectives – Types of levelling – Simple, Differential, Fly, Reciprocal, Profile, Cross sectioning – Booking of levels – Rise & fall and H. I methods – Contours and their characteristics – Methods of contour plotting – Interpolation – Grade contour – application of contours. Numerical examples on levelling and calculation of reservoir capacity.

UNIT-III **[12 HOURS]**

Theodolite Survey, Trignometric Levelling and Tacheometry:

Theodolite - Horizontal and Vertical angle measurements by repetition and reiteration – Trigonometric levelling - Single and Double plane for finding elevation of objects Computation of distances and elevations using Tacheometric methods, only concepts.

Calculation of area and Volumes- calculation of area using cross staff surveying-coordinates method -Simpson's and Trapezoidal rules and use of Digital Planimeter-Measurement of volume by Trapezoidal and Prismoidal formula Problems on Railway and Highway embankments.

UNIT-IV **[12 HOURS]**

Curves:

Simple curve-Elements of simple curves, Designation of a curve, setting out simple curve by offsets from long chord and offsets from chords produced, Setting out simple curve by Rankine's method, Numerical problems. Compound Curve- Tabulation and setting out of compound curve, Reverse curve, transition curve, combined curve and vertical curves, numerical examples.

REFERENCES BOOKS:

1. Punmia B C., Surveying, Vol. 1 & 2, Laxmi Publications Pvt. Ltd., New Delhi. 2009
2. T P Kanetkar & S P Kulkarni., Surveying, Vol. 1 & 2, Tata McGraw Hill Publishing Co. Ltd, New Delhi. 2009.
3. S K Roy, Fundamentals of Surveying, Prentice Hall of India, New Delhi. 2009
4. S K Duggal, Surveying, Vol. 1, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2008.
5. A M Chandra, Plane Surveying, New age international (P) Ltd.

BTCE16F3500	**Fluid Mechanics**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Physics

Course Objectives:

1. Understand the flow of fluids in motion, kinematics and dynamics, its properties and familiarize with Bernoulli's Energy Equation and Venturimeter.
2. Understand the types of losses in pipe flow, estimate the major loss and minor loss due to sudden expansion and pipe networks.
3. Understand various types of notches and weirs and their applications and estimate the flow of fluid in channels.

4. Learn the geometric properties and designing of open channels to carry uniform flow and for most economical conditions of channels

Course Outcomes:

1. Know the types of flow of fluids in motion, kinematics and dynamics, its properties and solve the numerical with Bernoulli's Energy Equation and Venturimeter.
2. Know about the types of losses in pipe flow, estimate the major loss and minor loss due to sudden expansion and pipe networks.
3. Know various notches and weir and their applications in estimating the flow of fluid in channels.
4. Know the geometric properties and designing of open channels to carry uniform flow and conditions for most economical channels.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3500	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Kinematics of Flow:

Introduction,methods of describing fluid motion, definitions of types of fluid flow, streamline, path line, stream tube. Three dimensional continuity equation in Cartesian Coordinates (derivation only). General Continuity equation (problems). Velocity potential, Stream function, Equipotential line, Stream line- problems, Physical concepts of Stream function. Introduction to flow net.

Dynamics of Fluid Flow

Introduction, Energy possessed by a fluid body. Euler's equation of motion along a streamline and Bernoulli's equation. Assumptions and limitations of Bernoulli's equation. Problems on application of Bernoulli's equation (with and without losses), Venturimeter.

UNIT-II **[12 HOURS]**

Pipe Flow:

Introduction, losses in pipe flow,. Darcy-Weisbach equation for head loss due to friction in a pipe. Pipes in series, pipes in parallel, equivalent pipe, pipe networks-problems. Minor losses in pipe flow, equation for head loss due to sudden expansion- problems. Momentum equation, problems on pipebends.

UNIT-III **[12 HOURS]**

Flow Through Notches and Weirs:

Introduction, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir and broad crested weir. Problems.

UNIT-IV **[12 HOURS]**

Uniform Flow in Open Channels:

Introduction, Geometric properties of Rectangular, Triangular, Trapezoidal channels. Chezy's equation, Manning's equation-problems. Most economical open channels-Rectangular, Triangular, Trapezoidal channel - problems.

REFERENCE BOOKS :

1. R.K.Rajput, A Textbook of Fluid mechanics & Hydraulic Machine, S.Chand & Co, New Delhi, 2006.

2. N.Narayana Pillai, Principles of Fluid Mechanics and Fluid Machines- Universities Press (India), Hyderabad, 2009

3. Madan Mohan Das, Fluid Mechanics and Turbo machines, PHI Learning Pvt. Limited, New Delhi. 2009.

4. Bruce R. Munson, Donald F. Young, Theodore H. Okiishi,Fundamentals of Fluid Mechanics Wiley India, New Delhi, 2009.

5. Edward j.Shaughnessy,jr; Ira m. Katz:; James p Schaffer, Introduction To Fluid Mechanics – Oxford University Press, New Delhi, 2005.

6. R.K.Bansal, Text Book Of Fluid Mechanics & Hydralic Machines Laxmi Publications, New Delhi, 2008.

7. Streeter, Wylie, Fluid Mechanics, Bedford New Delhi, 2008

BTCE16F3600	Strength of Materials Lab	L	T	P	C
Duration: 16weeks		0	0	1	2

Prerequisites:

Building Materials and Strength of Materials.

Course Objectives:

5. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials
6. To provide an opportunity to learn how to measure hardness of ferrous and non-ferrous materials.
7. To study the behaviour of mild steel under impact load, torsion, tension, compression and shear.
8. To study the behaviour of wood under compression and bending.

Course Outcomes:

1. Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
2. Measure the hardness of ferrous and nonferrous metals.
3. Identify, formulate and solve engineering problems of structural elements subjected to flexure.
4. Analyse the behaviour of wood under compression and bending test.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F3600	CO1	3	3	2	1	1	1			1	2	2	2	3	2	2	2
	CO2	3	2	1	2	1	2			1	2	3	2	2	3	2	2
	CO3	3	2	1	2	1	2			1	2	3	2	2	3	2	2
	CO4	3	2	1	2	1	2			1	2	3	2	2	3	2	2

Course Contents:

List of Experiments:

1. To determine the tensile test, compression test on mild steel specimen using Universal testing machine.
2. To determine hardness of metal using Rockwell Hardness test.
3. To determine hardness of metal using Brinell Hardness test.
4. Torsion test on mild steel rod.

5. To determine impact strength of steel (by Izod test)
6. To determine impact strength of steel (by Charpy test)
7. To determine Young's modulus of elasticity of different materials of beam simply supported at ends.
8. To determine the stiffness of the spring and modulus of rigidity of material of the spring wire
9. To determine the compressive strength of materials

Mode of Evaluation: Experiments/Record Work/Oral/Practical Examinations.

REFERENCE BOOKS:

1. Beer & Johnston, Mechanics of Materials
2. James M. Gere Mechanics of Materials, 5th Edition, Thomson Learning
3. Strength of Materials, Singer, Harper and Row Publications.
4. Timoshenko and Young, Elements of Strength of Materials, Affiliated East-West Press

BTCE16F3700	Surveying Practice Lab	L	T	P	C
Duration: 16weeks		1	0	1	2

Prerequisites:

Applied Surveying

Course Objectives:

1. To understand basics of linear and angular measurements in field using surveying equipment's.
2. To use compass for setting out of various civil engineering works involving linear and angular measurements.
3. Levelling techniques and contour map development.
4. To set out simple and compound curves by different methods.

Course Outcomes:

1. Develop skills of using instruments for distance measurement and angular measurements.
2. Develop skills to use theodolite for horizontal and vertical angle measurements.
3. Develop skill to measure distance and angle by single plane and double plane methods.
4. Develop skill to setting out simple and compound curves by different methods.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F3700	CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

List of Practical

1. To determine the tacheometric constants and to determine distance and elevation of an object using tacheometric methods (elevated/depressed LOS).
2. To set a simple curve by offsets from long chord and offsets from chords produced.
3. To set a simple curve and a compound curve by Rankine's deflection angle method.
4. Marking of residential building by centre line method for load bearing wall.
5. Marking of small commercial complex by centre line method for columns.
6. To set out compound curve with angular methods with using theodolite only.
7. Use of Total station in highway alignment.
8. Measurement and data logging of distances, horizontal angles and vertical angles using Total station.
9. Use of GIS software for land surveying.
10. Office work-Design and plotting using AutoCAD.

Mode of Evaluation: Experiments/Record Work/Oral/Practical Examinations.

REFERENCE BOOKS:

1 Punmia B C., Surveying, Vol. 1 & 2, Laxmi Publications Pvt. Ltd., New Delhi. 2009

2. T P Kanetkar& S P Kulkarni, Surveying, Vol. 1 & 2, Tata McGraw Hill Publishing Co. Ltd, New Delhi. 2009.

3. S K Roy, Fundamentals of Surveying, Prentice Hall of India, New Delhi. 2009

4. S K Duggal, Surveying, Vol. 1, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2008.

5. A M. Chandra, Plane Surveying, New age international (P) Ltd.

BTCE16F3800	Fluid Mechanics Lab	L	T	P	C
Duration: 16weeks		1	0	1	2

Prerequisites:

Applied physics & Fluid mechanics

Course Objectives:

1. To understand the properties of fluid, types of fluid and the Types of flow.
2. To study about the flow measuring devices such as orifice meter, venturimeter.
3. To acquire knowledge about the flow through pipes.
4. To acquire the ability to critically observe/ examine and Measure the discharges through flow measuring devices

Course Outcomes:

1. Analyse various flow problems and fluid characteristics.
2. Apply Bernoulli's equations in flow experiments to determine the coefficient of discharge.
3. Determine the losses of flow through various mediums like pipes.
4. Determine hydraulic coefficients of notches and orifices

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3800	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3

Course Contents:

List of experiments:

1 Calibration of measuring tank (gravimetric method)

2. Calibration of V-Notch

3. Calibration of Rectangular Notch.

4. Calibration of Cipolletti notch.
5. Calibration of Weirs: Broad Crested Weir
6. Calibration of Ogee Weir.
7. Calibration of Venturimeter.
8. Determinations of Major losses in pipe flow
9. Determinations of minor losses in pipe flow.
10. Determination of hydraulic coefficients of a vertical orifice.
11. Verification of Bernoulli's theorem.
12. Determination of vane coefficients for Flat, Inclined, semi-circular vanes.
13. Performance characteristics of a Single Stage Centrifugal Pump.

Mode of Evaluation: Experiments/Record Work/Oral/Practical Examinations.

REFERENCE BOOKS:

1. Fluid Mechanics & Machinery Laboratory Manual Prepared by School of Civil Engineering, REVA University, Bengaluru.
2. Dr.R.K.Bansal (2004), Fluid Mechanics & Hydraulic Machines, Laxmi Publication (P) Ltd,New Delhi

BTCE16F3900	**Architectural Planning and Design of Buildings**	L	T	P	C
Duration:16weeks		1	0	2	3

Prerequisites:

Basic Civil Engineering, Building Technology and Materials, National Building Code-2005, Developing Control Rules and Green building concepts

Course Objectives:

1. To understand necessity of Town planning, principles of planning, principles of architecture and byelaws.
2. To Understand the importance and the benefits of Green buildings
3. To study the planning for building services such as noise and acoustics, ventilation, lighting, plumbing work and safety practices.
4. To develop the plan, elevation and section of load bearing and framed structures.

Course Outcomes:

1. Make use of principles of planning and principles of architectural Planning
2. Improve the status of existing structures by proposing appropriate green measures.
3. Plan effectively various types of buildings according to their utility with reference to different codes.
4. Understand and resolve contemporary issues at multi-dimensional functional levels.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F3900	CO1	2	2											-	-	-	-
	CO2		3			2								-	-	-	-
	CO3		3			2				1				-	-	-	-
	CO4		2			3	2	1						-	-	-	-

Course Contents:

UNIT-I **[12 HOURS]**

Town Planning and Legal Aspects:
a) Town Planning: Necessity and evolution of town planning in India. Land use zoning, Introduction to different zones of land in town planning, Requirements of various zones, Height zoning and Density zoning.
b) Legal Aspects: Role of Plan sanctioning authority. List of documents to be submitted to local authority, Procedure for seeking Commencement and Occupancy Certificate, Various NOCs required.

UNIT-II **[12 HOURS]**

Architectural Planning, Building Bye Laws and Introduction To Green Buildings:

a) Principles of Architectural design relation between form and function, utility, aesthetics. Necessity of bye-laws, plot sizes, road width, open spaces, floor area ratio (F.A.R.), concept of V.P.R. Marginal distances, building line : control line, height regulations, room sizes, Area calculations (built-up area, carpet area etc.), Rules for ventilation, lighting, Vertical circulation, Sanitation and Parking of vehicles.
b) Green buildings: salient features, benefits, planning concepts (site selection, orientation, sun path and wind diagram etc.)

UNIT-III **[12 HOURS]**

Architectural Drawing and Safety Aspects:

a) Introduction to Architectural drawing: i) Line plan, ii) Developed Plan, iii) Elevation, iv) Section, Selection of scales for various drawings, dimensioning, abbreviations and conventions as per IS 962, Elements of perspective drawings, parallel and angular perspective of small building elements.
b) Safety Aspects: Fire load, grading of occupancies by fire loads, Evacuation Time, fire escape elements, Need for earthquake resistant structures, planning considerations, disaster management.

UNIT-IV **[12 HOURS]**

Building Services:
a) Noise and Acoustics – Sound insulation, Acoustical defects, Reverberation time, Sabine's formula, sound absorbents, planning for good acoustics.
b) Ventilation – Necessity of Ventilation, Natural ventilation: stack effect and wind effect, Thermal Insulation, Mechanical ventilation and its types, air conditioning systems.
c) Lighting – Principles of day lighting, design of windows, artificial illumination, SC, ERC, IRC, Daylight factor, Solar energy systems for lighting (BIPV).
d) Plumbing – Water storage tanks at ground level and on terrace (capacity), Plumbing systems, various types of traps, Fixtures and Fittings, Rain Water Harvesting etc.
e) Other services – Telecommunication, Electrical, Smart services and Waste management

Term Work:
Planning of Residential Buildings
a) Functional requirements of Bungalows, Twin bungalows, Row houses, Ownership flats, and Apartments.
b) Developed Plan, Elevation and Sectional Elevation of above mentioned categories.

Planning of Public Buildings
a) Functional requirements and planning of industrial buildings, commercial buildings, School, Colleges, Hostel, Auditorium, Restaurant/ Hotel building, Primary Health Center/ Hospital, Shopping complex, Sports complex, Vegetable market, Post office, Bank buildings etc .
b) Dimensioned line plans of above public buildings.

REFERENCE BOOKS:
1. M. G. Shah, C. M. Kale and S. Y. Patki, Building Drawings with an integrated Approach to Built-Environment, New Delhi, 5th edition Tata McGraw Hill.
2. Dr. S. V. Deodhar, Building science and planning, Khanna Publishers.
3. David V. Chadderton, Building Services Engineering, 6th edition, London & New York.
4. Jan A. Van Der Westhuizen, Drawing for Civil Engineering
5. National Building Code (latest).
6. Frederick Merrit, Building Design and construction, Tata McGraw Hill.
7. Callender, Times Saver standards of Architectural Design Data Tata McGaw Hill.
8. I.S. 962 – 1989 Code for Practice for Architectural and Building Drawings.
9. Development plan and DCP Rules of urban local body, New Delhi, Volume 12.
10. Model building bye laws by MoUD, GoI.

SEMESTER IV

BTCE16F4100	Civil Engineering Mathematics IV	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basics of probability and statistics

Course Objectives:

1. The concept of curve fitting and few statistical methods.
2. Fundamentals of probability.
3. Joint probability and regarding stochastic process.
4. Concept of Test of Hypothesis and able to apply in the various fields of Civil engineering.

Course Outcomes:

1. To solve the problems of Curve fitting and regression in various Civil engineering fields.
2. To solve the problems of Probability and statistics in various Civil engineering fields.
3. To apply stochastic process to solve various Civil engineering problems.
4. To apply the numerical methods and Sampling Theory concepts to solve various Civil engineering problems.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F4100	CO1	3	2	1	2	1	1							3	1	1	1
	CO2	3	2	1	2	1	1							3	1	1	1
	CO3	3	3	2	1	2	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1

Course Contents:

UNIT-I [12 HOURS]

Curve Fitting:Curve fitting by the method of least squares and fitting of the curves of the form, y = ax + b, y = ax2 + bx + c, y = aebx and y = axb

Statistical Methods:Measures of central tendency and dispersion. Correlation-Karl Pearson's coefficient of correlation-problems. Regressionanalysis- lines of regression (without proof) – problems.

UNIT-II [12 HOURS]

Probability Theory:Recap of Probability theory (definition, addition theorem, multiplication theorem and conditional probability and Baye's theorem).

Probability Distributions:Random variables (discrete and continuous), probability mass/density functions, mean, variance and moments. Binomial distribution, Poisson distribution. Exponential and normal distributions, problems.

UNIT-III [12 HOURS]

Joint Probability Distribution:Joint Probability distribution for two discrete random variables, expectation, covariance, correlation coefficient.

Stochastic Process:Stochastic processes, probability vector, stochastic matrices, fixed points, regular stochastic matrices, Markov chains, higher transition probability-simple problems.

UNIT-IV [12 HOURS]

Sampling Theory: Sampling, Sampling distributions, standard error, test of hypothesis for means and proportions, confidence limits for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

REFERENCE BOOKS:

1. B.S. Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2013.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th edition, Wiley Publications, 2012.
3. B.V. Ramana, Higher Engineering Mathematics, 1st edition, Tata McGraw Hill Publications, 2010.
4. R.K.Jain and S.R.K. Iyengar, Advanced Engineering Mathematics, 4th edition, Narosa Publishing House, 2002.

BTCE16F4200	Water and Waste Water Engineering	L	T	P	C
Duration :16 Weeks		3	1	0	4

Prerequisites:

Applied Chemistry, Fluid Mechanics

Course Objectives:

1. To introduce the fundamental scientific concepts of water supply, per capita demand, design period and various sources of water, its conveyance.
2. To describe the objectives and methods of water treatment and the principles involved in the design and selection of appropriate unit processes
3. To introduce to the types of sewerage system, sewer materials and sewer appurtenances used in sanitary engineering.
4. To select appropriate Waste water treatment unit processes and demonstrate the objectives of used water reuse and recycle.

Course Outcomes:

1. Understand the concepts of water supply, various sources of water and its conveyance.
2. Identify the various methods of water treatment and the principles involved in the design and selection of appropriate unit processes.
3. Explain the necessity of sanitation, types of sewerage system, sewer materials and analyse the various sewer appurtenances.
4. Select and design appropriate wastewater treatment unit processes and understand objectives of wastewater reuse and recycle.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F4200	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Water Supply: Need for protected water supply, water demands, design period –factors affecting, population forecasting, Numerical on population forecast, variations in demand of water, Source of water, Intake structures and types, Water quality parameters – Physical, chemical and Microbiological, Sampling.

Conveyance of pipes: Pipe materials (No Design examples), Pipe appurtenances, various valves, systems of water supply, methods of layout of distribution systems.

UNIT-II **[12 HOURS]**

Water Treatment: Objectives of treatment; Sedimentation- types, Coagulation and Floculation, clariflocculator; Filtration-theory, types, construction, operation and maintenance of filters-Design, Disinfection- methods, Miscellaneous treatments -Softening- lime soda process, zeolite process, RO and membrane techniques, Fluoridation and Defluoridation

UNIT-III **[12 HOURS]**

Sanitation: Necessity for sanitation, types of sewerage systems and their suitability. Dry weather flow-factors affecting dry weather flow, computation of design flow, wet weather flow, self cleansing and non scouring velocities. Sampling techniques, Physical, Chemical and Biological characteristics of waste water; Sewer materials and shapes(No design examples), laying of sewers, joints and testing of sewers, Sewer appurtenances: Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps.

UNIT-IV **[12 HOURS]**

Waste Water Treatment: Screening, grit chambers, skimming tanks, primary sedimentation tanks – (No Design examples). Trickling filter – theory and operation, types , Activated sludge process-Principle and flow diagram, Modifications of ASP, Sludge digestion, Septic tank, Oxidation Pond – Design example.

Disposal of effluents: Examples, Sewage farming, Recreational Reuse, Groundwater recharge of Sewage Effluents. Disposal standards for land, surface water & ocean.

REFERENCE BOOKS:

1. S.K.Garg, Water supply Engineering, Khanna Publishers
2. B C Punima and Ashok Jain, Environmental Engineering I
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous G, Environmental Engineering, McGraw Hill Book Co. 1986
4. S.K.Garg, Sewage Disposal and Air Pollution Engineering, Khanna Publishers
5. B C Punima and Ashok Jain, Wastewater Engineering, Lakshmi Publishers

6. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., Environmental Engineering - (1986), McGraw Hill Book Co.
7. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi

BTCE16F4300	**Structural Analysis**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Strength of Materials

Course Objectives:

1. To learn the basics of structures and present the concept of moment area method, conjugate beam method and unit load method to compute slopes and deflections.
2. Present systematic approach for analysing three hinged and two hinged arches.
3. Compute the moments of statically indeterminate structures by consistent deformation method, Clapeyron's theorem of three moments and slope deflection method.
4. Explain and demonstrate the concept involved in the analysis of indeterminate structures by moment distribution method and Kani's method**.**

Course Outcomes:

1. Enumerate the concept involved in analysingstructures by moment area method, conjugate beam method and unit load method.
2. Describe arches and explain the various parameters involved in analysing three hinged and two hinged arches.
3. Analyse statically indeterminate structures using consistent deformation method, Clapeyron's theorem of three moments and slope deflection method.
4. Represent the concept involved in moment distribution method and Kani's method and be able to apply for practical problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
	CO1	**2**	**3**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**

0	CO3	3	3	3	3		1	2	1	2		1	2	3	3	2	1
	CO4	3	3	3	3	2	1	3	1	2	2	2	2	3	3	2	1

Course Contents: **1**

UNIT-I **[12 HOURS]**

Introduction: Statically determinate and indeterminate structures,Concept of equilibrium and compatibility, determination of degree of static and kinematic indeterminacies of structures. Strain energy concepts.

Slope and Deflection of Beams: Moment area method, Conjugate beam method, Unit load method, Numerical problems.Deflection of Trusses: Unit load method, Numerical problem

UNIT-II **[12 HOURS]**

Arches: Analysis of three hinged and two hinged parabolic and circular arches, settlement. Determination of normal thrust, radial shear and bending moment. Numerical problems.

UNIT-III **[12 HOURS]**

Statically indeterminate structures: Analysis of propped cantilever and fixed beam by consistent deformation methods, Analysis of continuous beams by Clapeyron's theorem of three moments, Numerical Problems.

Slope Deflection Method: Assumptions and development of slope-deflection equations, analysis of statically indeterminate beams and rigid-jointed plane frames without sidesway. Numerical problems.

UNIT-IV **[12 HOURS]**

Moment Distribution Method: Introduction, Definition of terms Stiffness factor, Distribution factor, Carry-over factor, Analysis of beams and rigid jointed plane frames without sidesway. Numerical problems.

Kani's Method: Introduction, rotation and displacement contribution factors, Advantages, Analysis of Continuous beams and Analysis of rigid jointed plane frames without sidesway. Numerical problems.

REFERENCE BOOKS

1. Devdas Menon, Structural Analysis, Narosa Book Distributors Pvt Ltd. 2009
2. Reddy C. S., Basic Structural Analysis, Tata McGraw Hill, New Delhi.
3. Pandit and Gupta, Theory of Structures, Vol. – I, Tata McGraw Hill, New Delhi.
4. S. S. Bhavikatti, Structural Analysis-II, Vikas Publishers, New Delhi
5. D.S. PrakashRao, Structural Analysis- a Unified Approach, University Press.

6. Norris and Wilbur, Elementary Structural Analysis, International Student Edition, McGraw Hill Book Co., New York.
7. R C Hibbeler, Structural Analysis by Prentice Hall, New Jersey.
8. B.C. Pumia, R.K., Jain, Strength of Materials and theory of structures Vol I & II, Laxmi Publication New Delhi.

BTCE16F4400	**Design of RC Structural Elements**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Concrete Technology and Alternative Building Materials basic Structural Analysis

Course Objectives:

1. To learn about the concepts and principles of limit state design
2. To compute the ultimate flexural strength, shear strength and torsional strength of reinforced concrete beams.
3. To design reinforced concrete one-way , two-way slabs and Stairs
4. To design reinforced concrete columns and footings.

Course Outcomes:

1. Explain about the concepts and principles of limit state design
2. Compute the ultimate flexural strength, shear strength and torsional strength of reinforced concrete beams
3. Design reinforced concrete, one-way , two-way slabs and Stairs
4. Design reinforced concrete columns and footings

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F4400	**CO1**	**3**	**2**		**3**		**2**	**2**					**2**	**3**	**1**		
	CO2	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**	**3**	**2**	**2**	**2**	**1**	**2**	**1**	**2**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Design Concepts: Loading standards as per IS 875, grades of steel and concrete. Introduction to working stress, Ultimate load and limit state methods. Advantages of Limit State method over other methods – Limit State philosophy as detailed in current ARE Code. Limit state method: Assumptions. Flexure of RCC beams of rectangular section. Under reinforced, balanced and over-reinforced sections.

UNIT-II **[12 HOURS]**

Limit State Method Design of Beams (Flexure, Shear, Torsion, Bond): Design of singly and doubly reinforced rectangular and flanged beams – use of design aids for flexure – Behaviour of R.C. beams in shear and torsion – Shear and Torsional reinforcement – Limit State design of R.C. members for combined bending, shear and torsion – Use of design aids. Design requirement for bond and anchorage as per IS code. Serviceability requirements

UNIT-III **[12 HOURS]**

Limit State Design of Slabs and Stairs: Behaviour of one way and two way slabs —– design of one way simply supported, cantilever and continuous slabs. Design of two-way slabs for various edge conditions. Types of staircases - design of dog-legged staircase

UNIT-IV **[12 HOURS]**

Limit State Design of Columns And Footing: Types of columns – design of short columns for axial load, combined axial load with uniaxial and biaxial bending - use of design aids. Design of footing for masonry and reinforced walls – design of axially and eccentrically loaded square and rectangular footings – design of combined rectangular footings for two columns only.

REFERENCE BOOKS:

1. Sinha.S.N., Reinforced Concrete Design, 2nd Edition, Tata McGraw Hill Publishing Company, 2002.
2. Varghese. P.C., Limit State Design of Reinforced Concrete, 2nd Edition Prentice Hall Inc., 2010,
3. Gambhir.M.L., Fundamentals of Reinforced Concrete Design, Prentice Hall Inc., 2006.
3. Anand.S.Arya, Masonry and Timber Structures including Earthquake Resistant Design, Nem Chand and Bros., 2006.
5. IS 456–2000, Indian Standard – Plain and Reinforced Concrete – Code of Practice, Fourth Edition.
6. IS 1905–1987, Indian Code of Practice for Structural use of Unreinforced Masonry.
7. National Building Code of India 2005 (NBC 2005), Bureau of Indian Standards.
8. Dayaratnam.P., Limit State Design of Reinforced Concrete Structures, Oxford, IBH Publishing Company Pvt. Ltd., 2008.

9. Unnikrishna Pillai and Devdass Menon, Reinforced Concrete Design, Tata McGraw Hill Publishing Company Ltd., 2002
10. Gambhir.M.L., Fundamentals of Reinforced Concrete Design, Prentice Hall of India Private Ltd., 200

BTCE16F4500	Railways, Airways, Waterways & Tunnel	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Surveying.

Course Objectives:

1. Learn the components of railway tracks along with the basic geometric features.
2. Understand the types of airport, planning and along with the geometric features of runways and taxiways, markings, lighting and visual aids.
3. To make students appreciate the effects of natural phenomena on the components of harbours and ports
4. To educate students about the basic aspects of tunnel and also expose them to various methods of tunnelling and drainage, ventilation, lining.

Course Outcomes:

1. Outline the importance of transportation, Describe the characteristics of rail transportation and the requirements of the components, compute the geometric features of railway tracks
2. Associate the aircraft characteristics to the functioning of the various components of airports; illustrate the utility of the guiding and control aids; compute the geometric features of runways and taxiways.
3. Enumerate the different types of harbours and their components; illustrate the effects of wind, waves and tides on water and navigational aids.
4. Outline the methods of tunnelling, tunnel construction methods, tunnel lining, drainage and ventilation.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F4500	CO1	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2

Course Contents:

UNIT-I [12 HOURS]

Railway: Importance of transportation. Features of different modes of transportation. Components of railway track, gauges, typical cross sections, coning of wheels and tilting of rails, hauling capacity of locomotives and train loads on railways, types of rails, rail length, rail joints, creep of rails, sleepers, ballast, rail fixtures, gradients and grade compensation, speed of trains on curves, points and crossings - numerical examples.

UNIT-II [12 HOURS]

Airways: Layout of an airport and components, typical airport layouts, planning of terminal area, aircraft parking system, aircraft characteristics affecting planning and design of airports, site selection, orientation of runway, basic runway length and corrected runway length, taxiways and exit taxiways, airport markings and lighting, air traffic control, ILS - numerical examples.

UNIT-III [12 HOURS]

Waterways: Classification of harbours, layout of harbours, component parts.Site selection and requirements. Effects of natural phenomena on harbour structures, tides.Breakwaters, wet docks, dry docks, navigational aids.

UNIT-IV [12 HOURS]

Tunnels: Tunnels and open-cuts – advantages and disadvantages, setting out of tunnel, shapes of tunnels, tunneling in soft soils (needle beam and shield methods only), tunneling in rocks, tunnel lining, drainage of tunnels, tunnel ventilation.

REFERENCE BOOKS:

1. Khanna S.K and Justo C.E.G, Highway Engineering, Nemchand and Bros, Roorkee.

2. Saxena S C and Arora S P, A Text Book of Railway Engineering, DhanpatRai Publications Pvt. Ltd. New Delhi.
3. Khanna S K, Arora M G and Jain S S, Airport Planning and Design, Nemchand and Bros. Roorkee.
4. Srinivasan R, Harbour Dock and Tunnel Engineering, Charotar Publishing House.
5. Kadiyali L.R, Traffic Engineering and Transportation Planning, Khanna Publishers, Delhi.
6. SatishChandra and Agarwal M M, Railway Engineering, Oxford University Press, New Delhi.
7. Horonjeff, Planning and Design of Airports, McGraw Hill Publications, New Delhi.
8. William W. Hay, An Introduction to Transportation Engineering, Toppan Company Ltd., Tokyo.

BTCE16F4600	**Hydrology and Irrigation Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Fluid mechanics

Course Objectives:

1. To impart the knowledge of hydrology that deals with the occurrence, distribution and movement of water on the earth.
2. To educate the students about the Precipitation and related losses of water, concepts of Runoff & Hydrograph for applications like Flood etc.
3. To impart knowledge of various irrigation techniques and water requirements of crops along with assessment of irrigation water.
4. To learn the canal irrigation distribution system along with design of canal.

Course Outcomes:

1. Outline the important process involved in the water cycle & identify methods for determining Precipitation & Components of Water Losses.
2. Classify the runoff components and predict the surface runoff based on hydrograph theory.
3. Summarize various irrigation techniques &estimate water requirements of the crops.
4. Classify the distribution system for canal irrigation. And describe the design procedure of canal systems.

Mapping of Course Outcomes with programme Outcomes

Course Contents:

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F4600	CO1	**3**		**2**		**2**	**2**	**3**					**1**	**3**	**2**	**1**	**1**
	CO2	**2**	**3**	**1**	**2**		**2**		**2**	**1**		**1**		**2**	**3**	**3**	**2**
	CO3	**1**	**1**	**3**	**2**	**3**	**3**	**3**			**1**	**2**	**2**	**3**	**2**	**2**	**1**
	CO4	**3**	**2**	**2**	**1**		**2**		**1**		**2**	**3**		**2**	**3**	**3**	**2**

UNIT-I **[12 HOURS]**

Introduction & Water Losses: Introduction, Water budget equation, Precipitation: introduction, forms of precipitation, types of precipitation, measurement of precipitation (Simon's gauge & Syphon gauge only), selection of rain gauge station. Adequacy of rain gauges, methods of computing average rainfall, interpolation of missing data, adjustment of missing data by double mass curve method. Hyetograph and mass curve of rainfall. Evaporation: Definition, factors affecting, measurement (Class A pan). Estimation using empirical methods (Meyer's and Rohwer's equation), evaporation control. Evapo-transpiration: Definition, factors affecting, measurement, estimation (Blaneycriddle method) Infiltration: Definition, factors affecting, measurement (double ring infiltrometer), infiltration indices, Horton's equation of infiltration.

UNIT-II **[12 HOURS]**

Runoff & Hydrographs: Definition, concept of catchment, water budget equation, componenets, factors affecting, rainfall runoff relationship using simple regression analysis. Definition, components of hydrographs, unit hydrograph and its derivation from simple storm hydrograph, base flow separation, Prepositions of unit hydrograph-problems.

UNIT-III **[12 HOURS]**

Introduction to Irrigation Engineering: Introduction, need for irrigation, advantages and disadvantages of irrigation, environmental impacts of irrigation, Systems of irrigation: Gravity irrigation, lift irrigation, well irrigation, tube well irrigation, infiltration galleries, sewage irrigation, supplemental irrigation. soil-water-plant relationship, soil moisture. Irrigation relationship, frequency of irrigation. Water requirement of crops: Introduction, definitions, crop seasons of India, water requirement of a crop, duty, delta, base period. Consumptive use. Irrigation efficiencies. Assessment of irrigation water with numerical examples.

UNIT-IV **[12 HOURS]**

Canals: Definition, Types of canals, Silt theory,Alignment of canals, Design of canals by Kenedy's and Lacey's methods- Problems

REFERENCE BOOKS:

1. Subramanya.K, Engineering Hydrology, 4th Edition, Tata McgrawHill NewDelhi
2. Madan Mohan Das, Mim Mohan Das, Hydrology, PHI Learning private Ltd. New Delhi-2009
3. Jayarami Reddy, A Text Book Of Hydrology, Laksmi Publications, New Delhi-2007
4. P.N.Modi, Irrigation, water Resources and water power Engineering, Standard book house, New Delhi.
5. Madan Mohan Das & Mimi Das Saikia, Irrigation and Water Power Engineering, PHI Learning pvt. Ltd. New Delhi 2009.
6. Ghanshyam Das, Hydrology & Soil Conservation Engineering, PHI Learning Private Ltd., New Delhi, 2009
7. PatraK.C, Hydrology & Water Resources Engineering, Narosa Book Distributors Pvt. Ltd. New Delhi- 2008
8. R.K.Sharma & Sharma, Hydrology & Water Resources Engineering, Oxford and Ibh, New Delhi
9. S. K.garg, Irrigation Engineering and Hydraulic structures, Khanna Publication, New Delhi.

BTCE16F4700	**Concrete Technology Lab**	L	T	P	C
Duration:16Weeks		1	0	1	2

Prerequisites:

Construction materials, Concrete technology theory**.**

Course Objectives:

1. To understand the characteristics and behaviour of civil engineering materials used in buildings and infrastructure.
2. Students will learn standard principles and procedure to design prepare and/or test materials such as concrete mix design including field test methods for fresh concrete.
3. Students will know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.
4. Students will have exposure to practical applications including writing of a technical report related to each experiment.

Course Outcomes:

1. Demonstrate ability to make selection of materials based on their properties, behaviour and intended use in design and construction.
2. Write formal technical report & convey Engineering message efficiently.
3. Understand ethical issues associated with Engineering experiments and professional practice.
4. Collaborate lab work in groups and divide responsibilities among group members.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F4700	CO1	1	2	3	-	-	-	2	1	1	-	-	-	3	3	2	3
	CO2	1	2	3	-	-	-	-	1	-	-	-	-	3	3	3	2
	CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	3	3	1
	CO4	3	2	-	2	-	-	1	-	-	-	-	-	3	3	3	2

Course Contents:

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

REFERENCES BOOKS:

1. Sood, Hemant, Mittal L N and Kulkarni P D, Laboratory Manual on Concrete Technology, CBS Publishers, New Delhi, 2002.
2. Gambhir M L, Concrete Manual Laboratory testing for quality control of concrete, 4th edition DhanpatRai and Sons Delhi 1992

BTCE16F4800	Building Drawing With AUTOCAD	L	T	P	C
Duration: 16weeks		1	0	1	2

Prerequisites:

Prerequisite: Knowledge of building planning and drawing

Course Objectives:

1. Preparation of drawings of building components
2. Functional design of buildings (residential, public and industrial)
3. Development of plan, elevation and sectional views of residential buildings given line diagram.
4. To develop line diagrams for non-residential buildings

Course Outcomes:

1. Able to prepare drawings of building components
2. Able to carry out functional design of buildings (residential, public and industrial)
3. Able to develop plan, elevation and sectional views of residential buildings given line diagram.
4. Able to develop line diagrams for non-residential buildings Using drafting software.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F4800	CO1	3	2	2	-	-	-	-	-	2	-	-	3	3	3	3	3
	CO2	3	2	3	2	-	-	-	-	2	-	-	3	3	3	3	3
	CO3	3	2	3	2	-	-	-	-	2	-	-	3	3	3	3	3
	CO4	3	2	3	1	-	-	-	-	2	-	-	3	3	3	3	3

Course Contents:

Practical/Exercise

1. Draw Basic 2D objects such as line circle, polygon - (at least 04 objects)
2. Draw simple plan of a rectangular room for the given dimensions as a first exercise

3. Draw a drawing of a plan, elevation, side view and foundation details of One bed room and a two bed room residential building with all details of doors, windows and ventilators
4. Draw a drawing of a plan, elevation, side view and foundation details of Primary health centre
5. Convert Plan, Elevation and side view of a simple two room building to a three dimensional view

Suggested List of Student Activities :Visit to architect/civil engineering firm for understating the CAD and its applications and study of typical drawings prepared by AutoCAD

REFERENCE BOOKS:

1. Shah M.H and Kale C.M, Building Drawing, Tata Mc-Graw Hill Publishing co. Ltd., New Delhi.
2. Gurucharan Singh, Building Construction, Standard Publishers & distributors, New Delhi.
3. National Building Code, BIS, New Delhi.

BTCE16F4900	**Environmental Engineering Lab**	L	T	P	C
Duration16 Weeks		1	0	1	2

Prerequisites:

Theoretical Concept of Environmental Engineering

Course Objectives:

1. To estimate different parameters of the water quality
2. To Study and analysis the quality requirements for domestic waters.
3. To make the students as to suggest required type of treatment to purify raw water
4. To identify the ill effects of environmental pollution

Course Outcomes:

1. Analyse various physico-chemical and biological parameters of water quality
2. Assess complete water quality assessment for domestic supplies
3. Recommend the various types of treatment methods required to purify raw water.
4. Implement new environmental techniques to avoid pollutants

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4

BTCE16F4900	**CO1**	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**3**	**3**	**-**	**3**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

Laboratory Experiments

1. Determination of Alkalinity, Acidity, pH
2. Jar test for optimum dosage of alum
3. Determination of fluoride
4. Determination of chlorides
5. Determination of residual chlorine
6. Determination of percentage of available chlorine in bleaching powder
7. Determination of electrical conductivity and turbidity
8. Determination of DO and Biochemical Oxygen Demand (BOD) of Wastewater
9. Determination of Total solids, suspended solids, dissolved solids, volatile solids, fixed solids and settleable solids.
10. Determination of sulphates
11. Determination of iron by phenanthroline method.
12. MPN determination
13. Determination of nitrates.
14. Determination of heavy metals-Lead, Cadmium and Zinc

REFERENCE BOOKS:

1. Manual of Water and Wastewater Analysis – NEERI Publication.
2. Standard Methods for Examination of Water and Wastewater (1995), American Publication – Association, Water Pollution Control Federation, American Water Works Association, Washington DC.
3. IS Standards: 2490-1974, 3360-1974, 3307-1974.
4. Sayer and Mccarthy, Chemistry for Environmental Engineering,
5. Dr. BKotaiah, N Kumara Swamy, Environmental Engineering Laboratory Manual

SEMESTER V

BTCE16F5100	Highway Engineering	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Applied Surveying

Course Objectives:

1. To educate students about the importance of highway development, highway planning and highway alignment.
2. To make students familiar with highway geometric design elements and to educate students about the importance of traffic engineering and the features of traffic characteristics.
3. To educate students about the importance of materials used in highways, basic laboratory testing of these materials, their requirements and criteria for selection for highway works.
4. To give students an overview of highway construction, different drainage measures, failures in pavements and methods of maintenance of pavements

Course Outcomes:

1. Explain: the current highway development projects in India, the factors influencing highway alignment and the steps.
2. Describe the elements and factors affecting geometric design of highways, horizontal and vertical alignment details and outline the scope of traffic engineering, describe the road user characteristics and conduct various traffic studies.
3. Explain: the requirements and selection criteria of highway materials, basic methods of testing the highway materials and interpretation of results in comparison with standard IRC codes.
4. Enumerate: the steps of construction of various pavement layers, requirements of drainage systems and design procedures for drains, types of failures occurring in pavements and method of maintenance of pavements

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	PO 12	PSO 1	PSO2	PSO3	PSO4
	CO1	3	3				2	3	3	3	3		1	3	3	2	3
	CO2	3	3	3	2	1	2	2	3	2	2			3	2	3	3

BTCE16F5100	CO3	**3**	**3**	**3**	**3**		**2**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**2**	**2**
	CO4	**3**			**3**	**3**	**3**	**3**	**2**	**2**	**3**		**2**	**3**	**3**		**1**

Course Contents:

UNIT-I **[12 HOURS]**

Highway development, planning and alignment–Development of roads in India, current highway development projects. Necessity of highway planning, classification of roads, road patterns, Basic requirements of an ideal alignment and factors controlling alignment, steps in new and realignment.Numerical examples.

UNIT-II **[12 HOURS]**

Highway geometric design and traffic engineering– Introduction, highway cross-section elements.Sight distances, design speed, horizontal alignment and vertical alignment. Traffic characteristics, traffic studies, capacity and level of service. Traffic control devices, design of isolated signal by Webster's method. Numerical examples.

UNIT-III **[12 HOURS]**

Highway materials and construction – Importance and desirable properties of subgrade soil, HRB method of soil classification.Requirements, properties and tests on road aggregates and binders. Criteria for selection of emulsion and cutback. General features of construction of various pavement layers. Numerical examples.

UNIT-IV **[12 HOURS]**

Highway drainage and maintenance- design and construction of surface and sub-surface drainage system for highways, drainage materials. General causes and different types of failures in flexible and rigid pavements. Importance and methods of maintenance of different types of pavements, special repairs. Numerical examples.

REFERENCE BOOKS

1. Khanna S K, Justo C E G and Veereragavan A, Highway Engineering, Nemchand and Bros, Roorkee.
2. L R Kadiyali and Lal, Traffic Engineering and Transport planning, Khanna publishers, New Delhi
3. K P Subramanium, Transportation Engineering, SciTech Publications, Chennai
4. R Sreenivas Kumar "Highway Engineering", University Press, Pvt. Ltd. Hyderabad
5. S K Khanna, C E G Justo and A Veeraragavan, Highway Material and Pavement Testing Laboratory Manual, Revised 5th Edition, Nemchand and Bros, Roorkee
6. Relevant IRC Codes
7. MORTH Specifications

BTCE16F5200	Soil Mechanics and Foundation Engineering	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials and Fluid Mechanics

Course Objectives:

1. To create an ability to apply knowledge of geotechnical engineering.
2. To conduct experiments, as well as to analyse and interpret data related to the geotechnical engineering.
3. To accentuate the understanding of the basic principles.
4. To identify the type and characteristics of soil.

Course Outcomes:

1. Understand basic concepts of soil and they will be knowing the classification of soil.
2. Analysis of water soil interaction and seepage activities in soil.
3. Characterisation of compaction and consolidation of soil in field and Laboratory.
4. Understands the strength characteristic of soil in construction.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5200	CO1	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Definition of Soil and Soil Mechanics, Soil Problems in Civil Engineering Field, Basic definition in soil mechanics, Three phase diagram definition & relations. Laboratory methods of determination of index properties.

Grain size analysis, particle size distribution, Atterberg limits - Plasticity, liquidity and consistency indexes, Classification of coarse grained and fine grained soils as per BIS.

UNIT-II **[12 HOURS]**

Permeability and Seepage:

Permeability: One dimensional flow through soil – Permeability, Darcy's law, field and laboratory permeability tests, flow through stratified soils, factors affecting permeability.

Seepage: Introduction to flow nets- assumptions and limitations only, Estimating quantity of seepage and exit gradient.

UNIT-III **[12 HOURS]**

Compaction and Consolidation

Compaction:Proctor's test, moisture – density relations, field compaction methods – factors affecting compaction, effects of compaction on soil properties, proctors needle.

Consolidation:Definition, Terzaghi's theory of one dimensional consolidation partial differential equations (no analytical solutions), Mass spring analogy, Laboratory test – Determination of co-efficient of consolidation, Preconsolidation pressure and its determination by casagrande's method.

UNIT-IV **[12 HOURS]**

Shear Strength and Foundation

Shear Strength: Shear strength of cohesive and cohesionless soils – Mohr – coulomb's theory – Laboratory and field test: Direct, triaxial, vane and unconfined shear strength test – factors affecting shear strength.

Bearing Capacity: Definitions, Types of failure, Terzaghi's formula, Skempton's formula, BIS formula, Effect of water table, Allowable bearing pressure, bearing pressure based on SPT value, Plate load test.

REFERENCES BOOKS:

1. Murthy V.N.S, Principles of Soil Mechanics and Foundation Engineering, 4th Edition, UBS Publishers and Distributors, New Delhi. 1996

2. Punmia .B.C, Soil Mechanics and Foundations, Laxmi Publications Pvt. Ltd., 2005.

3. Gopal Ranjan and Rao .A.S.R, Basic and Applied Soil Mechanics, New age international (p) Ltd., 2007.

4. Braja, M. Das, Geotechnical Engineering; 5th Edition, Thomson Business Information India (P) Ltd., India, 2002
5. Bowles J.E, Foundation Analysis and Design, 5th Edition,McGraw Hill Pub. Co. New York. 1996
6. Alam Singh and Chowdhary G.R, Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd., New Delhi. 1994
7. Shashi K. Gulathi& Manoj Datta. Geotechnical Engineering- TataMcGraw Hill, 2009
8. Iqbal H. Khan, Text Book of Geotechnical Engineering, 2nd Edition, PHI, India. 2005
9. NarasimhaRao A. V. &Venkatrahmaiah C.Numerical Problems, Examples and objective questions in Geotechnical Engineering, Universities Press., Hyderabad. 2000
10. BIS Codes of Practice: IS 2720(Part-3/Sec. 1) – 1987; IS 2720 (Part – 2)- 1973; IS 2720 (Part – 4) – 1985; IS 2720 (Part – 5) – 1985; IS 2720 (Part – 6) – 1972; IS 2720 (Part – 7) – 1980; IS 2720 (Part – 8) – 1983; IS 2720 (Part – 17) – 1986; IS 2720 (Part - 10) – 1973; IS 2720 (Part – 13) – 1986; IS2720 (Part 11) – 1971; IS2720 (Part 15) – 1986; IS 2720 (Part 30) – 1987; IS 2720 (Part 14) – 1977; IS 2720 (Part – 14) – 1983; IS 2720 (Part – 28) – 1974; IS 2720 (Part – 29) – 1966, IS 2720 (Part-60) 1965.
11. Lambe T.W, Soil Testing for Engineers- Wiley Eastern Ltd., New Delhi.
12. Head K.H., Manual of Soil Laboratory Testing- Vol. I, II, III, Princeton Press, London, 1986
13. Bowles J.E. Engineering Properties of Soil and Their Measurements, McGraw Hill Book Co. New York, 1988

BTCE16F5310	Advanced Structural Analysis	L	T	P	C
Duration:16weeks		3	1	0	4

Prerequisites:

Strength of Materials, Structural Analysis.

Course Objectives:

1. To familiarize with structural analysis of cable and space structures
2. Understand the concept of plastic analysis of structures
3. To know the Matrix analysis of structures- Stiffness Matrix Analysis
4. To understand the analysis of Flexibility Matrix.

Course Outcomes:

1. Carry out analysis of cable and suspension bridges, three hinged stiffening girders
2. Carry out plastic hinge mechanism of indeterminate beams and frames
3. Will gain knowledge of analysis of structures by Stiffness Matrix methods
4. To analyse structure by Flexibility Matrix.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F5310	CO1	3	3	1		2	2	1					2	3	3		2
	CO2	3	3	1										3	3		
	CO3	3	3	1		3	2						2	3	3		3
	CO4	3	3	1		3	2						2	3	3		3

Course Contents:

UNIT-I [12 HOURS]

Cable and space structures: Analysis of trusses using method of tension coefficients, Beams curved in plan, Suspension cables, suspension bridges with two and three hinged stiffening girders.

UNIT-II [12 HOURS]

Plastic Analysis of Structures: Beams in pure bending, Plastic moment of resistance, Plastic modulus, Shape factor, Load factor, Plastic hinge and mechanism, Plastic analysis of indeterminate beams and frames.

UNIT-III [12 HOURS]

Matrix Analysis of Structures: Introduction, coordinate systems, displacement and force transformation matrices, Contra-gradient principle.

Stiffness Matrix Method of Analysis: Introduction, Element and structure stiffness matrices, Development of stiffness matrix for plane truss element and axially rigid plane framed structural elements, Analysis of plane truss and axially rigid plane frames.

UNIT-IV [12 HOURS]

Flexibility Matrix Method of Analysis: Introduction, Element and structure flexibility matrices; Development of flexibility matrix for plane truss element and axially rigid plane framed structural elements, Analysis of plane truss and axially rigid plane frames.

REFERENCE BOOKS:

1. Devdas Menon, Advanced StructuralAnalysis, Narosa Publishing House, 2009.
2. V.N.Vazirani & M.M.Ratwani, Analysis of Structures, Khanna Publishers, New Delhi. 2000
3. Theory of Structures, Pandit and Gupta, Vol. – I, Tata McGraw Hill, New Delhi.
4. Asslam Kassimali, Matrix Analysis of Structures, Brooks/Cole Publishing Co., USA, 1999.

5. Intermediate Structural Analysis by Wang and Chu Kia, McGraw Hill, New York.

BTCE16F5320	Industrial Waste Water Treatment	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Water supply and Sanitation Engineering, Hydraulic machines

Course Objectives:

1. To understand the effect of industrial effluents on streams.
2. To explain various tertiary treatment unit operations.
3. To explain combined treatment feasibility.
4. To understand the treatment of selected industrial waste.

Course Outcomes:

1. Assess the effect of industrial waste on stream.
2. Make use of tertiary treatment unit operations.
3. Make a choice of combined treatment of domestic and industrial waste.
4. Propose a treatment plant for few selected industrial processes.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5320	CO1	3	3	2	3	3	-	-	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	-	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	1	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	1	2	2	-	2	-	-	-	-	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Sampling, Effluent and Stream Standards and

Legislation to Control Water Pollution. Stream Quality, Dissolved oxygen Sag Curve in Stream, Streeter– Phelps formulation, Numerical Problems on DO prediction.

UNIT-II **[12 HOURS]**

Treatment Methods-I: Volume Reduction, Strength Reduction, Neutralization, Equalization and Proportioning.

Treatment Methods-II: Removal of Inorganic suspended solids, Removal of Organic Solids, Removal of suspended solids and colloids. Treatment and Disposal of Sludge Solids.

UNIT-III **[12 HOURS]**

Combined Treatment: Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams.

Treatment Of Selected Industrial Waste-I: Process flow sheet showing origin / sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of wastewater disposal on water bodies.

The Industries to be Covered are:

1. Cotton Textile Industry
2. Tanning Industry
3. Cane Sugar Industry & Distillery Industry

UNIT-IV **[12 HOURS]**

Treatment Of Selected Industrial Waste-I:

1. Dairy Industry
2. Canning Industry
3. Steel and Cement Industry
4. Paper and Pulp Industry
5. Pharmaceutical Industry
6. Food Processing Industry

REFERENCE BOOKS

1. Nelsol L. Nemerow, Industrial Waste Water Treatment, John Wiley & Sons Inc, 2009.
2. Rao MN, and Dutta A.K., Waste Water Treatment, Oxford & IBH Publishing Co.Pvt Ltd. 2008.
3. Metcalf and Eddy, Waste Water Treatment, Disposal and Reuse, Tata McGraw Hill Publications, 2003.
4. Patwardhan A.D., Industrial Wastewater Treatment, PHI Learning Private Ltd., New Delhi, 2009
4. Mahajan S.P, Pollution Control Processes in industries, Tata McGraw Hill Publications, 2004

BTCE16F5330	**Town and Country Planning**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

None

Course Objectives:

1. To educate students about the importance and need of town planning,
2. To make students familiar with the historical planning principles of various cities around the world.
3. To give students an overview of the planning of present and future cities in terms of development plans.
4. To make students appreciate the new concepts to be adopted for planning of future cities.

Course Outcomes:

1. Compare the various town planning concepts adopted in historical cities.
2. Describe the importance of development plans for the present and future cities.
3. Associate the modern strategies to be adopted in the present planning process.
4. Enumerate the different planning aspects contributing to a good city or smart city

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5330	CO1	2	2											-	-	-	-
	CO2		3			2								-	-	-	-
	CO3		3			2				1				-	-	-	-
	CO4		2			3	2	1						-	-	-	-

Course Contents:

UNIT-I [12 HOURS]

Ancient Town Planning: Historic evolution of settlements. Brief review of the origin of early human settlements. Brief review on town planning in historical perspective. Ancient Hindu city planning concepts. Ancient town patterns in India and Abroad. Garden cities, satellite towns, fringe areas. Development due to impact of industrial revolution.

UNIT-II [12 HOURS]

Evolution of Modern Town Planning Concepts: Planning Theories and their relevance to Indian conditions.Detailed study of Indian new cities. Planning Techniques-study and analysis of existing settlements, types of surveys and presentation of data.

UNIT-III **[12 HOURS]**

Planning Techniques and Urban Renewal: Components of a settlement-Activity pattern and land use, zoning regulations and bye-laws, density and population distribution. Land use Planning. Urban renewal– urban blight and obsolescence.Slumsand squatter settlements. Urban Decentralization.

UNIT-IV **[12 HOURS]**

Development Plans, Smart Cities: Process of preparation of comprehensive development plan, outline development plan (CDP and ODP).Brief to smart cities, factors responsible for smart city concept, environmental, economic, technological aspects. Various types of smart cities across the world - retrofit, in fill, newly developed cities and examples.

REFERENCE BOOKS

1. Galion and Eisner, Urban Pattern: City planning and Design. Ed, Van Nostrand Reinhold, New York, 1986.
2. Lewis Keeble, Urban Planning
3. Pratap Rao Urban Planning and Practices
4. Hiraskar: Town planning
5. CDPs of various cities

BTCE16F5340	**Principles of Planning and Construction Management**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Building planning and drawing

Course Objectives:

1. To study the concepts of construction resource planning, scheduling and to apply appropriate tools and techniques like allocation of resources as per requirement.
2. To know the methods of project estimation and obtain the knowledge of planning and preparing budgets for the construction projects.
3. Understand the effect of management for project organization and Control
4. To study the design and construction procedures along with labour material and equipment utilization

Course Outcomes:

1. Calculate the total time required to complete the job without delay.
2. Design the WBS and execute the plan.
3. Control over the projects.
4. Know the Production rates of Equipment's.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5340	CO1	**3**	**3**		**1**	**3**				**2**	**2**	**3**		**3**	**2**	**1**	**3**
	CO2	**3**	**3**		**1**	**2**				**3**	**2**	**3**		**3**	**2**	**1**	**3**
	CO3	**2**	**3**		**1**	**3**				**2**	**3**	**3**		**3**	**2**	**1**	**3**
	CO4	**3**	**3**		**1**	**1**				**3**	**3**	**3**		**3**	**2**	**1**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Resource Planning: Introduction to resources-Types of resources, manpower, Equipment, Material, Money- Resource Planning- manpower, Equipment, Material, Money – Scheduling – Procurement management.

UNIT-II **[12 HOURS]**

Cost Management: Methods of Estimating project cost (An overview), classification of construction cost – planning resources unit rate, cost inflation, Escalation and Contingencies, Earned value budget – Project master budget – contractors cost control system

UNIT-III **[12 HOURS]**

Procurement Management: Material: Time of purchase, quantity of material, sources, Transportation, Delivery and Distribution- control methods- Inventory basics, Inventory Planning –. EOQ. Equipment: Planning and selecting, Extension of Equipment, Types, Cost control Methods, Depreciation and Replacement.

UNIT-IV **[12 HOURS]**

Labour Management: - Labour Regulations: Social Security - welfare Legislation - Laws relating to Wages, Bonus and Industrial disputes. Labour Administration - Labour, Classes of Labour, Cost of Labour, Labour schedule, optimum use Labour, Insurance and Safety Regulations – Workmen's Compensation Act - other labour Laws.

REFERENCE BOOKS

1. Chitkara, K.K, Construction Project Management, Tata McGraw-Hill Publishing Company, 2012
2. Sharma .S.C, Construction Engineering and Management, Khanna Publishers, 2008.
3. Senguptha .B, "Construction Management and Planning", Tata McGraw Hill

BTCE16F5410	**Design of Masonry Structures**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Advanced Building Materials and Concrete Technology

Course Objectives:

1. To learn the history of masonry structures
2. To learn the characteristics, classification and properties of masonry materials
3. To learn the strength and elastic behaviour of masonry under compression
4. To learn the failure theories of masonry under compression.

Course Outcomes:

1. Has learnt the history of masonry structures
2. Has learnt the characteristics, classification and properties of masonry materials
3. Has learnt the strength and elastic behaviour of masonry under compression
4. Has learnt the failure theories of masonry under compression.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F5410	CO 1					3	2	3	2	2		2	2	3	1	1	3
	CO 2	2				2	2	3	1	1		1	2	3	2	1	3
	CO 3	2		2	1	1	1	3	1	1			2	3	2	1	3
	CO 4	3	1		1	1		3	2	1	1		3	3	2	1	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction, Masonry Units, Materials and Types: History of masonry, Characteristics of Brick, stone, clay block, concrete block, stabilized mud block masonry units – strength, modulus of elasticity and water absorption. Masonry materials – Classification and properties of mortars, selection of mortars.

Strength of Masonry in Compression: Behaviour of Masonry under compression, strength and elastic properties, influence of masonry unit and mortar characteristics, effect of masonry unit height on compressive strength, influence of masonry bonding patterns on strength, prediction of strength of masonry in Indian context.

UNIT-II **[12 HOURS]**

Failure theories of masonry under compression. Effects of slenderness and eccentricity, effect of rate of absorption, effect of curing, effect of ageing, workmanship on compressive strength.

Flexural and shear bond, flexural strength and shear strength: Bond between masonry unit and mortar, tests for determining flexural and shear bond strengths, factors affecting bond strength, effect of bond strength on compressive strength, orthotropic strength properties of masonry in flexure, shear strength of masonry, test procedures for evaluating flexural and shear strength.

UNIT-III **[12 HOURS]**

Permissible stresses: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses.

Design of load bearing masonry buildings: Permissible compressive stress, stress reduction and shape reduction factors, increase in permissible stresses for eccentric vertical and lateral loads, permissible tensile and shear stresses, Effective height of walls and columns, opening in walls, effective length, effective thickness, slenderness ratio, eccentricity, load dispersion, arching action, lintels; Wall carrying axial load, eccentric load with different eccentricity ratios, wall with openings, freestanding wall; Design of load bearing masonry for buildings up to 3 to 8 storeys using BIS codal provisions.

UNIT-IV **[12 HOURS]**

Earthquake resistant masonry buildings: Behaviour of masonry during earthquakes, concepts and design procedure for earthquake resistant masonry, BIS codal provisions.

Masonry arches, domes and vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure.

REFERENCE BOOKS:

1. Hendry A.W., Structural masonry, 2nd edition, Macmillan Education Ltd.,
2. Sinha B.P & Davis S.R., Design of Masonry structures- E & FN Spon
3. Dayaratnam P, Brick and Reinforced Brick Structures- Oxford & IBH
4. Curtin, Design of Reinforced and Prestressed Masonry- Thomas Telford

5. Sven Sahlin, Structural Masonry-Prentice Hall
6. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, Alternative Building Materials and Technologies, New Age International, New Delhi & Bangalore
7. IS 1905, BIS, New Delhi
8. SP20(S&T), New Delhi

BTCE16F5420	Air and Noise Pollution	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Environmental Studies, Engineering Chemistry

Course Objectives:

1. To introduce source, classification, characterization and effects of air pollution.
2. To explain the meteorological definitions & air transport equations.
3. To introduce the sampling & pollution control matters and devices.
4. To demonstrate legislations and regulations pertinent to air pollution.

Course Outcomes:

1. Identify the sources of air pollution.
2. Identify the effects of air pollution on humans, vegetation, materials etc.
3. Solve problems on stack height, concentration of pollutants.
4. Identify the effects and control measures of air pollution due to automobiles

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5420	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Definition – Types of Air Pollutants, Sources, Pollutants Characteristics, Concentration of pollutants, Numerical Problems., Behaviour and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog, Air Pollution Inventories. Environmental aspects of air pollution: On Human Health considerations and treatment, Animals, Plants and Materials.

UNIT-II **[12 HOURS]**

Meteorology: Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Wind rose, pollution roses. General Characteristics of Stack Plumes, Meteorological Models. plume rise, stack height, Numerical problems, Industrial Plant Location and Planning for Industries.

Noise pollution – sources, measurement units, effects and control.

UNIT-III **[12 HOURS]**

Sampling, Analysis And Control: Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement, Air Pollution Control Methods – Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic Precipitators, Wet Scrubbers – numerical problems. Selection of a Particulate Collecting Equipment, Minimizing Gaseous Emissions, Effects of emissions on Liquids and Solids, Combustion Odours control of vehicular emissions.

UNIT-IV **[12 HOURS]**

Air Pollution due to Automobiles: Air Pollution due to petrol Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control.

Burning Environmental Issues: Acid Rain, Global Warming, Ozone Depletion in Stratosphere, Indoor Air Pollution.

Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

Environmental Issues: Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards.

REFERENCE BOOKS

1. Rao M N. and Rao H V N., Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2004.
2. Boubel, R W., Donald, L.F., Turner, D.B., and Stern, A.C., Fundamentals of Air Pollution, Academic Press, 1994.
3. Crawford, M., Air Pollution Control Theory, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1980.
4. Henry C Perkins, Air Pollution, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1980.
5. Murali Krishna K V S G., Air Pollution & Control, Kaushal & Co., 1995.

6. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., Environmental Engineering, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1986.
7. Sincero, A.P and Sincero, G.A., Environmental Engineering, A Design Approach, Prentice Hall of India. 1999.
8. Wark, K., Warner, C.F. and Davies, W.T., Air Pollution- Its Origin and Control, Harper & Row Publishers, New York. 1998.
9. Rao C S., Environmental Pollution Control Engineering, New Age International, New Delhi. 2007.

BTCE16F5430	**Mass Transit Facilities**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. To educate the students the importance and types of existing mass transit facilities
2. To make students familiar with the terminologies related to mass transit
3. To educate students about different types of mass transit in different countries
4. To give an overview of different types of mass transit facilities

Course Outcomes:

1. Enumerate the different terminologies related to mass transit
2. Describe different types of mass transit facilities around the world
3. Compare the various modes of mass transit and their suitability
4. Explain the impact of mass transit on transportation planning

Mapping of Course Outcomes with programme Outcomes

Course Contents:

Code																	
BTCE16F5430	CO1	3	1				3		2		2		2	3			1
	CO2	3	3			2		2	2	3	3			3	3		1
	CO3	3	3		2	2	3			3	1	2		3	3	1	2
	CO4	3	3		2	2	1	2	3		3		2	3			2

UNIT-I **[12 HOURS]**

Introduction to Mass Transit: Mass transit definition- Classification of transport by the type of usage, basic characteristics of transit modes. Transit system-components, operation, service and characteristics. Transport System Performance at National, State, Local and International levels

UNIT-II **[12 HOURS]**

Mass Transit Modes: Para transit- car sharing, taxis, DAR, Jitney-case studies. Street transit- RB, Express bus, TB, SCR –case studies. Specialized transit modes - . Case studies

UNIT-III **[12 HOURS]**

Medium and High Performance Modes: Semi rapid- BRT, LRT, AGT- case studies. Rapid-LRRT, RTRT, monorail, RRT, RGR-case studies.

UNIT-IV **[12 HOURS]**

Impact of Mass transit: Private Sector in Mass Transport – Bus and Rail Integration – Co-ordination of Feeder Services – Transit Oriented Land Use Development – Case Studies - Urban Transportation and Land use – Impact of Transport Development on Environment – Remedial measures – Policy Decisions – Recent Trends in Mass Transportation Planning and Management

REFERENCE BOOKS

1. Michael J.Bruton , An Introduction to Transportation Planning, Hutchinson,1985
2. Michael D.Meyer and Eric J.Miller, Urban Transportation Planning – A Decision Oriented Approach, McGraw Hill Book Company, New York, 1984
3. Vuchic, Vukan R. Urban transit systems and technology. John Wiley & Sons, 2007.

BTCE16F5440	Remote Sensing and GIS	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

water supply and Sanitation Engineering, Hydraulic machines

Course Objectives:

1. To educate students about GIS and Remote sensing
2. To make students familiar with the recent techniques of remote sensing and GIS
3. To educate students on its application in Traffic and Transportation Engineering

4. To give an overview of importance and application of remote sensing and GIS

Course Outcomes:

1. Explain the basics of Remote Sensing.
2. Explain the various GIS techniques
3. Describe their application in the Transportation engineering.
4. Enumerate the uses in other streams of civil engineering

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F5440	CO1	3	1	1	2	3			-	2	-	-	3	3	3	3	3
	CO2	3	3	2	3	2		-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	-	-	-	-	1	-	-	3	3	3	3	3
	CO4	3	3	1	2	3	2	3	-	2	-	-	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Remote Sensing: Definition – Components of Remote Sensing – Energy, Sensor, Interacting Body – Active and Passive Remote Sensing – Platforms – Aerial and Space Platforms – Balloons, Helicopters, Aircraft and Satellites – Electromagnetic Radiation – EMR Spectrum

UNIT-II **[12 HOURS]**

Basic Concept and Components – Hardware, Software – Data Spatial and non-spatial – Geo-referencing – Map Projection – Types of Projection – Simple Analysis

UNIT-III **[12 HOURS]**

Data Structures and Analysis: Database – Raster and Vector data structures – Data storage – Run length, Chain and Block coding – Vector data storage – Topology – GIS Modelling

UNIT-IV **[12 HOURS]**

Applications In Civil Engineering: Applications of Aerial Photography and Satellite Imageries in Highway and Railway Alignment- terminals and roadside facilities – Accident analysis –. GIS as an

integration technology – Integration of GIS,GPS and Remote Sensing Techniques –ATIS –AVLS – applications in other streams of civil engineering .

REFERENCE BOOKS:

1. Anji Reddy, Remote Sensing and Image Interpretation, John Wiley and Sons Inc., New York, 1987.
2. M.G.Srinivas, Remote Sensing Applications, Narosa Publishing House, 2001.
3. Burrough P.A, Principles of GIS for Land Resources Assessment, Oxford Publication, 1994.
4. Jeffrey Star and John Ester, Geographical Information System – An Introduction, Prentice Hall Inc., Englewood Cliffe, 1990.
5. Marble, D.F, Calkins, H.W and Penquest, Basic Readings in GIS, Speed System Ltd., New York, 1984.

BTCE16F5510	**Design Of Earthquake Resistant Structures**	L	T	P	C
Duration:16weeks		3	1	0	4

Prerequisites:

Design of RCC

Course Objectives:

1. The phenomena of earthquakes.
2. Understand and analyse the dynamic forces caused by earthquakes and structures.
3. Process, measurements and the factors that affect the design of structures in seismic areas.
4. The codal provisions as well as the seismic design methodology.

Course Outcomes:

1. Understand the principles of Structural Dynamics and damping in structures.
2. Summarize the Solution techniques for dynamics of single degree of freedom systems.
3. Understand the principles of engineering seismology.
4. Understand the concepts of earthquake resistance of reinforced concrete buildings.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5510	CO1	2	3	1										2	3		
	CO2		2	2										3		1	2
	CO3	1	2					1						2		1	

	CO4	**1**	**2**	**1**									**2**			**1**

Course Contents:

UNIT-I [12 HOURS]

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, epicenter, Plate tectonics, seismographs, liquefaction, Types, effects and controlling factors seismic zoning map of India, Peak ground motion parameters.

UNIT-II [12 HOURS]

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 resistantbuilding architecture – lateral load resistant systems, building characteristics.

UNIT-III [12 HOURS]

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 (Equivalentlateral 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 [12 HOURS]

Earthquake resistant design of masonry buildings: Elastic properties of structural masonry, lateral load analysis, Design of two storeyed masonry buildings.

REFERENCE BOOKS:

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

6. Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, Elements of Earthquake Engg, 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.

BTCE16F5520	**Advanced Surveying**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Surveying

Course Objectives:

1. Have an overview of the advanced surveying techniques and modern surveying equipment.
2. Use the concepts of advanced data capturing methods.
3. Analyse spatial data using appropriate computational and analytical techniques.
4. To familiarize students about Map Projection Mercator projection, transverse Mercator projection and Photogrammetric and photographic interpretation

Course Outcomes:

1. Acquire knowledge about the modern surveying equipment.
2. Determine the depth of water bodies by sounding.
3. Use modern surveying instruments to obtain geo-spatial data and analyse the same to appropriate engineering problems.
4. Capture geodetic data to process and perform analysis for survey problems with the use of electronic instruments.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
	CO1	**3**	**2**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**

BTCE16F5520	CO2	**3**	**3**	**1**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO3	**2**	**2**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**
	CO4	**2**	**2**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**1**	**2**

Course Contents:

Route Surveying: General requirements and specifications for engineering project, Reconnaissance Transit party, level Party, Topographic party, Location Survey; Office location, Field location Survey for highway, earthen bund and canals Construction Surveying: setting out works, setting out a building, setting out a culvert, setting out a bridge, setting out slope of earthwork, grade and alignment by a laser device, tunnel surveys, surface surveys and tunnel alignment, underground surveys, transferring the surface alignment through a shaft, transferring the levels underground

UNIT-II **[12 HOURS]**

Hydrographic Surveys: Method of hydrographic surveys, Equipment for soundings, shore signal and buoys, sounding equipment, angle measuring instruments, locating the surrounding, observations from shore, observations from sounding boat, observations from both shore and sounding boat, reduction of soundings, plotting of locations of soundings, the capacity of a reservoir or lake, stream gauging.

UNIT-III **[12 HOURS]**

Topographical Surveys: Scale of topographic maps, precision required for topographic maps, methods of representing topography or relief, planning the surveys, establishment of control, horizontal control, vertical control, horizontal and vertical controls by three dimensional traverse, instruments for location of details, location of details, controlling point method, cross profile method, checker board method, trace contour method.

UNIT-IV **[12 HOURS]**

Map Projection: General, scale factor, geometry of the sphere, geometry of the cone, area of plane figures, surface areas of solids, types of map projections, map projections to a plane, conical projection, lambert projection, Photogrammetric and photographic interpretation Limitation, type's scale of vertical photograph, Determination of average scale of a photograph, Errors in computed Quantities

REFERENCE BOOKS

1. B C Punmia, Surveying Vol.2, Laxmi Publications Pvt. Ltd., New Delhi.

2. T P Kanetkar & S P Kulkarni., Surveying, Vol. 1 & 2, Tata McGraw Hill Publishing Co. Ltd, New Delhi. 2009.
3. S K Roy, Fundamentals of Surveying, Prentice Hall of India, New Delhi. 2009
4. S K Duggal, Surveying Vol.1, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5. A M Chandra, Plane Surveying, New age international (P) Ltd.

BTCE16F5530	**Water Resources Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	4

Prerequisites:

Hydrology & Irrigation Engineering

Course Objectives:

1. To apply the knowledge of Hydrology & Irrigation Engineering in understanding the principles of Water resource system & management.
2. To educate the students about importance of water & its conservation and learn about the water management techniques.
3. To learn about flood routing and management.
4. To learn about storm water management.

Course Outcomes:

1. Explain the importance and principles of hydrology and analyse the surface water system.
2. Inference the concept of watershed management and resource management.
3. Summarize the techniques for flood management and mitigation.
4. Engage as lifelong learners and possess knowledge for sustainable engineering solutions in global, economic and environmental issues

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
	CO1	2	1	2	1								2	3	3	2	1

BTCE51	CO2	3	1	1	3								2	3	3	2	1
0	CO3	3	1	1	3								2	3	3	2	1
	CO4	3	1	2	3	2							2	3	3	2	1

Course Contents:

UNIT-I **[12 HOURS]**

Hydrologic Process: Introduction, the worlds fresh water resources, water use in the world, water management sectors, the water management community, the future of water resources, introduction to hydrology, hydrologic cycle, atmosphere and ocean circulation, precipitation: formation and types, rainfall variability, disposal of rainfall on a watershed, design storms.

UNIT-II **[12 HOURS]**

Surface Runoff, Water Withdrawal's And Uses: Drainage basins, hydrologic losses and rainfall excess, rainfall runoff analysis using unit hydrograph approach, SCS rainfall-runoff relation, water use data: classification of uses, water for energy, water for agriculture, irrigation trends and needs, irrigation infrastructures, irrigation system selection and performance, water requirement for irrigation, impact of irrigation, draught management: options severity, economic aspects of water storage.

Analysis of surface water supply: surface water reservoir systems, storage – firm yield analysis for water supply, reservoir simulation.

UNIT-III **[12 HOURS]**

Flood and Storm water control: Introduction, flood plain management, flood plain definition, hydrologic and hydraulic analysis of floods, storm water management. Flood control alternatives: structural and non structural measures. Flood damage and net benefit estimation: damage relationships, expected damages, risk based analysis. Operation of reservoir systems for flood control.

Storm water management, storm system: information needs and design criteria. Rational method of design, hydraulic analysis of design, storm sewer appurtenances, storm detention: effects of urbanization, types of surface detention, sub surface disposal of storm water.

UNIT-IV **[12 HOURS]**

Storm water control, Street and Highway Drainage: Drainage of street and highway pavements: design considerations, flow in gutters, pavement drainage inlets, inlet locations, median, and embankment and bridge culvert design. Hydraulic design of culverts: culvert hydraulics, culvert design.

Hydrologic considerations, dams: types, hazard classification, spillway capacity, criteria, safety of existing dams.

REFERENCE BOOKS:

1. Ralph A Wurbs , Wesley P. James, Water Resources Engineering, PHILearningpvt. Ltd. New Delhi, 2009
2. Chin D.A., Water resources engineering: Prentice Hall, 2009
3. Larry W. Mays, Water resources engineering, John Wiley & sons, 2005
4. David chin, Water resources engineering, Pearson Education, NJ, 2006
5. SathyaNarayana Murthy Challa, Water resources engineering, New Age International Publishers, New Delhi, 2002
6. Water Resources Engineering, lecture notes, IIT Kharagpur.

BTCE16F5540	**Non Destructive Testing**	L	T	P	C
Duration:16weeks		3	1	0	4

Prerequisites:

Concrete technology, Structural Analysis, Design of Reinforced Concrete structures.

Course Objectives:

1. Gain the knowledge in the importance of NDT techniques.
2. Impart knowledge in various NDT methods, partial destructive techniques and other methods
3. Study and know how the actual cases where the NDT techniques are applied on actual structures
4. The Various Case Studies of NDT

Course Outcomes:

1. Narrate the importance of NDT on distressed structures
2. Describe the various methods of NDT and partial destruction techniques.
3. Apply the knowledge of NDT techniques in practical conditions.
4. Explain Various Methods of NDT technics employed in Case Studies

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4

BTCE16F5540	**CO1**	**3**	**3**	**2**	**3**	**1**	**1**	**1**		**1**			**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**		**1**			**2**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**	**3**	**1**	**1**		**1**			**2**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**1**	**1**	**2**	**1**		**1**			**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to NDT of Structures: Importance and need of non-destructive testing, Basic methods for NDT of concrete structures,

Basic manufacturing processes and defects of concrete structures, Types of concrete structures, Composition of concrete, Process of concrete manufacture, Properties of concrete and their control, Discontinuities and defects in concrete structures, General procedure for visual inspection of distressed structures.

Situations where NDT is an option to consider for investigation of in situ concrete, Testing of concrete, Quality control tests, Properties of fresh and hardened concrete, Partial destructive tests, Other tests, Comparison of NDT methods with partial destructive and destructive testing methods.

UNIT-II **[12 HOURS]**

Methods Of NDT: Principle, equipment, procedure, applications and limitations of Half-cell electrical potential method, Rebound hammer method, Ultrasonic testings- Ultrasonic pulse velocity testing, Ultrasonic pulse echo method, Impact echo method, relative amplitude method, Velocity vs Rebound number curves.

UNIT-III **[12 HOURS]**

Partial Destructive Testing Techniques & Other Methods of NDT: Principle, equipment, procedure, applications and limitations of Carbonation depth measurement test, Permeability test, Penetration resistance or Windsor probe test, Core cutting, Resistivity measurement, Electromagnetic methods of testing concrete, Radiographic testing, Infrared themography, Laser methods and Ground penetrating radar.

UNIT-IV **[12 HOURS]**

Case Studies of NDT: Case studies on NDT techniques- Buildings, bridges and flyovers, scour of river bridges around piers, road pavement evaluation and sluices

REFERENCES BOOKS:

1. J Prasad, C G K Nair, Non-destructive testing and evaluation of materials, Tata McGraw Hill education private ltd.
2. Dr B.Vidiveli, Rehabilitation of concrete structures, Standard publishers Distributors
3. B.L Gupta and Amit Gupta, Maintenance and repair of civil structures, Standard publishers Distributors
4. P.S Gahlot and Sanjay Sharma, Building Repair and Maintenance Management, CBS publishers & Distributors Pvt. Ltd.
5. Sidney, M. Johnson, Deterioration, Maintenance and Repair of Structures.
6. Denison Campbell, Allen & Harold Roper, Concrete Structures – Materials, Maintenance and Repair, Longman Scientific and Technical
7. R.T.Allen and S.C. Edwards, Repair of Concrete Structures, Blakie and Sons
8. Belen Riveiro, Mercedes Solla, Non Destructive Techniques for the evaluation of structures and infrastructure, CRC press, 2016.

BTCE16F5600	**Highway Engineering Laboratory**	L	T	P	C
Duration:16Weeks		1	0	1	2

Prerequisites:

Highway Engineering

Course Objectives:

1. To understand the characteristics and behaviour of civil engineering materials used in construction of highway.
2. Students will learn standard principles and procedure to design prepare and/or test materials including field test methods.
3. Students will know how to select materials based on their properties and their proper use for a particular facility under prevailing loads and environmental conditions.
4. Students will have exposure to practical applications including writing of a technical report related to each experiment.

Course Outcomes:

1. Demonstrate ability to make selection of materials based on their properties, behaviour and intended use in design and construction.
2. Write formal technical report & convey Engineering message efficiently.

3. Understand ethical issues associated with Engineering experiments and professional practice.
4. Collaborate lab work in groups and divide responsibilities among group members.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F5600	CO1	1	2	3	-	-	-	2	1	1	-	-	-	3	3	2	3
	CO2	1	2	3	-	-	-	-	1	-	-	-	-	3	3	3	2
	CO3	3	2	3	-	-	-	-	-	-	-	-	-	3	3	3	1
	CO4	3	2	-	2	-	-	1	-	-	-	-	-	3	3	3	2

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Course Contents:

List of experiments

1. Field Density by Sand Replacement Method
2. Aggregate Impact Test, Aggregate Crushing Test
3. Los Angeles Abrasion Test, Aggregate Specific Gravity and Water Absorption Test
4. Aggregate Shape Tests
5. Stripping Value Test
6. Bitumen Specific Gravity Test, Penetration Test
7. Softening point Test, Ductility Test
8. Elastic Recovery Test, Viscosity Test
9. Flash and Fire Point Test
10. Solubility Test
11. Rothfutch's Aggregate Proportioning Method
12. Marshall Method of Mix Design

REFERENCES BOOKS:

1. S K Khanna, C E G Justo and A Veeraragavan, "Highway Engineering", Revised 10th Edition, Nemchand and Bros, Roorkee
2. S K Khanna, C E G Justo and A Veeraragavan, "Highway Material and Pavement Testing Laboratory Manual", Revised 5th Edition, Nemchand and Bros, Roorkee
3. Relevant BIS and IRC Codes

BTCE16F5700	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Geotechnical Engineering

Course Objectives:

1. To gain experience regarding the determination of properties of different types of soils and understand how they behave
2. To provide an opportunity to learn how to measure the shear strength of the soil and its importance
3. To impart knowledge about the foundation engineering.

Course Outcomes:

1. Determine the index properties of the soil
2. Classify the soil and identify the suitability of the soil for different foundations.
3. To implement the properties of soil for the analysis and design of foundations

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F5700	CO1	3	3	1	1	1	2	1	-	1	2	-	2	3	2	2	2
	CO2	3	2	1	2	1	2	1	-	1	2	-	2	3	2	2	2
	CO3	3	2	2	3	1	2	1	-	1	2	-	2	3	2	2	1

Course Contents:

List of Experiments:

1. Water content determination (Oven drying method), Determination of Specific gravity by Pycnometer and density bottle method.
2. Grain size distribution (Sieve analysis Only)
3. Determination of Liquid (Casagrande method) and Plastic limit.
4. Determination of Shrinkage limit of soil.
5. Determination of moisture-density relationship (Standard Proctor's)
6. Determination of Permeability by Constant and Variable head method.

7. Determination of in-situ density by sand replacement and core cutter method.
8. Unconfined compression test for fine grained soils.
9. Triaxial Compression Test.
10. Direct shear test.
11. Determination of CBR value.
12. Only Demonstration - Determination of Relative density – Sand, Vane shear test. Odometer test (Consolidation)

REFERENCE BOOKS:

1. Alamsingh - Geotechnical manual,
2. GopalRanjan and Rao A.S.R, Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi, 2000
3. Shamsherparekh – Geotechnical Manual.
4. Head K.H., Manual of Soil Laboratory Testing, Vol. I, II, III, Princeton Press, London, 1986
5. Relevant BIS codes.

BTCE15F5800	Hydraulic Structures Design And Drawing	L	T	P	C
Duration:16Weeks		2	0	1	3

Prerequisites:

Hydraulic structures

Course Objectives:

1. To Design & drawings of surplus works like surplus weir with stepped apron
2. Design & drawing of some of elements of storage tank outflow controls such as Tank plug sluice without tower head & Tank plug sluice with tower head
3. Design & drawing of canal conveyance structures like canal cross regulator,canal drop & Aqueduct

Course Outcomes:

1. Design & drawing details of surplus works of surplus weir with stepped apron.
2. Design & drawing details of storage tank outflow controls works of tank plug sluice with tower head & Tank plug sluice.
3. Design & drawing details of conveyance structures of canal cross regulator, canal drop & Aqueduct

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE15F5800	CO1	**3**	**3**	**3**	**3**		**2**	**-**	**-**	**-**	**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**		**2**	**-**	**-**	**-**	**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**		**2**	**-**	**-**	**-**	**1**	**3**	**3**	**3**	**3**	**3**	**3**

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Course Contents:

Design and Drawing with all the three views of:

1. Surplus weir with stepped apron
2. Tank plug sluice without tower head
3. Tank sluice with tower head
4. Notch type Canal drop
5. Canal cross Regulator
6. Aqueduct (Hydraulic Design only)

REFERENCES BOOKS:

1. R.K.Sharma, Textbook of Irrigation Engineering and Hydraulic Structures, oxford and IBH Publishing co., New Delhi, 2002

2. G.L.Aswa, Irrigation and water resource engineering- New Age International publishers New Delhi, 2005

3. Modi P. N, Irrigation, water resources and water power engineering Standard book house, New Delhi.

4. C. Sathyanarayana Murthy, Design of minor irrigation and canal structures Wiley eastern limited, New Delhi, 1990

2. Dr. N. Balasubramanya, Hydraulic structures & Irrigation Design Drawing, Tata Mcgraw-Hill Education Pvt. Ltd., New Delhi

Semester VI

BTCE16F6100	Steel Structures	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of RCC structures, Basic Structural Analysis

Course Objectives:

1. Learn the concepts and principles of limit state design of steel structures, plastic analysis , provisions of I.S.Codes 800, 875 , to analyse statically indeterminate beams by plastic methods
2. Analyse and design bolted and welded connections
3. Analyse and design tension and compression members
4. Design column bases and laterally supported and unsupported beams

Course Outcomes:

1. Understand the concepts and principles of limit state design of steel structures, plastic analysis ,provisions of I.S.Codes 800, 875,to analyse statically indeterminate beams by plastic methods
2. Analyse and design bolted and welded connections
3. Analyse and design tension and compression members
4. Design column bases column bases and laterally supported and unsupported beams.

Mapping of Course Outcomes with programme Outcomes

Course Contents:

Code	COs	1	2	3	4	5	6	7	8	9	10	11	12	O 1	O2	O3	O4
BTCE16 F6100	CO1	3	3											3	3		
	CO2	3	3	3	1	2			2		2		1	3	3	3	1
	CO3	3	3	3	2	3	1	1	1		2		1	3	3	3	2
	CO4	3	3	3	2	3	1	1	1		2		1	3	3	3	2

UNIT-I **[12 HOURS]**

Type of steel Structures - Properties of Indian standard rolled steel sections- limit state method of design – partial safety factor- general codal requirements

Bolted connections - modes of failure of joints - permissible stresses for various types of bolts and welds –lap and butt joints -Design strength of ordinary Black Bolts and High Strength Friction Grip bolts (HSFG)

Welded Connection-Design of welds, Simple joints, Moment resistant connections,pin connections – truss joint – angle seat connections – stiffened and unstiffened seat connection - moment resistant connections –beam to beam connections- beam and column splices

UNIT-II **[12 HOURS]**

Tension Members: Bolted Connections: Tension member - Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension and other sections, Design of simple and built up members subjected to tension- tension splices

UNIT-III **[12 HOURS]**

Compression Members: Compression member - Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, - design of simple and built up compression members with lacing and battens

Design of slab base and gusseted base.

UNIT-IV **[12 HOURS]**

Design of Beams: Introduction, Beam types, Lateral stability of beams,factors affecting lateral stability, Behaviour of simple and built-up beams in bending(without vertical stiffeners), Design strength of laterally supported beams in Bending, Design strength of laterally unsupported beams, Shear strength of steel beams, Maximum deflection, Design of beams and purlins

REFERENCE BOOKS

1. N Subramanian, Design of Steel Structures, , Oxford,2008

2. Ramchandra .S, VirendraGhelot, Design of Steel of Structures, Volume 1, Scientific Publishers, 2009, New Delhi

3. Duggal .S.K, Limit State Design of Steel Structures, 1st Edition, Tata McGraw Hill Publishing Company, New Delhi, 2010.

4. Bureau of Indian Standards, IS800-2007, IS 875-1987

5. Steel Tables

6. Ramamrutham .S. & Narayanan .R, Design of Steel Structures, Dhanpat Rai & Sons, Delhi 1997. 7. Vazirani .V.N and Ratwani .M.M, Steel Structures, Khanna Publications New Delhi, 1992.

BTCE16F6200		**L**	**T**	**P**	**C**

Duration: 16weeks	Prestressed and Prefabricated Structures	2	1	0	3

Prerequisites:

Design of RCC structures

Course Objectives:

1. To understand the working principles of Prestressing.
2. To understand the different losses and deflections in Pre-stressing members.
3. To understand the failure pattern, designs of PSC beam.
4. Able to identify the requirements and applications of materials used in prefabricated structures.

Course Outcomes:

1. Familiar with the concepts, principles and methods of prestressing and able to compute the losses that occur in Prestressed concrete members.
2. To analyse the stresses in prestressed concrete beams at transfer and working condition and to compute the short-term and long-term deflections of Prestressed concrete beams.
3. To compute the ultimate flexural strength and shear strength of PSC beam sections and Design of PSC beams with the provisions of **IS: 1343-2012.**
4. Identify the suitable Pre-fabricated Elements required for Design

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6200	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO3	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Principles of Prestressing Introduction• History of Prestressed Concrete• Classification and Types of Prestressed Concrete Structures• Prestressed Concrete Analysis• Prestressed Concrete Design• Prestressed Concrete versus Reinforced Concrete• Chapter 2. Constituent Materials and Code Provisions Reinforcing Steel• Prestressing Steel• Concrete•

UNIT-II [12 HOURS]

Prestress Losses Total Losses in Pretensioned Members• Total Losses in Post-Tensioned Members, Methods for Estimating Prestress Losses• Elastic Shortening• Relaxation• Shrinkage• Creep, Friction, Anchorage Set

UNIT-III [12 HOURS]

Flexure: Ultimate Strength Analysis and Design Load-Deflection Response• Flexural Types of Failure, Analysis of the Section at Ultimate, Concept of Reinforcement Index• Limiting Values of the Reinforcement Index, Satisfying Ultimate Strength Requirements• Design for Ultimate Strength• Indeterminate Structures and Composite Elements - Ultimate Strength•

UNIT-IV [12 HOURS]

General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Code specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control, Lateral load resistance, Location and types of shear walls.

Prefabricated structures - Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, -Connections – Beam to column and column to column.

REFERENCE BOOKS

1. Krishnaraju N, Prestressed concrete, Tata McGraw-Hill Private Limited, New Delhi
2. T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc.
3. N.C.Sinha, S.K.Roy, Fundamentals of Prestressed Concrete, John Wiley and Sons, Inc.
4. Leonhardt F., Wilhelm Ernst and Shon, Berlin, Prestressed Concrete-Design and Construction, CBS Publishers, New Delhi.
5. Freyssinet, Prestressed Concrete, Tata McGraw-Hill Private Limited, New Delhi.
6. Evans, R.H. and Bennett, E.W., Chapman and Hall, Prestressed Concrete, Champman and Hall, London.
7. Rajgopalan, Prestressed Concrete, Asia Publishing House, Bombay.
8. IS: 1343-Code for Practice for Prestressed Concrete, BIS India.
9. IS: 3370-3 (1967): Code of Practice Concrete structures for the storage of liquids, Part 3: Prestressed concrete structures, BIS India.

BTCE16F6310	Design of Tall Structures	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of steel structures and RCC structures

Course Objectives:

1. The objective of this course is to make students to learn principles of stability of tall buildings,.
2. To design the tall buildings for earthquake and wind resistance. To understand to find factor of safety of Earth slope.
3. To evaluate the performance of tall structures for strength and stability

Course Outcomes:

1. Gain the design philosophy for high rise structures
2. Predominance of wind load behaviour
3. Behaviour of various structural systems
4. Stability of tall buildings

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6310	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO3	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Design Criteria: Design philosophy, loading, sequential loading, and materials – high performance concrete, fiber reinforced concrete, lightweight concrete, design mixes. Loading and Movement: Gravity loading: Dead and live load, methods of live load reduction, Impact, Gravity loading; Construction loads

UNIT-II **[12 HOURS]**

Wind loading: Static and dynamic approach, Analytical and wind tunnel experimentation method. Earthquake loading: Equivalent lateral force, modal analysis, combinations of loading, working stress design, Limit state design, Plastic design.

UNIT-III **[12 HOURS]**

Behaviors of Various Structural Systems: Factors affecting growth, Height and structural form; High rise behavior, Rigid frames, braced frames, in-filled frames, shear walls, coupled shear walls, wall-frames, tubular, cores, Futigger – braced and hybrid mega system.

UNIT-IV **[12 HOURS]**

Analysis : Modeling for approximate analysis, accurate analysis and reduction techniques, analysis of building as total structural system considering overall integrity and major subsystem interaction, analysis for member forces, Stability of Tall Buildings: Overall buckling analysis of frames, wall frames, approximate methods, second order effects of gravity of loading, P-Delta analysis, simultaneous first order and P-Delta analysis, Transnational, Torsional instability

REFERENCE BOOKS:

1. Taranath B.S, Structural Analysis and Design of Tall Buildings, McGraw Hill
2. Wilf gang Schuller, High rise building structures- John Wile
3. Bryan Stafford Smith & Alexcoull, Tall building structures Analysis and Design- John Wiley
4. T.Y Lin & D. Stotes Burry, Structural concepts and system for Architects and Engineers- John Wiley
5. Lynn S. Beedle, Advances in Tall Buildings- CBS Publishers and Distributors.
6. Dr. Y.P. Gupta – Editor, Proceedings National Seminar on High Rise Structures- Design and Construction practices for middle level cities- New Age International Limited
7. Craig R.F. Soil Mechanics, Van Nostrand Reinhold Co. Ltd. 1987
8. Braja M. Das, Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India. 2002

BTCE16F6320	**Advanced Geotechnical Engineering**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials and Basic Geotechnical Engineering.

Course Objectives:

1. To understand the different methods of soil exploration methods and dewatering techniques.
2. To understand earth pressures on foundations and retaining structures.
3. To understand to find factor of safety of Earth slope.
4. To understand the different types foundation and their bearing capacity and settlement.

Course Outcomes:

1. Understand soil exploration methods and dewatering techniques.
2. Determine the soil earth pressures on foundations and retaining structures.
3. Calculate factor of safety of Earth slope.
4. Analyse (bearing capacity and settlement) shallow and deep foundations.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6320	CO1	3	3	1	3	2	2	1	-	-	2	-		3	3	3	2
	CO2	3	2	1	3	-	2	1	-	-	2	-		3	3	3	2
	CO3	3	2	3	3	-	2	1	-	-	2	-		3	3	3	1
	CO4	3	2	3	3	-	2	1	-	-	2	-		3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Subsurface Exploration and Proportioning Of Shallow Foundations

Subsurface Exploration: Importance of exploration program, Methods of exploration: Boring, Seismic refraction method of geophysical exploration, Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearance, Typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report.

Proportioning of Shallow Foundations: Allowable Bearing Pressure, Factors influencing the selection of depth of foundation, Factors influencing Allowable Bearing Pressure, Factors influencing the choice of foundation, Proportioning isolated, combined, strip and mat foundations.

UNIT-II **[12 HOURS]**

Stresses in Soils and Lateral Earth Pressure

Stresses in Soils: Boussinesq's and Westergaard's theories for concentrated, circular and rectangular loads. Comparison of Boussinesq's and westergaard's analysis. Pressure distribution diagrams, Contact pressure, Newmark's chart.

Lateral Earth Pressure: Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories - assumptions and limitations,

Graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, Earth pressure distribution.

UNIT-III **[12 HOURS]**

Stability of Earth Slopes And Foundation Settlement:

Stability of Earth Slopes: Types of slopes, causes and type of failure of slopes. Definition of factor of safety, Stability of infinite slopes, Stability of finite slopes by Method of slices and Friction Circle method, Taylor's stability number.

Foundation Settlement Importance and Concept of Settlement Analysis, Immediate, Consolidation and Secondary settlements (no derivations, but, computation using relevant formula for Normally Consolidated soils), Tolerance. BIS specifications for total and differential settlements of footings and rafts.

UNIT-IV **[12 HOURS]**

Analysis and Design Of Deep Foundations: Classification of pile foundation, Pile load capacity, Proportioning pile foundation, static method for driven piles in sand and clay, negative skin friction, Dynamic formulae, pile load test(Only static), Batter piles, drilled Pier, caissons, well foundation.

REFERENCE BOOKS:

1. Alam Singh and Chowdhary G.R, Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd., New Delhi. 1994

2. Punmia B.C, Soil Mechanics and Foundation Engg., 16th Edition Laxmi Publications Co., New Delhi. 2005

3. Bowles .J.E, Foundation analysis and design, McGraw Hill, 2001.

4. Murthy .V.N.S, Textbook of Soil Mechanics and Foundation Engineering, CBS Publishers and Distributors, New Delhi, 2009.

5. Basic and Applied Soil Mechanics- Gopal Ranjan and Rao A.S.R., New Age International (P) Ltd., New Delhi. 2000

6. Geotechnical Engineering- Venkatrahmaiah C., 3rd Edition New Age International (P) Ltd., New Delhi. 2006
7. Craig R.F. Soil Mechanics, Van Nostrand Reinhold Co. Ltd. 1987
8. Braja M. Das, Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India. 2002
9. Iqbal H. Khan, Text Book of Geotechnical Engineering, 2nd Edition, PHI, India, 2005

BTCE16F6330	**Pavement Materials and Analysis**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

None

Course Objectives:

1. Explain the origin, properties, constituents of different bituminous materials and specifications
2. Provide the overview about bitumen, tar, emulsion and cutbacks and proportioning of materials
3. Provide the knowledge about the bituminous mixes and soil stabilization
4. Provide an overview of stresses in flexible pavements and cement concrete pavements

Course Outcomes:

1. Describe the properties of soil, aggregates, bitumen, tar and portland cement and its tests
2. Analyses the properties of bituminous emulsion and cutback and soil stabilization method
3. Analyse the properties of bitumen mixes
4. Evaluate the stresses in flexible pavements and stresses in rigid pavements

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6330	CO1	**3**	**3**				**2**	**3**	**3**	**3**	**3**		**1**	**3**	**3**	**2**	**3**
	CO2	**3**	**3**	**3**	**2**	**1**	**2**	**2**	**3**	**2**	**2**			**3**	**2**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**		**2**	**3**	**3**	**3**	**3**	**1**	**2**	**3**	**3**	**2**	**2**
	CO4	**3**			**3**	**3**	**3**	**3**	**2**	**2**	**3**		**2**	**3**	**3**		**1**

Course Contents:

UNIT-I **[12 HOURS]**

Basic road construction materials: Soil, Bitumen, Tar. – Origin, classification, functions, specifications for use in various components of road.Aggregates: Tests and specifications on road aggregates for flexible and rigid pavements. Aggregate gradation and Shape factor in mix design.

UNIT-II **[12 HOURS]**

Bitumen and Tar: Preparation, properties and constitution of bituminous road binders; requirements. Bituminous Emulsions and Cutbacks: Preparation, characteristics, uses and tests. Adhesion of Bituminous Binders to Road Aggregates: Adhesion failure, mechanism of stripping, tests and methods of improving adhesion. Numerical examples.

UNIT-III **[12 HOURS]**

Bituminous Mixes: Mechanical properties, dense and open textured mixes, flexibility and brittleness, bituminous mix, design methods using Rothfutch's Method and specification using different criteria- voids in mineral aggregates, voids in total mix, density, flow, stability, percentage voids filled with bitumen. Numerical examples.

UNIT-IV **[12 HOURS]**

Stresses in Flexible Pavements: Stresses and deflections in homogenous masses Boussinesq's theory Burmister's theory stresses. Stresses in Rigid Pavements Factors affecting design and performance of rigid pavements, Types of stresses and causes, factors influencing the stresses.EWL, loading positions. Numerical examples.

REFERENCE BOOKS

1. S K Khanna, C E G Justo and A Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand and Bros, Roorkee
2. S K Khanna, C E G Justo and A Veeraragavan, Highway Material and Pavement Testing Laboratory Manual, Revised 5th Edition, Nemchand and Bros, Roorkee
3. MoRTH Specifications for Roads and Bridges Works- Indian Roads Congress
4. HMSO Publication - Soil Mechanics for Road Engineers
5. Relevant BIS and IRC Codes

BTCE16F6340	**Applications of GPS**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

None

Course Objectives:

1. To educate students to integrate knowledge of mathematics, science, and engineering in Global Positioning and identify GPS equipment
2. To make students familiar with the GPS signal structure and the methods of collecting and analyzing GPS data.
3. To give students an overview about comparing the results of GPS derived positions with classical survey data.
4. To familiarize students about the different GPS errors and levels of accuracy and limitations of GPS surveying in comparison with traditional surveying methods

Course Outcomes:

1. Explain the fundamental concepts of Geodesy
2. Describe Global Positioning System related field procedures
3. Analyze GPS data and appreciate the advantages of GPS applications related to mapping
4. Understand the different errors that are developed during the GPS operation and their accuracy

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6340	CO1	3	1	1	2	3			-	2	-	-	3	3	3	3	3
	CO2	3	3	2	3	2		-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	-	-	-	-	1	-	-	3	3	3	3	3
	CO4	3	3	1	2	3	2	3	-	2	-	-	3	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

Introduction to Geodesy: Definitions and Fundamentals of Geodesy, Earth, Geoids And Ellipsoid of Rotation, Reference Surface, Geodetic Systems, and Indian Geodetic System Introduction to GPS: Transit, Imation, Navistar Gps, Gps Design Objectives and Details of Segments Space, Control and user, Blocks of Gps Advantages and Current Limitations of Gps, Status of Gps Surveying and Applications, Factors affecting GPS, GPS applications.

UNIT-II [12 HOURS]

GPS Signal Structure: Carriers, GPS codes, navigational message, GPS receiver: Types and Structure of receivers, Principles of GPS position fixing: Pseudo ranging.

GPS Orbits: Determination of GPS satellite coordinates, Types of ephemerides, GPS data formats: RINEX, SP3, Components of GPS-Space, control and user segments. Relative and differential positioning.

UNIT-III **[12 HOURS]**

GPS Errors and Accuracy: Satellite dependent: Ephemeris errors and orbit perturbations, Forces on GPS satellites, Effects of orbital bias, Types of satellite ephemerides, Satellite clock bias, Selective availability. Observation medium dependent: Ionosphere errors, Troposphere errors. Station dependent: Multipath. Satellite geometry based measures: Geometry dependent, User Equivalent Range Error UERE.

UNIT-IV **[12 HOURS]**

GPS Survey Methods: Single Point or Point Vs Relative, Static Vs Kinematic, Real time Vs Post mission. Practical GPS survey field procedures: Code- and Carrier-based positioning, Accuracy and recording time. Preparation of GPS surveys: GPS Modernization Plans: Future developments in GPS, Introduction to GLONASS and GALILEO systems. GPS Applications: Geodetic control surveys, Cadastral surveys

REFERENCE BOOKS

1. Agrawal, N. K, Essentials of GPS, Publisher: Spatial Networks, 2006.
2. R. Wolf, and C. D. Ghilani, Adjustment Computations: Statistics and Least Squares in Surveying and GIS, Publisher: John Wiley & Sons, New York (USA), 1997.
3. J. V. Sickle, GPS for Land Surveyors Publisher: Ann Arbor Press, Michigan(USA), 2001.
4. B. Hofmann-Wellenhof, H. Lichtenegger and J. Collins, Global Positioning System: Theory and Practice, Publisher: Springer, Berlin (Germany), pages 355. 1994.
5. Gunter Seeber, Satellite Geodesy, Publisher: Walter de Gruyter, Berlin (Germany), pages 612. 2003.
6. A. Leick, GPS Satellite Survey (2nd ed.), Publisher: John Wiley & Sons, New York (USA), pages 429. 2004.
7. Xu Guochang, GPS: Theory, Algorithms and Applications, Publisher: Springer, Berlin (Germany). 2007.

BTCE16F6410	Matrix Methods of Structural Analysis	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Structural analysis

Course Objectives:

1. Elucidate the concepts and principles of structural analysis
2. Develop element stiffness and flexibility matrices.
3. Elaborate the structures by flexibility and stiffness methods using force/displacement transformation matrices
4. Explain different methods for the solution of simultaneous equations

Course Outcomes:

1. Explain static and kinematic indeterminacy
2. Derive element stiffness and flexibility matrices
3. Analyze framed structures by flexibility and stiffness methods using force/displacement transformation matrices
4. Employ Gauss elimination, Gauss Seidel Method, Jacobi Method and Cholesky method for the solution of simultaneous equations

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F6410	CO1	**3**	**3**	**1**		**2**	**2**	**1**					**2**	**3**	**3**		**2**
	CO2	**3**	**3**	**1**										**3**	**3**		
	CO3	**3**	**3**	**1**		**3**	**2**						**2**	**3**	**3**		**3**
	CO4	**3**	**3**	**1**		**3**	**2**						**2**	**3**	**3**		**3**

Course Contents:

UNIT-I **[12 HOURS]**

Basic Concepts Of Stiffness And Flexibility: Static and Kinematic indeterminacy, Energy concepts, Principles of minimum potential energy and minimum complementary energy, Equilibrium, Compatibility and Force-displacement relations, Concepts of stiffness and flexibility, Reciprocal relationships between stiffness and flexibility, Development of element flexibility and element stiffness matrices for truss, beam, rigid frame elements.

UNIT-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

Solution techniques: Solution techniques including numerical problems for simultaneous equations, Gauss elimination, Gauss Seidel Method, Jacobi Method and Cholesky method, Bandwidth consideration.

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.

BTCE16F6420	**Ground Improvement Techniques**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials, Fluid Mechanics and Geotechnical Engineering

Course Objectives:

1. To create an ability to apply to analyse and interpret data related to improvement in strength and compressibility characteristics of weak soils;

2. To accentuate the understanding of the basic principles involved in various techniques of ground improvement.
3. To accentuate the understanding of the Stabilization concept of ground improvement.
4. To create an ability to apply the grouting process in different locations.

Course Outcomes:

1. At the end of this course the student is expected to learn various techniques of insitu ground modification.
2. At the end of this course the student is expected to learn various techniques of insitu ground compaction and variation of soil properties in ground.
3. At the end of this course the student is expected to learn various stabilization process and about chemical stabilization.
4. At the end of this course the student is expected to learn various methods of soil reinforcement and about grouting method.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6420	**CO1**	**2**				**2**		**3**				**2**		**3**	**2**	**1**	**2**
	CO2	**2**	**2**	**1**		**2**		**2**						**3**	**2**	**1**	**2**
	CO3	**2**				**3**		**2**						**3**	**3**	**3**	**1**
	CO4	**2**				**3**		**1**						**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Role of ground improvement in foundation engineering - methods of ground improvement – Geotechnical problems in alluvial, laterite and black cotton soils -Selection of suitable ground improvement techniques based on soil condition.

UNIT-II **[12 HOURS]**

Drainage and Dewatering

Definition, aim, principle, techniques. Gravity drain, lowering of water table, multistage well point, vacuum dewatering. Requirement of filter, Filter material design criteria.

Modification By Admixtures:

Cement stabilization and cement columns, Lime stabilization and lime columns. Stabilization using bitumen and emulsions, Stabilization using industrial wastes Construction techniques and applications

UNIT-III **[12 HOURS]**

In situ Treatment of Cohesion less and Cohesive Soils

In situ densification of cohesion less and consolidation of cohesive soils -Dynamic compaction and consolidation – Vibrofloation - Sand pile compaction - Preloading with sand drains and fabric drains – Stone columns – Lime piles - Installation techniques only - relative merits of various methods and their limitations.

UNIT-IV **[12 HOURS]**

Earth Reinforcement and Grout Techniques

Concept of reinforcement - Types of reinforcement material - Applications of reinforced earth – use of Geotextiles for filtration, drainage and separation in road and other works.

Types of grouts - Grouting equipment and machinery - Injection methods - Grout monitoring – Stabilization with cement, lime and chemicals - Stabilization of expansive soils.

REFERENCE BOOKS:

1. Purushothama Raj P, Ground Improvement Techniques, Laxmi Publications, New Delhi.1999
2. Koerner R.M, Construction and Geotechnical Method in Foundation Engineering, McGraw Hill Pub. Co., New York. 1985
3. Manfred Hausmann, Engineering principles of ground modification- McGraw Hill Pub. Co., New York. 1990
4. Bell, F.G. Methods of treatment of unstable ground, Butterworths, London. 1975
5. Nelson J.D. and Miller D.J. Expansive soils, John Wiley and Sons. 1992
6. Ingles. C.G. and Metcalf J.B, Soil Stabilization; Principles and Practice, Butterworths, London. 1972

BTCE16F6430	**Traffic Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Highway Engineering

Course Objectives:

1. Provide an insight on various elements of traffic engineering
2. To explain the various traffic studies

3. Illustrate the application and functions traffic control devices
4. Various grade separated intersections

Course Outcomes:

1. Describe various elements of traffic engineering
2. Explain the various traffic studies
3. Illustrate the application and functions traffic control devices
4. Classify the different grade separated intersections

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6430	CO1	3					3		2		2		2	3			1
	CO2	3	3			2		2	2	3	3	1		3	3		1
	CO3	3	3		2	2	3	1		3	1	2		3	3	1	2
	CO4	3	3		2	2	1	2	3		3		2	3			2

Course Contents:

UNIT-I [12 HOURS]

Scope of traffic engineering & study of its elements – Introduction, objectives and scope of traffic engineering, components of road traffic, road user characteristics –physical and psychological, vehicle characteristics- static and dynamic. Traffic stream characteristics- relationship between speed, flow and density – Numerical examples.

UNIT-II [12 HOURS]

Traffic Engineering Studies and Analysis: methods of traffic study, equipment, data collection, analysis and interpretation of - Speed studies, Travel time and Delay studies, Volume studies, Origin – destination studies, Parking studies and Accident Studies. Capacity studies- Introduction, highway capacity, level of service, basic freeway capacity studies. Sampling in traffic studies – Numerical examples.

UNIT-III **[12 HOURS]**

Design and Management of traffic control measures – need, control of traffic movements through time sharing and space sharing concepts,Design of channelizing islands, T, Y, skewed, staggered, roundabout and other at grade intersections, provision for safe crossing of pedestrians and cyclists – grade separated intersection.

UNIT-IV **[12 HOURS]**

Traffic control devices – traffic signs, markings and islands. Different methods of signal design, signal system and co-ordination. Traffic Regulation- Road lighting, Regulations on vehicles, drivers, and traffic. Traffic engineering impacts on environment – air and noise pollution, impacts on land development, technological approaches to improving environment.

REFERENCE BOOKS:

1. Kadiyali. L. R., Traffic Engineering and Transport planning, Khanna publishers, New Delhi.
2. S K Khanna, C E G Justo and A Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand and Bros, Roorkee
3. Papacostas, C.A., Fundamentals of Transportation Engineering, PrenticeHall of India Private Limited, New Delhi.
4. William R. Mc Shane and Roger P. Roess, Traffic Engineering, Prentice Hall, New Jersey, 2000.
5. Matson, Smith and Hurd, Traffic Engineering, McGraw Hill and Co, New York.
6. Relevant IRC Codes

BTCE16F6440	**Open Channel Hydraulics**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Hydraulic & Hydraulic Machines.

Course Objectives:

1. Understand the different types of Flows.
2. Understand the Critical flow depth measurements.
3. Understand the different Flow Profiles.
4. Understand the concept of Hydraulic Jumps.

Course Outcomes:

1. Design of Open channels for uniform flow, critical flow, and gradually varied flow.
2. Analyse and solve practical problems on Critical Flow.
3. Analyse the problems on flow profiles,
4. Explain about concept of rapidly varied flow, of hydraulic jump and its applications as energy dissipater.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F6440	CO1	3	3	3	1								3	3	3	3	3
	CO2	3	2	3	2								3	3	3	3	3
	CO3	3	2	3	2								3	3	3	3	3
	CO4	3	2	3	2			1					3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Difference between pipe flow and open channel flow, classification of flow, energy equation, momentum equation, kinetic energy and momentum factors.

Uniform Flow: Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow.

UNIT-II **[12 HOURS]**

Critical Flow: Concept of specific Energy – Classification of flow. Design of channel, Section Factor, Hydraulic exponent for critical flow critical depth as a flow measurement.

Gradually Varied Flow: Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation, Characteristics of flow profile and classification.

UNIT-III **[12 HOURS]**

Analysis of flows profiles, Method of singular point and transitional depth, Methods of computation, Practical problems.

Gradually Varied Flow Computations: Different methods, direct integration method, Bress's Solution, Chow's solution, direct method, standard step method.

UNIT-IV **[12 HOURS]**

Rapidly Varied Flow: Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump – length location height, application of hydraulic jump stilling basins, shape type-2 and type-4.

Hydraulic jump in rectangular channels, Sloping channels, Jump in non rectangular channels, application of hydraulic jump as energy dissipater.

REFERENCE BOOKS:

1. Subramanya, Open Channel Hydraulics, Tata McGraw Hill Publishing Co Ltd, New Delhi
2. Madan Mohan Das, Open Channel Flow –Prentice Hall of India Pvt. Ltd., and New Delhi 2008
3. Rajesh Srivastava, Flow through Open Channels –Oxford Press, New Delhi 2008.
4. French, Open Channel Hydraulics, McGraw Hill Book Company, New Delhi.
5. Modi and Seth, Fluid Mechanics, Standard Book Home, New Delhi.
6. Henderson, Open Channel Hydraulics, Mr.Millan Publishing Co. Ltd., New York.
7. VenTeChow, Open Channel Hydraulic: McGraw Hill Book Company, New Delhi.

BTCE16F6510	Theory of Elasticity	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Strength of materials

Course Objectives:

1. The objective of this course is to make students to learn principles of Analysis of Stress and Strain
2. To predict the stress-strain behaviour of continuum.
3. To evaluate the stress and strain parameters and their inter relations of the continuum

Course Outcomes:

1. Understand the state of stress and strain at a point, critical at a point in any structural elements
2. Airy's stress function and problems on polynomials
3. Plastic analysis of structures

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F6510	CO1	3	3	1	1	1	2	1		1	2		3	3	3	3	2
	CO2	3	3	1	2		2	1		1	2		3	3	3	3	2
	CO3	3	3	2	2	2	2	1		1	2		3	3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to vectors, Definition continuum, difference between theory of elasticity and strength of materials, stress and strain at a point, stress tensor, Equilibrium equations, stress on an oblique plane, stress transformation, principal stresses and their planes as Eigen value problems, maximum shear stress, hydrostatic and deviatoric stress, octahedral stresses, Mohr's circle of stress.

UNIT-II **[12 HOURS]**

Strain at a point, strain- displacement relations, strain of linear element, strain quadric, strain tensor, strain transformation, principal strains, maximum shear strain, volumetric strain, spherical and deviatoric strain, Mohr's circle of strain.

UNIT-III **[12 HOURS]**

Classification of problems of solid mechanics into plane stress, plane strain, axi-symmetric problems with illustrations. Equations of equilibrium for plane stress and plane strain boundary conditions. Strain components in plane stress and plane strain conditions, Boundary conditions.

Generalized Hooke's laws (orthotropy, anisotropy, and isotropy), constitutive models for plane stress, plane strain and axi-symmetric problems. Lame's equation, Navier equation, Airy's stress function, Biharmonic equations, Polynomial solutions.

UNIT-IV **[12 HOURS]**

Failure theories: Rankine's theory, Tresca's theory, maximum elastic strain theory, octahedral shearing stress theory, maximum elastic energy theory and Mohr's failure theory.

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. Xi Lu, Theory of Elasticity, John Wiley.

BTCE16F6520	**Hydraulic Machinery**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Fluid Mechanics

Course Objectives:

1. Impulse momentum equation and its applications related to Impact of jet on vanes-Flat and Curved – Stationary and moving, Concept of velocity triangles, Work done and efficiency related problems.
2. Introduction to turbines, Classifications, theory, equation for work done and efficiency, design parameters related Pelton, Francis and Kaplan.
3. To learn about performance evaluation of turbines, water hammer in pipes and its estimation.
4. Centrifugal pump, definition, description and general principal of working and related problems.

Course Outcomes:

1. Impulse momentum equation and its applications and learn how to find the magnitude and direction of force excreted by a jet of water on fixed and moving vane and also on a series of flat and curved vanes
2. Determination of work done and efficiency of various types of turbines.
3. How to evaluate the performance of various types of turbines (Impulse and Reaction turbines).
4. Designing and performance evaluation of Centrifugal pumps.

Mapping of Course Outcomes with programme Outcomes

Course Contents:

Code	COs																
BTCE16F6520	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3

UNIT-I **[12 HOURS]**

Dimensional analysis.

Introduction,Systems of units, Dimensions of quantities, DimensionalHomogeneity of an equation. Analysis –Raleigh's method, Buckingham'sπ theorem- problems.

Model studies, similitude, non dimensional numbers: Froude models- undistorted and distorted models, Reynolds models

Impact of Jet on Vanes: Introduction, Impulse- Momentum equation. Direct impact of a jet on a stationary flat plate, Oblique impact of a jet on a stationary flat plate, direct impact on a moving plate, directπimpact of a jet on a series of flat vanes on a wheel. Conditions for maximum hydraulic efficiency. Impact of a jet on a hinged flat plate- problem. Force exerted by a jet on a fixed curved vane, moving curved vane. Introduction to concept of velocity triangles, Impact of jet on a series of curved vanes-numerical examples.

UNIT-II **[12 HOURS]**

Turbines: Introduction to Turbines, Classification of Turbines. Pelton wheel- components, working and velocity triangles. Maximum power, efficiency, working proportions- problems.

Kaplan Turbine-Theory, equation for the work done and efficiency, design parameters, problems. Components, Working and Velocity triangles, Properties of the Turbine, Discharge of the Turbines, Number of Blades-numerical examples.

UNIT-III **[12 HOURS]**

Performance of Turbines: Draft tubes types, equation for efficiency, problems.Cavitations in turbines, governing of turbines. Specific speed of a turbine, Equation for the specific speed and problems. Unit quantities of a turbine, definitions, equations and problems. Characteristics curves of turbines, general layout of hydroelectric plants.Water hammer in pipes, equation for pressure rise due to gradual valve closure & sudden closure for rigid and elastic pipes numerical examples.

UNIT-IV **[12 HOURS]**

Centrifugal Pumps: Introduction, Classification, Priming, methods of priming. Heads and Efficiencies. Equation for work done, minimum starting speed, velocity triangles. Multistage Centrifugal Pumps (Pumps in Series and Pumps in parallel). Characteristic Curves for a Single stage Centrifugal Pumps-numerical examples.

REFERENCE BOOKS:

1. R.K.Rajput, A Textbook of Fluid mechanics & Hydraulic Machines, S.Chand & Co, New Delhi, 2006.
2. R.K.Bansal, Text Book Of Fluid Mechanics & Hydralic Machines, Laxmi Publications, New Delhi, 2008
3. Fluid Mechanics and Turbomachines'- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009
4. Robert w. Fox: Philip j. Pritchard: Alan t. McDonald, Introduction to Fluid Mechanics, Wiley India, New Delhi, 2009

5. Edward j.Shaughnessy, jr; Ira m. Katz: James p Schaffer, Introduction to Fluid Mechanics –Oxford University Press, New Delhi, 2005.
6. Dr. P.N. Modi & Dr S.M. Seth, Hydraulics and Fluid Mrchanics, Standard Book House- New Delhi. 2009

BTCE16F6530	**Occupational Safety and Health Hazards**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Course Outcomes:

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
4. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
Course Contents:																	3
6F6530	CO2	3	3	2	2	3	-	3	-	-	-	-	3	3	3	3	3
	CO3	2	3	2	2	3	-	3	-	-	-	-	3	3	3	3	3
	CO4	2	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3

UNIT-I **[12 HOURS]**

Introduction: History and Development, Parameters of Safety- Factors affecting the conditions of Occupational and Industrial safety, Safety regulations, Occupational Safety and Health Act, right to know laws, OHSHAS 18001 Health & Safety Standards, Occupational safety and health administration

UNIT-II **[12 HOURS]**

Ergonomics: Principles of Ergonomics: Role of Ergonomics in designing work place. Effects of Work Environment – Light, Ventilation, Vibration, Noise, Work physiology and its relevance to Safety, Performance evaluation of Systems involving man and environment, Task analysis, preventing ergonomics hazards, Ergonomics program.

UNIT-III **[12 HOURS]**

Occupational Health Hazards and Control: Occupational Health and Hazards – Physical – Chemical and Biological Hazards, Occupational Diseases – Prevention and Control, Health Protection Measures for Workers - Health Education – Medical first aid, Management of Medical Emergencies, Hazard analysis, Human error and fault tree analysis, Hazard and their control in different manufacturing and processing industries.

UNIT-IV **[12 HOURS]**

Industrial Safety and Safety Management: Industrial Safety Standards, Accidents – Definition - Frequency rate - Prevention and Control, Work study – Work measurement - Measurement of skills. Safety Cost and Expenses. Types of fires, fire development and its severity, effects, extinguishing fire, electrical safety, product safety. Health and safety consideration, personal safety equipments. Concepts of Safety Management Systems, Principles of functions and Safety Management, International Safety Certification, OSHA Compliance.

REFERENCE BOOKS

1. Scott, R.M., Basic Concepts of Industrial Hygiene, Lewis Publishers, New York, 1997.
2. Peterson, R.D., and Cohen, J.M, The Complete Guide to OSHA Compliance, Lewis Publishers, New York, 1997.
3. Diberardinis, L.J., Handbook of Occupational Safety and Health, John Wiley, New York, 1998.
4. David L. Goetsch. Occupational Safety and Health for Technologists, Engineers and Managers 3rd edition. Prentice hall,1999
5. David. A. Calling - Industrial Safety Management and Technology, Prentice Hall, New Delhi.
6. Della D. E. and Giustina, Safety and Environmental Management. Van Nostrand Reinhold International Thomson Publishing Inc, 1996.
7. Trevethick R. A. Environmental and Industrial Health Hazards, William Heinemann Medical Books Ltd., London (1973).
8. CPHEEO, Manual on sewage treatment.

9. Industrial Safety and Pollution Control Handbook, National Safety Council

BTCE16F6540	**Basics of Structural Dynamics**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Structural Analysis

Course Objectives:

1. The phenomena of earthquakes.
2. Understand and analyse the dynamic forces caused by earthquakes and structures.
3. Process, measurements and the factors that affect the design of structures in seismic areas.
4. The codal provisions as well as the seismic design methodology.

Course Outcomes:

1. Understand the principles of Structural Dynamics and damping in structures.
2. Summarize the Solution techniques for dynamics of single degree of freedom systems.
3. Understand the principles of engineering seismology.
4. Understand the concepts of earthquake resistance of reinforced concrete buildings.

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	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F6540	CO1	2	3	1										2	3		
	CO2		2	2										3		1	2
	CO3	1	2					1						2		1	
	CO4	1	2	1										2			1

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Introduction to Dynamic problems in Civil Engineering, Concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles Dynamics

of Single degree-of-freedom systems: Mathematical models of Single-degree-of-freedom systems system, Free vibration response of damped and undamped systems. Methods of evaluation of damping.

UNIT-II **[12 HOURS]**

Response of Single-degree-of-freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, Numerical methods applied to Single-degree-of-freedom systems – Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

UNIT-III **[12 HOURS]**

Dynamics of Multi-degree freedom systems: Mathematical models of multi-degree-of-freedom systems, Shear building concept, free vibration of undamped multi-degree-of-freedom systems – Natural frequencies and mode shapes – orthogonality property of modes.

UNIT-IV **[12 HOURS]**

Approximate methods: Rayleigh's method Dunkarley's method, Stodola's method. Dynamics of Continuous systems: Free longitudinal vibration of bars, flexural vibration of beams with different end conditions,

REFERENCE BOOKS:

1. Mario Paz, Structural Dynamics, Theory & Computations, Van Nostrand Co., Inc., 1980.
2. Timoshenko, Vibration problems in Engineering, Van Nostrand Co., Inc., 1955.
3. Biggs, Introduction to Structural Dynamics - McGraw Hill Book Co. 1975.
4. Clough & Penzien, Dynamics of Structures - McGraw Hill Book Col, 1975.
5. Hurty and Rubinsteian, Dynamics of structures
6. A.K. Chopra, Dynamics of structures, Prentice Hall – 1996.

BTCE16F6600	STAAD PRO and ETABS Lab	L	T	P	C
Duration: 16weeks		1	0	3	0

Prerequisites:

Structural analysis and design

Course Objectives:

1. Draw SFD and BMD, analyse and design singly reinforced and doubly reinforced beams using MS EXCEL software.
2. Analyse 2D trusses, rigid frames using Etabs and STAAD Pro software
3. Analyse 3D moment resistant frames using Etabs and STAAD Pro software
4. Analyse 3D Truss using Etabs and STAAD Pro software

Course Outcomes:

1. Draw SFD and BMD, analyse and design singly reinforced and doubly reinforced beams using MS EXCEL software.
2. Analyse 2D trusses, rigid frames using Etabs and STAAD Pro software
3. Analyse 3D moment resistant frames using Etabs and STAAD Pro software
4. Analyse 3D Truss using Etabs and STAAD Pro software.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F6600	**CO1**	**3**	**3**			**3**								**3**	**3**	**2**	**3**
	CO2	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
	CO3	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
	CO4	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**

Course Contents:

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 - 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. Ramesh Bangia, Learning Excel 2002- -Khanna Book Publishing Co (P) Ltd.,
2. Mathieson SA, Microsoft Excel, Starfire publishers
3. https://www.bentley.com/en/products/product-line/structural-analysis-software/ staadpro
4. https://www.csiamerica.com/products/etabs

BTCE16F6700	Design & Drawing of RCC & Steel Structures	L	T	P	C
Duration: 16weeks		1	1	0	2

Prerequisites:

Building Planning & Drawing, Design of RCC Structural Elements, Design of Steel Structures

Course Objectives:

1. The general layout of buildings and detailing of staircase and column footings
2. Design and detail cantilever type retaining walls, circular and rectangular water tanks resting on ground
3. The detailing of steel connections
4. The design and detailing of column splices and column bases

Course Outcomes:

1. Draw the general layout of buildings and detail staircase and column footings
2. Design and detail cantilever type retaining walls, circular and rectangular water tanks resting on ground
3. Design and detailing of steel connections
4. Design and detail column splices, lacing and battens ,column bases

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F6700	CO1	2	1	1			2	3	1	1	1		2	3	3	2	1
	CO2	3	3	3			2	3	1	1	1		2	3	3	2	1
	CO3	3	3	3	1		2	3	1	1	1		2	3	3	3	1
	CO4	2	3	3	1		2	3	1	1	1		2	3	3	3	1

Course Contents:

UNIT-I **[12 HOURS]**

Layout Drawing: General layout of building showing position of columns, footings, beams and slabs with standard notations, Detailing of Beam and Slab floor system, continuous beams, Detailing of Staircases: Dog legged and Open well.

Design and Detailing of Column footings: Column and footing (Square and Rectangle), Design and detailing of Rectangular Combined footing slab and beam type.

UNIT-II **[12 HOURS]**

Design and detailing of Cantilever type retaining walls.

Design and detailing of Circular and Rectangular water tanks resting on ground (Flexible base and Rigid base) using IS: 3370 (Part IV) only.

UNIT-III **[12 HOURS]**

Detailing of steel connections: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened. Detailing of column splices, Column-column of same and different sections. Columns, Lacing and battens. Detailing of column bases: Slab base and gusseted base, grillage foundation.

UNIT-IV **[12 HOURS]**

Design and drawing of roof truss (design forces in the members to be given)

REFERENCE BOOKS

1. N. Krishna Raju, Structural Design & Drawing Reinforced Concrete & Steel- University Press, Delhi
2. Krishnamurthy, Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
3. B.C. Punmia, Reinforced Concrete Structures, Laxmi Publishing Co.
4. S.N.Sinha, Reinforced Concrete Design –Mc-GrawHill Education,
5. S.K. Duggal, Design of steel structures - Tata Mcgraw Hill, New Delhi
6. N. Subramanian, Design of Steel Structures, Oxford University, Press.
7. Negi, Design of Steel Structures - Tata McGraw Hill Publishers.
8. Arya and Ajaman, Design of Steel Structures - Nem Chand &Bros. Roorkee.
9. S Unnikrishna Pillai & DevadasMenon, Reinforced Concrete Design- Tata McGraw-Hill, New Delhi
10. IS: 456-2000, IS: 800 – 2007, SP(16)-1980, SP 6 (1) – 1984

BTCE16F6800	New Tank and Old Tank Project	L	T	P	C
Duration: 16weeks		1	0	1	2

Prerequisites:

Hydrology & Irrigation ,Design of Hydraulic Structuresand Surveying practice lab

Course Objectives:

1. To apply knowledge of mathematics, science, and engineering to understand the measurement techniques.
2. To train the students under difficult and realistic situation of the surveying project.
3. To acquire a sound practical knowledge and application of theory and in practical to overcome the difficulties that could arise in field during surveying.
4. To impart training in the use of modern surveying instruments and to acquire a comprehensive idea of the project.

Course Outcomes:

1. Experiment the use of surveying instruments and performing various survey works in difficult terrain and to identify sites necessary for conducting various surveys.
2. Appraise the need for accurate and thorough note taking in field work to serve as a legal and produce the required maps and related calculations pertaining to survey work
3. Develop the adaptability in conversant with the camp life, to communicate with the local population, to develop team spirit, community living and self-management.
4. Adopt the working of Total station and Global Positioning System in the view of need for licensed surveyors.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F6800	CO1	1	2	3	-	-	-	2	1	-	-	-	-	3	3	2	3
	CO2	1	2	3	-	-	-	-	1	-	-	-	-	3	3	3	2
	CO3	3	2	-	-	-	-	-	-	-	-	-	-	3	3	3	1
	CO4	3	2	-	-	-	-	1	-	-	-	-	-	3	3	3	2

Course Contents:

New Tank Project:

1. General instructions, reconnaissance of the sites and fly levelling to establish bench marks.
2. Alignment of center line of the proposed bund, longitudinal and cross sections of the center line
3. Capacity surveys
4. Details of waste weir and sluice points
5. Canal alignment

Old Tank Project

1. Alignment of center line of the existing bund, longitudinal and cross sections of the center line.
2. Capacity surveys to explore the quantity.
3. Details at existing waste weir and sluice points.

REFERENCE:

1. Punmia B C, Ashok K Jain, Arun K Jain, Surveying Vol 1, 2,3: Surveying, laxmi Publications (P) Ltd, New Delhi.
2. Duggal S.K., Surveying Vol 1, 2: McGraw Hill Educatiion (India) Pvt.Ltd.
3. P.N.Modi, Irrigation, water Resources and water power Engineering- standard book house, New Delhi.
4. ChallaSatya Murthy, Water Resources Engineering: Principles and Practice, 2nd Edition, New Age International Publishers, New Delhi

SEMESTER VII

BTCE16F7100	Solid waste & Hazardous waste Management	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Industrial Waste Management and Environmental Engineering.

Course Objectives:

1. To develop insight into the collection, transfer, and transport of municipal solid waste.
2. Different methods of municipal solid waste disposal are studied.
3. Examine the operation of a resource recovery facility and understanding the different methods of waste to energy facility.
4. To understand the different types of biological and hazardous waste disposal.

Course Outcomes:

1. Explain the different methods of collection, transfer, and transport of municipal solid waste.
2. Explain the Different methods of municipal solid waste disposal.
3. Exposure to different method of waste to energy facility.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F7100	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	2	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO3	1	3	2	2	3	-	3	-	-	-	-	3	3	3	3	3
	CO4	1	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Definition, Scope and importance of solid waste management, Functional elements of solid waste management, Sources, Type sand Characteristics of solid waste, Numerical problems. Land Pollution-Sources, Causes, Effects and Control.

UNIT-II **[12 HOURS]**

Collection, Transportation, Treatment/Processing: Systems of collection, collection equipment, garbage chutes, transfer stations, bailing and compacting, route optimization techniques, Numerical problems. Components separation, volume reduction, size reduction, chemical reduction. Plastic waste, environmental significance and reuse of materials in other industries.

UNIT-III **[12 HOURS]**

Disposal Methods: Open dumping , ocean disposal, feeding to hogs, incineration- Process – 3 T's, factors affecting incineration process, incinerators – types, prevention of air pollution, Pyrolysis, energy recovery operations, composting- Aerobic (Indore process) and anaerobic (Bangalore processes) composting, factors affecting composting, mechanical and semi mechanical composting processes. Vermi- composting, Numerical problems. Sanitary landfill- Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geo-synthetic fabrics in sanitary landfills. Numerical problems.

UNIT-IV **[12 HOURS]**

Hazardous Waste: Classification, Generation, Toxicology, Bio-medical wastes, Treatment of hazardous waste-physico-chemical processes, stabilization and solidification, thermal methods, secured landfills in disposal of Hazardous waste, Remedial technologies.

REFERENCE BOOKS:

1. GeorgeTchobanoglous, Hilary Theisen, Samuel A Vigil, Integrated Solid Waste Management: Engineering principles and management issues, M/c Graw hill Education. Indian edition
2. Bhideand Sunderashan Solid Waste Management in developing countries.
3. Pavoni J.L. Handbook on Solid Waste Disposal.
4. Howard S Peavy, Donald R Rowe and George Tchobanoglous, Environmental Engineering, Tata Mcgraw Hill Publishing Co ltd.,
5. Bio medical waste handling rules– 2000.

BTCE16F7200	Open Elective	L	T	P	C
Duration: 16weeks		3	1	0	4

OPEN ELECTIVE OFFERED BY OTHER DEPARTMENT WILL BE OFFERED TO CIVIL ENGINEERING STUDENT

BTCE16F7310	Design of Industrial Structures	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Advanced design of RC and Steel structures

Course Objectives:

1. To familiarize with industrial structures such as gantry girder, crane girder
2. To understand the design concept of cooling towers, bunkers and silos
3. To familiarize with transmission towers

Course Outcomes:

1. Design independently gantry girders, crane girders which are compulsorily used in manufacturing industries
2. Able to know the concept of analysis and design of power plants, containment structures such as cooling towers, bunkers and silos
3. Able to analyze and design transmission towers
4. Able to design of self supporting chimney

Mapping of Course Outcomes with programme Outcomes

Course Contents:

e Code	COs	1	2	3	4	5	6	7	8	9	10	11	12	O 1	O2	O3	PS O4
BTCE16F7310	CO1	2	1	1			2	3	1	1	1		2	3	3	2	1
	CO2	3	3	3			2	3	1	1	1		2	3	3	2	1
	CO3	3	3	3	1		2	3	1	1	1		2	3	3	3	1
	CO4	2	3	3	1		2	3	1	1	1		2	3	3	3	1

UNIT-I **[12 HOURS]**

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 **[12 HOURS]**

Industrial Buildings: Steel and RCC - Gantry Girder, Crane Girders - Design of Corbels and Nibs – Design of Staircase.

UNIT-III **[12 HOURS]**

Power Plant Structures: Types of power plants – Containment structures - Cooling Towers - Bunkers and Silos - Pipe supporting structures

UNIT-IV **[12 HOURS]**

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 Hausmann, 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,

BTCE16F7320	Construction Chemicals and Special Concretes	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Concrete Technology

Course Objectives:

1. To familiarize with the recent trends of using chemical and mineral admixtures to improve the workability characteristics
2. Use of light weight aggregates may economize the construction costs
3. To understand the concept of use of ferrocement techniques
4. To make the student to know the concept of using fibers in concrete to improve the tensile strength characteristics of concrete

Course Outcomes:

1. To know the concept of using chemical admixtures for improving the workability
2. Use light weight aggregates and high density concrete for specific applications
3. To gain knowledge of wider application of ferrocement technology
4. To know concept of using fibers in concrete to improve the tensile strength characteristics of concrete

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7320	CO1	3	2	2	3									3	1	1	2
	CO2	3	3	2										3	3	1	1
	CO3	3	3	2	1									3	3	1	1
	CO4	3	3	3	1									3	3	3	2

Course Contents:

UNIT-I [12 HOURS]

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

UNIT-II [12 HOURS]

Light Weight concrete: Introduction, classification, properties, strength and durability, mix proportioning and problems. High density concrete: Radiation shielding ability of concrete, materials for high density concrete, mix proportioning, properties in fresh and hardened state, placement methods.

UNIT-III [12 HOURS]

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-IV [12 HOURS]

Fibre reinforced concrete: Fibre materials, mix proportioning, distribution and orientation, interfacial bond, properties in fresh state, strength and behavior in tension, compression and flexure

of steel fibre reinforced concrete, mechanical properties, crack arrest and toughening mechanism, applications. High Performance concrete: constituents, mix 8 Hours L1, L2 14 proportioning, properties in fresh and hardened states, applications and limitations. Ready Mixed Concrete-QCI-RMCPC scheme requirements, Self Compacting Concrete, Reactive powder concrete, and bacterial concrete

REFERENCE BOOKS:

1. M.S.Shetty, Concrete Technology, Theory and Practice, S.Chandand Company, New Delhi.
2. Neville, A.M, Properties of Concrete, ELBS, London
3. A.R. Santhakumar, Concrete Technology, Oxford University Press (2007)
4. N Krishnaraju, Design of Concrete Mixes, Sehgal Educational Consultants & Publishers Pvt. Ltd, Faridabad.
5. Recommended guidelines for concrete mix design - IS:10262,BISPublication.
6. K.S. Jagadish, B.V.Venkatarama Reddy & K S NanjundaRao, Alternative building materials and technologies,
7. New Age International Publishers Ltd, New Delhi.
8. Relevant IS Codes

BTCE16F7330	**Pavement Design and Construction**	L	T	P	C
Duration:16Weeks		3	1	0	4

Prerequisites:

Pavement Materials and Analysis

Course Objectives:

1. To understand the fundamentals of conducting analysis of pavements, types and functions of pavement layers.
2. Understand design concepts of flexible pavement and rigid pavement by various methods.
3. Understand the components of highway construction, material mixes and soil stabilization methods.
4. Understand pavement and its components, pavement construction activities and its requirements, Specifications and quality checks for flexible and rigid pavement.

Course Outcomes:

1. To analyse the factors affecting pavement design for flexible and rigid pavements.

2. To design flexible and rigid pavement by different methods.
3. Capable to acquire understanding on construction mixes and stabilization methods for pavements.
4. Capable to understand specifications, quality checks in pavement construction.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7330	CO1	1	2	2	2									2	2	2	2
	CO2	2	2	3	2									2	2	3	2
	CO3	2	3	3	2									2	2	3	2
	CO4	2	2	3	2									2	2	3	2

Course Contents:

UNIT-I [12 HOURS]

Introduction: Factors Affecting Pavement Design, Types of Pavements, Functions of Individual Layers, Classification of Legal Axle and Gross Weights. Tire Pressure, Contact Pressure, EAL and ESWL Concept, Lane Distributions and Vehicle Damage Factors, Subgrade support - CBR and plate bearing tests, CSA. Numerical examples

UNIT-II [12 HOURS]

Design of Flexible Pavements:Design methods and principle, design steps, advantages and applications of different pavement design methods. IRC: 37-2001, AASHTO and Asphalt Institute methods.Specifications and guidelines. Numerical examples.

UNIT-III [12 HOURS]

Design of Rigid Pavements:IRC: 58-2011 Method of design by stress ratio method. Design of continuously reinforced concrete pavements and airfield pavements. Design of joints. Specifications and guidelines.Design features of CRCP, SFRC and ICBP- Numerical examples.

UNIT-IV [12 HOURS]

Embankment Construction: Specifications and steps for the construction of road in embankment and cut, construction steps for subgrade and preparation of subgrade. Flexible Pavement

Construction:General specifications and construction methods. Rigid Pavement Construction:General specifications and construction methods.

REFERENCE BOOKS:

1. Khanna, S.K., C.E.G. Justo and A. Veeraragavan, Highway Engineering, Revised 10th Edition, NemChand and Bros. Roorkee
2. Sharma, S.C, Construction Equipment and its Management- Khanna Publishers.
3. Yang H. Huang, Pavement Analysis & Design - II edition
4. Yoder and Witzack Principles of Pavement Design, 2nd edition, John Wileys and Sons
5. Relevant IRC Publications.

BTCE16F7340	Offshore Structures and Coastal Management	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Hydraulics

Course Objectives:

1. To develop adequate understanding of Wave characteristics
2. To enable one to identify the offshore structure to be adopted
3. To understand the design concepts of offshore structures.
4. To understand the coastal profile and its management.

Course Outcomes:

1. Have developed an understanding of wave characteristics
2. Be able to identify the offshore structure to be adopted
3. Have knowledge on the design concepts of offshore structures.
4. Be able to manage and conserve the coastal zone and offshore structures.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7340	CO1	2	1	1			2	3	1	1	1		2	3	3	2	1
	CO2	3	3	3			2	3	1	1	1		2	3	3	2	1
	CO3	3	3	3	1		2	3	1	1	1		2	3	3	3	1

	CO4	**2**	**3**	**3**	**1**		**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**3**	**1**

Course Contents:

UNIT-I **[12 HOURS]**

Wave Hydrodynamics : Introduction - wind and waves – sea and swell - introduction to small linear waves-properties – waves in shallow waters – wave refraction, diffraction, shoaling and breaking. Met ocean Engineering – wind, wave and current loads on offshore structures Types of Platforms – Jackets, TLPs, Semisubmersibles, Jack-ups, Concrete Gravity

UNIT-II **[12 HOURS]**

Design of Offshore Structures: Floating Platforms – Sizing, stability, structural design concepts of TLPs, semisubmersibles

Fixed Offshore structures – Sizing and layout, structural design concepts of Jackets, Breakwaters and Seawalls

Offshore Pipelines – Hydrostatic, hydrodynamic analysis and structural design concepts

UNIT-III **[12 HOURS]**

Classification of Coast and Profile

Seas and oceans – classification –exclusive economic zone – continental area – coastal zone – coral reefs – mangroves – wetlands – importance – food, BTCE16F7530 ation, recreation – reef structure, types and formation – mangrove distribution- dynamic beach profile- cross shore transport- littoral transport- sediment movement.

Buoys and Mooring systems – mooring configurations, advantages and disadvantages. Ocean mining and energy systems – description and systems

UNIT-IV [**12 HOURS]**

Management of Coastal Zone & Offshore Structures: Conservation and management strategies – restoration technology –management strategies and methods – role of institutions – global policies – conservation strategies in different countries.

Safety of offshore structures – reliability and risk assessment, failure modes

Corrosion - Corrosion mechanism - Types of corrosion - Offshore structure corrosion zones – Biological corrosion - Preventive measures of Corrosion

REFERENCE BOOKS:

1. Dawson, T. H., Offshore Structural Engineering, Prentice Hall, 1983.
2. Richard Sylvester, Coastal Engineering, Volume I and II, Elseiner Scientific Publishing Co., 1999
3. Quinn, A.D., Design & Construction of Ports and Marine Structures, McGraw-Hill Book Co., 1999
4. API RP 2A., Planning, Designing and Constructing Fixed Offshore Platforms, API.

5. McClelland B & Reifel M. D, Planning & Design of fixed Offshore Platforms, Van Nostrand, 1986.
6. Graff W. J, Introduction to Offshore Structures, Gulf Publ. Co.1981.

BTCE16F7410	**Advanced Prestressed Concrete**	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Prestressed concrete structures

Course Objectives:

1. To familiarize the design concept of flexural prestressed members
2. To understand the design of continuous and cantilever beams
3. To understand the design of composite members

Course Outcomes:

1. Confidently design the flexural prestressed members
2. Applications of prestressed concrete members in different types of structures
3. Able to design of Tension and Compression Members
4. Understand the applications in the composite members

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7410	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO3	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Design of Flexural Members: Behaviour of flexural members, determination of ultimate flexural strength – Various Codal provisions - Design of flexural members, Design for shear, bond and torsion. Transfer of prestress. Block design and cantilever beams.

UNIT-II **[12 HOURS]**

Design of Continuous and Cantilever Beams: Analysis and design of continuous beams - Methods of achieving continuity - concept of linear transformations, concordant cable profile and gap cables – Analysis and design of cantilever beams.

UNIT-III **[12 HOURS]**

Design of Tension and Compression Members: Design of tension members - application in the design of prestressed pipes and prestressed concrete cylindrical water tanks - Design of compression members with and without flexure - its application in the design piles, flag masts and similar structures.

UNIT-IV [**12 HOURS]**

Design of Composite Members: Composite beams - analysis and design, ultimate strength - their applications. Partial prestressing - its advantages and applications.

REFERENCE BOOKS:

1. Krishnaraju N, Prestressed concrete, Tata McGraw-Hill Private Limited, New Delhi
2. T.Y.Lin, Design of Prestressed Concrete Structures, John Wiley and Sons, Inc.
3. N.C.Sinha, S.K.Roy, Fundamentals of Prestressed Concrete, John Wiley and Sons, Inc.
4. Leonhardt F., Wilhelm Ernst and Shon, Berlin, Prestressed Concrete-Design and Construction, CBS Publishers, New Delhi.
5. Freyssinet, Prestressed Concrete, Tata McGraw-Hill Private Limited, New Delhi.
6. Evans, R.H. and Bennett, E.W., Chapman and Hall, Prestressed Concrete, Champman and Hall, London.
7. Rajgopalan, Prestressed Concrete, Asia Publishing House, Bombay.
8. IS: 1343-Code for Practice for Prestressed Concrete, BIS India.
9. IS: 3370-3 (1967): Code of Practice Concrete structures for the storage of liquids, Part 3: Prestressed concrete structures, BIS India.
10. Graff W. J, Introduction to Offshore Structures, Gulf Publ. Co.1981.

BTCE16F7420	Ground Water Engineering	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Fluid Mechanics, Hydraulics Machines

Course Objectives:

1. To To learn about various types of Aquifers, Darcy's Law and related technical terms and related problems,
2. Relevance of Rainwater Harvesting its need and advantages, Various methods/techniques of Rainwater harvesting and a case study
3. Basics terms and concepts of Groundwater, history, background and its potential in India.
4. Water Quality standards of Groundwater and its Pollution, Different methods of artificial recharge and investigation.

Course Outcomes:

1. solve problems related to permeability and transmissibility, How to carry out ground water recharge,Applications of prestressed concrete members in different types of structures
2. Understand the Importance and need for rain water harvesting, various methods commonly adopted for rain water harvesting.
3. Understand the historic background and its potential in India. Basic terms related to Groundwater.
4. Understand the Importance and need for groundwater recharge, various methods commonly adopted for groundwater recharge.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE 16F7 420	CO1	3	3	2	3	3	-	-	-	2	-	-	3	3	3	3	**3**
	CO2	3	3	2	3	2	-	-	-	2	-	-	3	3	3	3	**3**
	CO3	3	3	2	1	2	-	2	-	2	-	-	3	3	3	3	**3**
	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	**3**

.

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Ground water occurrence, definition of aquifer, aquifuge, aquitard and aqueduct. Types of aquifer & its parameters, Darcy's law, hydraulic conductivity, permeability coefficient, intrinsic permeability, transmissibility, problems.

UNIT-II **[12 HOURS]**

Ground Water Recharge, Runoff And Balance: Artificial recharge: spreading method, urban storm runoff, vertical recharge, recharge component estimation, ground water discharge estimation, ground water balance and its components, case study.

UNIT-III **[12 HOURS]**

Ground Water Development And Management:Type of well, method of construction, tube well, dug well, ground water development, water logging, conjunctive use, modeling in ground water management, well hydraulic- thesis method, coofer and Jacob method, case study.

UNIT-IV [**12 HOURS]**

Ground Water Exploration Techniques: Hydro geologic well logging, geophysical well logging, tracer techniques, problems, seismic method, electrical resistivity method, geologic and hydrologic logging, case study.

Ground water extraction& intrusion, ghyben-Herzberg relation, saline zones & interface, prevention & control of saline water intrusion, zone of diffusion.

REFERENCE BOOKS:

1. K Todd, Ground water hydrology, Wiley & sons, New Delhi.
2. H.M. Raghunath, Ground water, Wiley Eastern Limited.
3. Karanath K .R : Ground water Assessment, Development and management, Tata McGraw hill, New Delhi, 1987
4. Bower H, Ground water Hydrology: McGraw hill, New Delhi.
5. Garg satyaprakesh, Ground water and tube well, oxford & IBH, New Delhi

BTCE16F7430	Highway Geometric Design	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. To understand the design aspects of road geometrics to address the practical problems in highway engineering.
2. To get the knowledge of selecting appropriate cross sectional elements of roads.
3. To understand the analysis of horizontal alignment& vertical alignment of roads.
4. To understand the design various types of intersections of roads.

Course Outcomes:

1. Select appropriate cross sectional elements of roads.
2. Analyse the horizontal alignment of roads.
3. Analyse the vertical alignment of roads.
4. Design various types of intersections of roads.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2		PS O3	PS O4
BTCE16F7430	CO1	3	3	3	2						1		1	3	2		3	2
	CO2	3	3	3	2			2		3	3			3	3		3	2
	CO3	3	3	2	2		1			2	1			3	3		3	2
	CO4	3	3			2					2	3	2	3	3			1

Course Contents:

UNIT-I **[12 HOURS]**

Elements, Controls and SSD: Elements and controls of highway geometric design, pavement surface characteristic, camber, widths of carriageway and formation, road margins, right of way, typical cross sections, sight distance, stopping sight distance.Numerical examples.

UNIT-II **[12 HOURS]**

OSD and Horizontal Alignment : Overtaking sight distance – analysis and derivation, sight distances at uncontrolled intersections, horizontal alignment – superelevation, extra widening of pavements, transition curves and set-back distances on horizontal curves.Numerical examples.

UNIT-III **[12 HOURS]**

Vertical Alignment and Engineering Surveys: Types of gradients, grade compensation along horizontal curves, design of summit curves, design of valley curves, engineering surveys for highway location, drawings and report preparation, design of hill roads, road humps.Numerical examples.

UNIT-IV **[12 HOURS]**

Intersections, Bus and Pedestrian Facilities: Intersections at grade – forms, unchannelized, channelized, median openings, rotary intersections, grade separated intersections, ramps, bus and pedestrian facilities, design standards for rural expressways.Numerical examples.

REFERENCE BOOKS

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, Highway Engineering, Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. L. R. Kadiyali& N. B. Lal, ―Princple and Practice of Highway Engineering‖, Khanna Publications, 2005.
3. Kadiyali L.R, Traffic Engineering and Transportation Planning, Khanna Publishers, Delhi.
4. AASHTO, A Policy on Geometric Design of Rural Highways, American Association of State Highway and Transportation Officials, Washington D C.
5. Indian Roads Congress, Guidelines for Design of Horizontal Curves for Highways and Design Tables, IRC: 38-1988, Indian Roads Congress, New Delhi.
6. Indian Roads Congress, Recommended Practice for Sight Distance on Rural Highways, IRC: 66-1976, Indian Roads Congress, New Delhi.
7. Indian Roads Congress, Geometric Design Standards for Rural (Non-Urban) Highways, IRC: 73-1980, Indian Roads Congress, New Delhi.
8. Indian Roads Congress, Geometric Design Standards for Urban Roads in Plains, IRC: 86-1983, Indian Roads Congress, New Delhi.

BTCE16F7440		**L**	**T**	**P**	**C**

Duration: 16weeks	Green Buildings and Green Technology	2	1	0	3

Prerequisites:

Building Materials and Construction, Architectural Planning and Design of Buildings (Manual Drawing)

Course Objectives:

1. Understand the basic concepts of green buildings and its design.
2. To promote the technology to develop solutions to address non-renewable energy challenges.
3. Understand the cleaner production and life cycle assessment
4. Know the impacts of green technology.

Course Outcomes:

1. Recollect the basic concepts of green buildings and its design.
2. Expose to design criteria of green buildings.
3. Explain cleaner production and life cycle assessment
4. Describe the principles of green manufacturing and use of alternative energy resources

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7440	**CO1**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**2**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I [12 HOURS]

Introduction to Green Building: Green Buildings: Definition of green building, benefits and challenges, public policies and market-driven initiatives, effective green specifications, LEED ratings, green materials.

Overview to Site Design: Site planning and analysis: biophysical, social, economic factors, Basic steps of site analysis, Site assessment, strategies for optimizing land use; transportation fundamentals.

UNIT-II [12 HOURS]

Energy Efficient Buildings: Energy Efficient Design: Overview of the Building Energy System Design Process, Assessing human functional and physiological needs, local climate and free energy resources. Design scenarios, Passive solar design, Building Envelope, Plug Loads, Domestic Hot Water, HVAC, Day lighting, Electric Lighting, Green Power, Water and Site Design: problems and issues with water and site practices, Nature as a model approach, Overview of site and landscape solutions.

UNIT-III [12 HOURS]

Cleaner Production Technology: Cleaner Production and Life Cycle Assessment: Definition, Importance, Source Reduction Techniques, Process and equipment optimization, reuse, recovery, recycle, raw material substitution, Elements of LCA, Life Cycle Costing, Eco-labelling, Designs for the Environment, International Environmental Standards, ISO 14001, Environmental Audit.

UNIT-IV [12 HOURS]

Green Technology: Introduction, sustainable green manufacturing, Alternative energy resources-wind turbines, hydroelectric, bio-fuels, solar power, fuel cells, and green technology systems. Case studies on cleaner production, Life Cycle assessment and Green buildings.

REFERENCE BOOKS

1. Prasad Modak, C.Visvanathan and Mandarparasnis, Cleaner Production Audit", Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok. 1995

2. Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok.

3. L Bishop Pollution Prevention, Fundamentals and Practice “, McGraw-Hill International. 2000

4. Green Building Rating System for New Construction and Major Renovations (LEED-NC), Version 2.2, October 2005.

BTCE16F7510	Finite Element Analysis	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Theory of Elasticity

Course Objectives:

1. To learn about energy concepts and theorems, Rayleigh - Ritz Method and Galerkin's Method
2. To learn about basic concepts, principles, advantages and disadvantages of FEM
3. To derive element properties and analyze 2D problems of framed structures and continuum
4. To learn about formulation of Isoparametric elements and learn about the modules of a standard FEM computer program

Course Outcomes:

1. Understand energy concepts and theorems, Rayleigh - Ritz Method and Galerkin's Method
2. Has learnt about basic concepts, principles, advantages and disadvantages of FEM
3. Is able to derive element properties and able to analyze 2D problems of framed structures and continuum
4. Has learnt about formulation of Isoparametric elements and learnt about the modules of a standard FEM computer program

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F7510	**CO1**	**2**	**2**											**3**	**3**	**3**	**3**
	CO2	**2**	**3**	**2**	**1**	**1**								**3**	**3**	**3**	**3**
	CO3	**1**	**3**	**3**	**3**		**2**			**1**				**3**	**3**	**3**	**3**
	CO4	**2**	**3**	**2**	**2**					**1**				**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction, Basic Concepts of Finite Element Analysis, Steps in Finite Element Analysis, Fundamental concepts of Elasticity, Matrix displacement formulation, Energy concepts, Principles of minimum potential energy and minimum complementary energy.

Rayleigh - Ritz Method, Galerkin's Method, Simple numerical problems.

UNIT-II **[12 HOURS]**

Displacement models, natural coordinates, one dimensional, Triangular,

Rectangular Elements, construction of shape functions for 2 D truss, beam and rigid frame elements, Lagrangian interpolation, Lagrange and Serendipity Elements, assembly of stiffness matrices and load vectors by direct stiffness method, boundary conditions,

Formation of stiffness matrices and analysis of Truss, Continuous Beam (2 spans).

UNIT-III **[12 HOURS]**

Analysis of 2D Continuum Problems: Plane stress and Plane strain, Polynomial displacement functions, Triangular, rectangular elements, Shape functions, Pascal triangle, convergence requirements of shape functions, Simple numerical problems, Numerical Integration: One Dimensional, Two Dimensional

UNIT-IV **[12 HOURS]**

Theory of Isoparametric Elements: Isoparametric, sub parametric and super-parametric elements, formulation of Isoparametric triangular and rectangular elements.

FEM Program: Structure of computer program for FEM analysis, description of different modules, pre and post processing.

REFERENCE BOOKS

1. C.S. Krishnamoorthy, Finite Element Analysis, Theory and Programming, Tata McGraw Hill Co. Ltd., New Delhi.

2. Chadrupatla, Tirupathi R., Finite Element Analysis for Engineering and Technology- University Press, India.

3. J.F. Abel and Desai. C.S., Introduction to the Finite Element Method by Affiliated East West Press Pvt. Ltd., New Delhi.

4. Rajasekharan. S, Finite Element Analysis in Engineering Design- Wheeler Publishers.

5. Daryl L Logan, A First Course on Finite Element Method –Cengage Learning

6. Zienkiewicz. O.C., The Finite Element Method Tata McGraw Hill Co. Ltd., New Delhi.

7. S.S. Bhavikatti, Finite Element Analysis New Age International Publishers, New Delhi.

8. R.D.Cook, et al., Concepts and applications of finite element analysis, John Wiley & Sons, New York.

BTCE16F7520		**L**	**T**	**P**	**C**

Duration: 16weeks	Structures on Expansive Soil	2	1	0	3

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials, Structural Analysis, Fluid Mechanics and Geotechnical Engineering

Course Objectives:

5. To know the occurrence and distribution of expansive soils
6. To study the properties of expansive soils
7. To understand various methods of prediction of heave
8. To study the design procedure for foundation on expansive soils and understand various methods of stabilization used in expansive soils

Course Outcomes:

1. An ability to analyze, design, foundations that are required for special structures such as bridges, piers etc, on expansive soils.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7520	**CO1**	**3**	**3**	**1**	**3**	**2**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**2**
	CO2	**3**	**2**	**1**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**2**
	CO3	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**1**
	CO4	**3**	**2**	**3**	**3**	**-**	**2**	**1**	**-**	**-**	**2**	**-**		**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Geotechnical Problem: Occurrence and distribution - Expansive soils of India, related civil engineering problems - Environmental interaction, moisture equilibrium – Distress symptoms- Factors influencing swelling & shrinkage of soils.

UNIT-II **[12 HOURS]**

Expansive Soil Properties : Soil structure and Clay mineralogy - field exploration – Identification of expansive soils , free swell, cation exchange capacity, expansive index test- classification using engineering index properties

UNIT-III **[12 HOURS]**

Heave Prediction: Methods of prediction of heave - Empirical methods - double oedometer tests - soil moisture- suction - field observations - shrinkage.

UNIT-IV **[12 HOURS]**

Foundation Design and Stabilization: Recommendations for type of foundation in expansive soils - Design consideration - Individual and continuous footings, stiffened mats, under reamed piles - codal provisions.

Soil stabilization -Method - mechanical stabilization - cement stabilization – lime stabilization - bituminous stabilization - chemical stabilization - Thermal stabilization.

REFERENCE BOOKS

1. John .D.N & Debora .J.M, Expansive Soils Problems And Practice In Foundation & Pavement Engineering, 1992.

2. Chenn .F.R, Foundation on Expansive Soils- Elsevier, 1973.

2. Parcher .J.V & Means .R.E, Soil Mechanics and Foundations, Columbus, 1968.

3. Boominathan. S, Lecture Notes on Structures on Expansive Soil, College of Engineering, Guindy, Anna University, Chennai. 1990

BTCE16F7530	Urban Transport Planning	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. Understand the methods of data collection and analysis of Data
2. Introducing four stages of urban transportation planning i.e., trip generation, trip distribution, and mode choice modelling and route assignment.
3. Integrating land use with transportation and compare land use models
4. To make students appreciate the factors affecting modal split, traffic assignment techniques and the economic evaluation

Course Outcomes:

1. Illustrate the transportation planning process activities
2. Analyse the required data by performing Transportation surveys
3. Give exposure to land-use transport models.
4. Assess applicability of land use models for solving urban transport problems,

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7530	CO1	3					3		2		2		2	3			1
	CO2	3	3			2		2	2	3	3	1		3	3		1
	CO3	3	3		2	2	3	1		3	1	2		3	3	1	2
	CO4	3	3		2	2	1	2	3		3		2	3			2

.

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to urban system components, concepts and definitions, scope and elements of urban transport planning. Interdependency of land use and traffic. Urban Transport planning for small and medium sized cities. Difficulties in transport planning. Systems approach to urban planning – Stages.

UNIT-II **[12 HOURS]**

Transport Surveys: Basic Movements-Study Area- Zoning – Surveys- Planning of different types of surveys and interpretation- expansion of data from sample- Transport modeling, Transport demand and supply- Traffic surveys for mass transit system planning- Mass Transit Systems: Capacity, Fleet planning and Scheduling.

UNIT-III **[12 HOURS]**

Trip Generation and Distribution: Factors governing trip generation and attraction –Application of Regression Analysis- Methods of trip distribution: Growth Models and Synthetic Models-Calibration and Application of gravity model. Category analysis. Numerical Examples.

UNIT-IV **[12 HOURS]**

Modal Split: Factors affecting modal split, Modal split in transport planning, recent developments in modal split analysis. Traffic Assignment: Principles of traffic assignment; assignment techniques.Evaluation: Need for evaluation, Identification of corridor; Formulation of plans; Economic evaluation. Numerical Examples.

REFERENCE BOOKS

1. Kadiyali, L.R., Traffic Engineering and Transportation Planning, Khanna Publication, New Delhi, 2009

2. Jotin Khisty and B. Kent Lall, Transportation Engineering –An Introduction-3rd Indian Edition PHI, New Delhi, 2006.

3. Hutchinson, B.G., Principles of Urban Transport System Planning - McGraw Hill Book Co., London, UK, 1982.

4. Institute of Traffic Engineers - An Introduction to Highway Transportation Engineering' New York., 1982

5. Transportation Planning Resource Guide

6. Introduction to Transportation Planning – M.J.Bruton; Hutchinson of London Ltd.

BTCE16F7540	Construction Equipments	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Highway construction, Materials

Course Objectives:

1. The elements of construction planning and implication
2. The making of construction schedule and calculate the time schedule and cost of equipment's
3. The Capacity of construction equipment can be used for construction and the production capacity of the plants producing aggregates
4. The type of the equipment for different works and determine the performance of the equipment's

Course Outcomes:

1. Prepare a suitable construction planning for particular project
2. Estimate and find the cost of hiring equipment for construction activity
3. Identify the suitable equipment's required for the work
4. To know the power requirements and output of the equipment's.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7540	CO1	3	3	3	2		1			2	2	3	2	3	2	2	3
	CO2	2	3	3	2		1			3	3		3	3	2	2	3
	CO3	3	2	3	2		1			3	3		2	3	2	2	3
	CO4	3	2	3			2			2	2		3	3	2	2	3

Course Contents:

UNIT-I [12 HOURS]

Fundamental Concepts of Equipment Economics: Evaluation, ownership cost, operation cost, Rent and lease considerations, Equipment records, cost for bidding, replacement, Equipment planning.

UNIT-II [12 HOURS]

Equipment for Excavation and Compaction of Soils: Types of Excavation, Compaction and stabilization equipment, Selection of equipments, Cost consideration, Finishing Equipments.

UNIT-III [12 HOURS]

Equipment for Pavement Material Production – Aggregate production unit, Crushers, Crushing equipment selection, Safety. Asphalt mix production plant and process. Concrete mix production plant.

UNIT-IV **[12 HOURS]**

Equipment for Placing and Hauling: Trucks and Hauling Equipments, production calculation, Production issues and safety.

Special Construction Operations and Equipments: Drilling Equipments, Dozers, Graders, Scrapers, Blasting operation.

REFERENCE BOOKS

1. Peurifoy / Schexnayder, Construction Planning, Equipment and Methods- McGraw - Hill Higher Education

2. Sharma S.C. Construction Equipment and its Management- Khanna Publishers, Delhi

3. K.K. Chitkara, Construction Project Management, Planning, Scheduling and Controlling- Tata McGraw –Hill Publications

4. Operation Manuals of relevant equipment.

BTCE16F7600	Steel Structures Design and Drawing- Manual	L	T	P	C
Duration:16weeks		1	0	1	2

Prerequisites:

Design of steel structures

Course Objectives:

1. To make the students to design and drawing the details of connections, beam to beam and beam to column connections
2. To understand the design and drawing of plate girder and truss

Course Outcomes:

1. Prepare Design and draw the details independently
2. Plate girder design is important in the design of bridges, the student can confidently design the plate girder and truss

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F7600	CO1	3	3											3	3		
	CO2	3	3	3	1	2			2		2		1	3	3	3	1

Course Contents:

(DRAWINGS TO BE PREPARED FOR GIVEN STRUCTURAL DETAILS)

UNIT-I **[12 HOURS]**

Connections: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

UNIT-II **[12 HOURS]**

Columns: Splices, Column-column of same and different sections. Lacing and battens.

Column bases: Slab base and gusseted base

UNIT-III **[12 HOURS]**

Design and Drawing of Plate Girder: Bolted and welded

UNIT-IV **[12 HOURS]**

Design and Drawing of Roof Truss (Forces in the members to be given)

Project Term work: Design and drawing of a single storeyed industrial building

REFERENCE BOOKS

1. S.K. Duggal, Limit State Design of Steel Structures 2nd Edition. Tata McGraw Hill, New Delhi.

2. S.S. Bhavikatti, Design of Steel Structures 3rd Edition. Tata McGraw Hill, New Delhi. Detailed Syllabus B. Tech. Program, NIT Patna Session 2015-16 Page 79

3. N. Subramanian, Design of Steel Structures 2nd Edition. Oxford University Press India.

BTCE16F7700	**Estimation, Costing and Valuation**	L	T	P	C
Duration: 16weeks		3	1	0	4

Prerequisites:

Design of RCC, Steel structures.

Course Objectives:

1. To learn study various drawing with estimates, methods of taking out quantities and preparation of detailed and abstract estimates for different civil engineering works.
2. To learn about writing specifications for various civil engineering works
3. To carry out rate analysis for various civil engineering works and to learn about the measurement of earth work for roads and other civil engineering works.
4. To understand the concept of valuation of a property.

Course Outcomes:

1. Students will learn how to study the various drawings and taking out quantities, and work out the cost and preparation of abstract for the estimated cost for the various civil engineering works.
2. To write specifications for various items of works.
3. To carry out rate analysis for various items of works and Obtain measurement of earth work for roads by various standard methods.
4. Preparation of contract document related to a project..

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F7700	**CO1**	**1**	**2**	**3**	**-**	**1**	**-**	**2**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**2**	**3**
	CO2	**1**	**2**	**3**	**-**	**1**	**-**	**-**	**1**	**2**	**-**	**-**	**-**	**3**	**3**	**3**	**2**
	CO3	**3**	**1**	**3**	**-**	**1**	**-**	**-**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**1**
	CO4	**3**	**1**	**3**	**-**	**1**	**-**	**1**	**-**	**1**	**-**	**-**	**-**	**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Estimate of Buildings: Load bearing and framed structures – Calculation of quantities of brick work, RCC, PCC, Plastering, white washing, colour washing and painting / varnishing for shops, rooms, residential building with flat and pitched roof – Various types of arches – Calculation of brick work and RCC works in arches – Estimate of joineries for paneled and glazed doors, windows, ventilators, handrails etc.

UNIT-II **[12 HOURS]**

Estimate of Other Structures: Estimating of septic tank, soak pit – sanitary and water supply installations – water supply pipe line – sewer line – tube well – open well – estimate of bituminous and cement concrete roads – estimate of retaining walls – culverts – estimating of irrigation works – aqueduct, syphon

UNIT-III **[12 HOURS]**

Specification and Tenders: Data – Schedule of rates – Analysis of rates – Specifications – sources – Preparation of detailed and general specifications – Tenders – TTT Act – e-tender – Preparation of Tender Notice and Document – Contracts – Types of contracts – Drafting of contract documents – Arbitration and legal requirements.

UNIT-IV **[12 HOURS]**

Valuation: Necessity – Basics of value engineering – Capitalized value – Depreciation – Escalation – Value of building – Calculation of Standard rent – Mortgage – Lease

Report Preparation: Principles for report preparation – report on estimate of residential building – Culvert – Roads – Water supply and sanitary installations – Tube wells – Open wells.

REFERENCE BOOKS:

1. B. N. Dutta, Estimating & Costing, Chand Publisher
2. P.L. Basin, Quantity Surveying- S. Chand: New Delhi.
3. S.C. Rangawala, Estimating & Specification - Charotar publishing house, Anand.
4. G.S. Birde, Text book of Estimating & Costing, Dhanpath Rai and sons: New Delhi.
5. D.D. Kohli and R.C. Kohli, A text book on Estimating, Costing and Accounts- S. Chand: New Delhi.
6. B. S. Patil, Contracts and Estimates, University Press, 2006.

BTCE16F7800	Highway and Public Health Engineering Projects	L	T	P	C
Duration:16 Weeks		1	0	1	2

Prerequisites:

Highway Engineering and Environmental Engineering

Course Objectives:

1. To carry out survey for water supply to identifies and locate source and treatment plant
2. To carry out survey for sanitary system for sewer lines and treatment plant
3. To carry out survey to plan a safe highway network
4. To carry out the survey to plan for future development and anticipated traffic Planning of highway

.

Course Outcomes:

1. Conduct the survey for water supply to identifies and locate source
2. Conduct the survey for sanitary system for sewer lines and treatment
3. Conduct the survey to plan a safe highway network
4. Conduct the survey to plan for future development and anticipated traffic Planning of highway

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
BTCE16F7800	CO1	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
	CO2	3	3	3	3	3	-	-	-	-	-	-	3	3	3	3	3
	CO3	3	3	3	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO4	3	3	3	3	3	-	3	-	-	-	-	3	3	3	3	3

Course Contents:

1. General instructions, Reconnaissance of the sites and fly levelling to establish bench marks.

2. Highway Project:

Relevant investigations, to align a new road between two obligatory points. Report should contain design of all features for the traffic and design speed assumed. Drawing shall include key plan, alignment, longitudinal section along final alignment and typical cross sections.

3. Water Supply and Sanitary Project:

Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of map by any suitable method of surveying (like plane tabling), location of sites for ground level and overhead tanks underground drainage system surveys for laying the sewers.

REFERENCES BOOKS:

1. S K Khanna, C E G Justo and A Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand and Bros, Roorkee
2. L R Kadiyali and Lal, Traffic Engineering and Transport planning, Khanna publicshers, New Delhi
3. K P Subramanium Transportation Engineering, SciTech Publications, Chennai
4. S.K.Garg, Water supply Engineering, Khanna Publishers
5. B C Punima and Ashok Jain Environmental Engineering I

VIII Semester

BTCE16F8100	Financial and Project Management	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Estimation, costing and valuation, CPM and PERT

Course Objectives:

1. Understand the Financial Management.
2. Understand the Economic analysis of the projects.
3. Understand the Financial Planning of the projects.
4. Understand the concept and functions of Entrepreneurship

Course Outcomes:

1. Explain the objectives of the financial management
2. Analyse the cost involved in the projects
3. Explain the Financial implications of the project and Economizing the projects
4. Explain the concept and functions of an entrepreneur.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F8100	**CO1**	**3**	**2**		**1**	**1**	**1**		**2**	**3**	**2**	**2**		**3**	**3**		**3**
	CO2	**3**	**2**		**2**	**2**			**2**	**2**	**2**	**3**		**3**	**2**		**3**
	CO3	**3**	**2**		**3**	**3**	**2**		**2**	**2**	**3**	**2**		**3**	**2**		**2**
	CO4	**3**	**3**		**2**	**2**			**3**	**2**	**3**	**2**	**2**	**3**	**3**		**1**

Course Contents:

UNIT-I **[12 HOURS]**

Principles of Economics: Importance of the economic background to measurement, objectives of business firm. Factors bearing on size of firms. Motives to growth. Obstacles to growth of firms, Study of present economy. Capital: Analysis of need for working capital, Estimation of requirements of working capital, Credit Management, Cash Management, Managing payments to suppliers and out standings.

UNIT-II **[12 HOURS]**

Economic Analysis: Cost implication to different forms of construction and maintenance and maintenance and replacement lives of material, Installation and running cost of services, Capital investment in project, Cost analysis by traders and by functional element, Cost planning techniques, Cost control during design and Construction, Depreciation, Various Appraisal Criteria Methods. Break-even analysis, Cash flow analysis, Risk Analysis and Management Practice, Role of Lender's Engineer.

UNIT-III **[12 HOURS]**

Financial Planning: Long term finance planning, Stock, Borrowings, Debentures, Loan Capital, Public Deposit, Dividend Policies, Bonus Shares, Market value of shares, Reserves. Over and under capitalization, Introduction to Micro financing.

UNIT-IV **[12 HOURS]**

Project management: Construction Accounts: Accounting process, preparation of profit and loss account and balance sheet as per the companies Act, 1956, preparation of contract accounts for each project, methods of recording and reporting site accounts between project office and head office, Ratio Analysis.

Case Studies: Case studies for Dams, Mass Transit System, Infrastructure Projects, Government Funded Projects with respect to a) Project Appraisal b) Raising of funds c) Cost to complete analysis

REFERENCE BOOKS

1. Mubarak, Construction project scheduling and control, Wiley India.
2. D Lal, Construction Management & PWD Accounts, S. K. Kataria & Sons, 2012
3. Singh H, Construction Management and Accounts -- Tata McGraw Hill, New Delhi, 1988
4. Cormican D. Construction Management: Planning and finance-- Construction press, London, Feb 2002.
5. Financial Management, Indian Institute of Banking and Finance – Macmillan Publications.
6. Projects planning, Analysis Selection, Implementation and Review, Prasanna Chandra Tata McGraw Hill, New Delhi, 2005

7. Pravin Kumar, Fundamentals of Engineering Economics, Wiley, India.
8. Leland T. Blank. Anthony Tarquin, Engineering Economy, McGraw Hill, 2008.

BTCE16F8210	**Design of Bridges**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of RCC, PSC Structures

Course Objectives:

1. To understand the concept of codal provisions for the design of bridges.
2. To study the loading patterns on the bridges.
3. To design the different types of bridges for railway and highway standards.
4. To understand the design principles of PSC bridges.

Course Outcomes:

1. To develop an understanding of an appreciation of basic concepts and terms involve in design of bridges.
2. To carry out a design of bridge starting from conceptual design
3. Shall be able to design the composite bridges and culverts
4. Shall be able to design PSC bridges

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F8210	CO1	1	1	1	-	1	-	2	1	2	-	-	-	3	3	2	3
	CO2	1	2	3	-	1	-	-	1	2	-	-	-	3	3	3	2
	CO3	3	3	3	1	1	-	1	-	1	-	-	-	3	3	3	1
	CO4	3	2	3	1	1	-	1	-	1	-	-	-	3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: History of bridges, Railway bridges and highway bridges, components of bridges and their definitions, classification of bridges and loads on bridges, selection of site for bridge design, types of abutments, piers, and wing walls, IRC codes for the design

Methods to calculate design discharge, natural, artificial and linear water ways, afflux, economic span, load combinations for different working state and limit state designs

UNIT-II **[12 HOURS]**

Design of slab culvert for class AA and class A loading, design of pipe culvert.

UNIT-III **[12 HOURS]**

Design of T beam: with cross beams by Piegaud's and Courbon's method for class AA loading, empirical design of substructures and foundations.

Choices of superstructure, longitudinal analysis of bridge, transverse analysis of bridge

UNIT-IV **[12 HOURS]**

Design of PSC bridges: Introduction to pre and post tensioning, analysis of main girder using Courbon's method for IRC class AA tracked vehicle, Design of end block

REFERENCE BOOKS:

1. D Johnson victor, Essential of bridge engineering, Oxford and IBH publishing Co New Delhi.
2. N Krishnaraju, Design of bridges, Oxford and IBH publishing New Delhi.
3. Jagadeesh T R and Jayaram M A, Design of bridge structures, Prentice hall of India pvt ltd.
4. IRC 6 – 1966 "Standard specification and code of practice for road bridges" section II
5. IRC 21 – 1966 "Standard specification and code of practice for road bridges" section II

BTCE16F8220	**Hydro Power Engineering**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Fluid Mechanics, Hydraulics & Hydraulic Machines

Course Objectives:

1. To learn about Reservoirs, sources of power, basic conceptsand and load estimation,
2. To know the regulations of Reservoirs, pumped storage Developments,
3. To Understand Project feasibilities studiesand System planning
4. To Design and construction of Hydro-electric works and power station planning.

Course Outcomes:

5. Explain various sources of power, relative importance of Hydro-Electric, Thermal, Nuclear, Geo-Thermal and other forms of energy development
6. Will be able to do load estimation, about regulations of reservoirs, understand about economic feasibility of projects
7. Will be able to design and construction of Hydro-Electric works
8. Can undertake power station planning

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
BTCE16F8220	CO1	3	2				2	3					2	3	1	3	3
	CO2	3	2				2	3	1				2	3	1	3	3
	CO3	3	2			1	2	3	1	2		2	2	3	1	3	3
	CO4	3	2				2	3	1	2		2	2	3	1	3	3

Course Contents:

UNIT-I [12 HOURS]

Historical developments and Basic concepts: Brief historical survey of power development, sources of power, relative importance of Hydro – electric, Thermal, Nuclear, Geo – thermal and other forms of energy development, types of water power development, run of the river plant, storage plants and pumped storage schemes

Basic Concepts: Plant Layout: plant capacity, load factor, hydro and thermal cost of power development, firm capacity, principles of Hydro power development, investigations and constructional aspects

UNIT-II [12 HOURS]

Load estimation and regulation of reservoirs: Daily and seasonal load curves. Market survey for demand, analysis of demand, Load duration curve, peak percentage curve, alternative cost approachfor choosing power schemes. Determination of size of power plant units. Operation of power schemes. Variation of efficiency with load fluctuation on power plants

Regulation of Reservoirs: storage, storage benefits. Dead storage and its effect on Power generation. Rule curves for operation, mathematical modelling for design and operation of power schemes

UNIT-III [12 HOURS]

Pumped storage developments, Project feasibility studies and system planning: General arrangement and layout of schemes, components of pumped storage schemes, the power house, mechanical and other equipments, operating conditions, economic aspects of inter connected grid systems

Project feasibility studies: economic feasibility, government regulation and ownership, financial feasibility

System planning: future system composition, planning a power system, sequential analysis of systems operation for best performance

UNIT-IV **[12 HOURS]**

Design and construction of Hydro Electric works and power station planning: Layout of schemes, design of intakes, penstocks, economic diameter of penstocks. Design of anchor blocks, saddles, air vents, water hammer problems- surge tanks – types, stability of surge tanks (Hydraulic aspects) – design of simple tanks by Johnson's method

Power station planning: Layout and equipment, general arrangement, underground power stations. Draft tubes and outlet channels. Power house sub structure and super structure.

REFERENCE BOOKS:

1. Creager and Justin, Hydro-Electric Power Hand book
2. Masonyi E, Water power development Vol. 1 and 2
3. Kulper E. Water Resources Development

BTCE16F8230	**Pavement Evaluation and Rehabilitation**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. Outline the various pavement failures, causes and remedial measures
2. Explain various methods of finding functional and structural condition of pavements
3. Discuss the need of PMS in planning and maintaining the flexible pavements.
4. Discuss the performance of pavements, causes of failure, rating methods.

Course Outcomes:

1. Identify the type of pavement failure, speculate its cause and decide the appropriate remedial measure
2. Evaluate and determine the functional and structural condition of pavements
3. Explain working of various pavement instrumentation technologies
4. Develop and validate models for predicting pavement performance

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4

BTCE16F8230	CO1	3	3				2	3	3	3	3		1	3	3	2	3
	CO2	3	3	3	2	1	2	2	3	2	2			3	2	3	3
	CO3	3	3	3	3		2	3	3	3	3	1	2	3	3	2	2
	CO4	3			3	3	3	3	2	2	3		2	3	3		1

Course Contents:

UNIT-I [12 HOURS]

Introduction: Structural and functional requirements of flexible and rigid pavements; pavement distresses; different types of pavement failures, causes and remedial measures.

Evaluation of Surface Condition: Methods of evaluating pavement surface condition, PCI and PSI, Measurement of skid resistance and unevenness by various methods

UNIT-II [12 HOURS]

Evaluation of Pavement Structural Condition: Evaluation by non –destructive tests such as FWD, Benkel man Beam rebound deflection using BBD for flexible overlay design, Plate load test, Evaluation by destructive testing methods.

UNIT-III [12 HOURS]

Pavement Instrumentation: Role of sensors in pavement evaluation. Principle and working of Load cells, Strain gauges, Density Gauges, Temperature Gauges and Multi-depth Deflectometer. Introduction to PMS: Basic components of PMS, Network and Project levels of PMS, Functions of PMS

UNIT-IV [12 HOURS]

Rehabilitation of Pavements: Asphalt pavement overlays, Surface preparations-Localized surface preparation, Asphalt pavement Cold Milling, Recycling of asphalt pavements, CIR and FDR, Rehabilitation techniques used in concrete pavements, Concrete pavement surface preparation, Rehabilitation versus Reconstruction.

REFERENCE BOOKS:

1. S K Khanna, C E G Justo and A Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand and Bros, Roorkee

2. Ralph Haas and Ronald W. Hudson, Pavement Management System, McGraw Hill Book Co. 1978.

3. Ralph Haas, Ronald Hudson Zanieswki. Modern Pavement Management, Krieger Publications, New York, 1992.

4. Proceedings of North American Conference on Managing Pavement, USA, 2004.

5. Proceedings of International Conference on Structural Design of Asphalt Pavements NCHRP, TRR and TRB Special Reports, USA, 2006.
6. Relevant IRC Codes

BTCE16F8240	Disaster Management and Mitigation	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. To create awareness on various natural and man-made disasters occur.
2. To learn about the concept of the chronological phases of natural disaster response, refugee relief operation, vulnerability assessment and preparedness for various disasters.
3. To learn about the various measures of disaster mitigation and disaster management.
4. To learn the importance of public awareness and rehabilitation.

Course Outcomes:

1. Demonstrate the usefulness of integrating management principles in disaster mitigation work.
2. Distinguish between the different approaches needed to manage pre, during& post disaster periods and examine the vulnerability, preparedness of disasters.
3. Describe the strategies of disaster management and explain the various mitigation measures.
4. Explain the various safety programmes, rehabilitation programmes and general awareness on disasters.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16 F8240	CO 1	2					3	3	1	1	1	2	2	3	2	1	2
	CO 2	2	2	2	1		2	3	1	3		2	3	3	2	3	2
	CO 3	2		3	2	3		3	1	3		1	3	3	2	2	2
	CO 4	2	2	3	1	2			2	3	2		3	3	2	1	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Principles of Disaster Management, Natural Disasters- earthquakes, floods, tsunamis, landslides and volcanoes, Significance of earth processes in natural disasters, Hazards, Risks and Vulnerabilities, Human induced disasters, Case studies of important natural and human induced disasters.

UNIT-II **[12 HOURS]**

Vulnerability Assessment and Preparedness: Assessment of Disaster Vulnerability of a location and vulnerable groups, Vulnerability assessment for earthquakes, floods, tsunamis, landslides and volcanoes, Preparedness for various Disasters- earthquakes, floods, tsunamis, landslides and volcanoes with special reference to construction of residential buildings and public utility buildings, Preparation of Disaster Management Plans

UNIT-III **[12 HOURS]**

Mitigation Measures and Disaster Management: Disaster mitigation planning of human settlements and townships for earthquakes, floods, Fire, tsunamis, landslides and volcanoes, Issues in Environmental Health, Water & Sanitation, Post disaster Relief & Logistics Management. Basic principles of disaster Management, Emergency Support Functions, Resource & Material Management, Management of Relief Camp, Information systems & decision making tools, Voluntary Agencies & Community Participation at various stages of disaster management

UNIT-IV **[12 HOURS]**

Rehabilitation and Awareness: School Awareness & Safety Programme, Integration of Rural Development Programmes with disaster reduction and mitigation activities, Role of Remote Sensing, Science & Technology Information systems and decision making tools in disaster management, Rehabilitation Programmes, New initiatives, Disaster management in India.

REFERENCE BOOKS:

1. R.B.Singh, Environmental Geography, Heritage Publishers New Delhi,1990
2. Savinder Singh Environmental Geography, PrayagPustakBhawan, 1997
3. Kates,B.I & White, G.F The Environment as Hazards, oxford, New York, 1978
4. R.B. Singh, Disaster Management, Rawat Publication, New Delhi, 2000
5. H.K. Gupta, Disaster Management, Universiters Press, India, 2003
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED) University of Tokyo, 1994
7. Dr. Satender , Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994
9. R.K. Bhandani An overview on Natural & Manmade Disaster & their Reduction, CSIR, New Delhi
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster
11. Abbott, P.L, Natural Disasters. 3rd Ed., McGraw Hill Company, 2001.

BTCE16F8310	**Repair & Rehabilitation of Structures**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Design of structures (RCC, Steel, PSC), Concrete Technology, Masonry Structures

Course Objectives:

1. To learn about causes of deterioration of structures, the investigation and methods of diagnosis of damaged structures and Quality assurance for concrete properties.
2. To learn about influence on serviceability and durability properties of concrete, cause of corrosion and methods to prevent corrosion. Importance and protective measures on various aspects of maintenance.
3. To learn about Inspection, Assessment procedure for evaluating a damaged structure and materials used for repair of damaged structure
4. To learn about techniques for repair , case studies

Course Outcomes:

1. Identify the causes of deterioration of structures, diagnosis of damaged structures by using various methods and capable of maintaining Quality assurance for concrete properties.
2. Examine influence on serviceability and durability properties of concrete, should give preventive measures of corrosion control by various methods.
3. Asses and evaluate the damaged structure by using suitable materials.
4. Identify techniques for repair with the help of different case studies

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F8310	CO1	3	2	3	2		2	1	2		3	2		3	3		3
	CO2	3	2	2	3	3	2	3	1	2	3	1	2	3	3	1	3
	CO3	3	3	3	1	3	1	1		1	2	3	2	3	3	1	3
	CO4	2	3	3	2	3	2	3	2	1	1	1	2	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

Deterioration of concrete in structures: Physical processes of deterioration like Freezing and Thawing, Wetting and Drying, Abrasion, Erosion, Pitting, Chemical processes like Carbonation, Chloride ingress, Corrosion, Alkali aggregate reaction, Sulphate attack Acid attack, temperature and their causes, Mechanism, Effect, preventive measures. – Cracks:Cracks in concrete, type, pattern, quantification, measurement & preventive measures.

UNIT-II [12 HOURS]

Failure of buildings: Definition of building failure-types of failures- Causes of Failures- Faulty Design, Accidental over Loading, Poor quality of material and Poor Construction practices- Fire damage – Methodology for investigation of failures-diagnostic testing methods and equipments-repair of cracks in concrete

UNIT-III **[12 HOURS]**

Materials for repair and rehabilitation -Admixtures- types of admixtures- purposes of using admixtures- chemical composition- Natural admixtures- Fibres- wraps- Glass and Carbon fibre wraps- Steel Plates-Concrete behavior under corrosion, disintegrated mechanisms- moisture effects and thermal effects – Visual investigation- Acoustical emission methods- Corrosion activity measurement- chloride content – Depth of carbonation- Impact echo methods- Ultrasound pulse velocity methods- Pull out tests.

UNIT-IV **[12 HOURS]**

Repair Techniques: Grouting, Jacketing, Shotcreting, externally bonded plates, Nailing, Underpinning and under water repair; Materials, Equipments, Precautions and Processes.

Investigation of structures: Distress, observation and preliminary test methods. Case studies: related to rehabilitation of bridge piers, dams, canals, heritage structures, corrosion and erosion damaged structures.

REFERENCE BOOKS:

1. B.L. Gupta & Amit Gupta, Maintenance & Repair of Civil Structures
2. B. Vidivelli, Rehabilitation of Concrete Structures, Standard Publishers.
3. V. K. Raina, Concrete Bridge Practice Construction, Maintenance & Rehabilitation.
4. R. Doodge Woodson, Concrete Structures- protection Repair and Rehabilitation, BH Publishers

BTCE16F8320	**Environmental Impact Assessment**	L	T	P	C
Duration:16 Wks		2	1	0	3

Prerequisites:

Knowledge in Water Supply Engineering and Waste Water Treatment, Solid and Hazardous Waste Management, Air and Noise Pollution control, Industrial Waste Water Treatment

Course Objectives:

1. To provides instruction in the theory and methods of environmental impact assessment (EIA).
2. To Gain a critical understanding of the use, strengths, and limitations of EIA, and develop working familiarity with EIA methods and analytic techniques.
3. To use for professional planning for different ways which includes evaluation of proposed public and private development projects, government policies and programs.

Course Outcomes:

1. Strengthen understanding of the impacts related to developing projects on Environment, culture and socio-economic environment.
2. Understanding the methodology for preparation of a systematic EIA report.
3. Learn to discuss adaptive management and monitoring as follow up activities.
4. Through case studies, students get exposed to a variety of different resettlements, scenarios, challenges and solutions.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE 16F8 320	CO1	3	3	2	3	3	-	-	-	2	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	2	-	2	-	2	-	-	3	3	3	3	3
	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

Introduction: Environmental Impact Assessment (EIA), Historical development of Environmental Impact Assessment - Environmental Impact Statement (EIS) - Environmental Risk Assessment (ERA) - Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of Reference in EIA- Issues in EIA - national - cross sectoral - social and cultural.

UNIT-II [12 HOURS]

Components and Methods & Quality Control: Components - screening - setting - analysis - prediction of impacts - mitigation. Matrices - Networks - Checklists. Importance assessment techniques - cost benefit analysis - analysis of alternatives - methods for Prediction and assessment of impacts - air - water - soil - noise - biological - cultural - social - economic environments.

Standards and guidelines for evaluation, Public Participation in environmental decision making, Trends in EIA practice and evaluation criteria - capacity building for quality assurance.

UNIT-III **[12 HOURS]**

Expert System in EIA - use of regulations and AQM. Document planning - collection and organization of relevant information - use of visual display materials – team writing - reminder checklists. Environmental monitoring - guidelines - policies - planning of monitoring programmes. Environmental Management Plan, Post project audit.

UNIT-IV **[12 HOURS]**

Case Studies of EIA of Developmental Projects- EIA for Water resource developmental projects, Highway projects: Nuclear-Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

RERERENCE BOOKS:

1. Canter, L.W., Environmental Impact Assessment, McGraw Hill, New York, 1996.
2. Petts, J., Hand book of Environmental Impact Assessment Vol. I and II, Blackwell Science, London, 1999.
3. The World Bank Group. Environmental Assessment Sourcebook Vol. I, II and III, the World Bank.
4. Guidelines for EIA of developmental Projects Ministry of Environmentand Forests, GOI.

BTCE16F8330	**Highway Economics and Preparation of Detailed Project Report**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

None

Course Objectives:

1. To give the students an overview of Economics, its basic terms and concepts, and discuss various types of costs and benefits that economist discuss in transport projects.
2. To educate students the importance of transport economic analysis and edify the basic methods of economic analysis carried for transportation engineering projects.
3. To make the students capable of recognizing a project from different methods of economic analysis by identifying the limitations of each method.
4. To expose the students to the surveys to be conducted and the method of preparing detailed project report.

Course Outcomes:

1. Elucidate the elements of transport economics: highway transportation costs, road user costs and benefits.

2. Explain the economic evaluation of null alternative, methods of analysis when applied to a group of mutually exclusive alternatives, depreciation cost, accounting methods, salvage value estimation, depreciation, taxes.
3. Associate characteristics and limitations of the different methods of economic analysis, ranking of independent projects, sensitivity analysis.
4. To appreciate the surveys to be conducted and the method of preparing detailed project report.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE16F8330	CO1	3	2		1	1	1		2	3	2	2		3	3		3
	CO2	3	2		2	2			2	2	2	3		3	2		3
	CO3	3	2		3	3	2		2	2	3	2		3	2		2
	CO4	3	3		2	2			3	2	3	2	2	3	3		1

Course Contents:

UNIT-I [12 HOURS]

Introduction: Concepts and Principles of Engineering Economics, Identification and Measurements of Highway Benefits, Highway Transportation Costs, Road User Costs and Benefits, Road User Cost Study in India. Illustrative applications. Numerical examples.

UNIT-II [12 HOURS]

Methods of Economic Analysis: Basic Characteristics of BCR, NPV, IRR methods. Illustrative applications on above. Comparison of the Methods of Analysis when Applied to a Group of Mutually Exclusive Alternatives. Economic Evaluation of Null Alternative. Numerical examples.

UNIT-III [12 HOURS]

Depreciation Concepts: Depreciation Cost, accounting Methods, Salvage Value Estimation, Depreciation, Taxes, Problems. Characteristics and Limitations of the Different Methods of Economic Analysis, Ranking of Independent Projects, Sensitivity Analysis. Case studies. Numerical examples.

UNIT-IV **[12 HOURS]**

Preparation of Detailed Project Report – Introduction, DPR Surveys & Formats, Feasibility report, Road inventories and data Sheets, preparation and presentation of project documents, checklist of major operations involved in the survey and investigation for a road project. Questionnaire for Environmental Appraisal(For Road/Highway Projects), Checklists.

REFERENCE BOOKS:

1. S K Khanna, C E G Justo and A Veeraragavan, Highway Engineering, Revised 10th Edition, Nemchand and Bros, Roorkee
2. Robley Winfrey, Economic Analysis for Highways, International Textbook Company, Pennsylvania, 1990.
3. Kenneth J Button, Transportation Economics, Edward Elgar publishing
4. Jotin Khisty and Kent Lall, Introduction to Transportation Engineering, PHI, New Delhi, 2001.
5. Kadiyali.L.R., Traffic Engineering and Transport planning, Khanna publications.
6. IRC: SP: 30-1993, Manual on Economic Evaluation of Highway Projects in India.

BTCE16F8340	**Plastic Analysis of Structures**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of steel structures.

Course Objectives:

1. To familiarize the concept of Plastic mechanism
2. To understand the analysis of indeterminate structures with the application of plastic mechanism
3. To understand the concept of minimum weight design

Course Outcomes:

1. Design the indeterminate structures using plastic analysis concept
2. Design through minimum weight design concept

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BTCE 16F8 340	CO1	**2**	**3**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**	**2**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**3**		**1**	**2**	**1**	**2**		**1**	**2**	**3**	**3**	**2**	**1**
	CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**

.

Course Contents:

UNIT-I [**12HOURS]**

Introduction: Ductility of metals: Concept of plastic design, Overloaded factors, Ultimate load analysis and methods of mechanism

UNIT-II [**12HOURS]**

Analysis of Indeterminate Structures: Hinge formation in indeterminate structures, Redistribution of moments, Assumption made for structure subjected to bending only. Numerical example

UNIT-III [**12HOURS]**

Minimum Weight Design: Concept, assumption, Design of frame with prismatic members, Elements of linear programming and its application to minimum weight design problems.

UNIT-IV [**12HOURS]**

Deflection: Assumption, Calculation of deflection at ultimate loads, Permissible rotations.
Secondary Design Considerations: Influence of direct load, shear local bucking, lateral bucking, repeated loading and brittle fracture on moment capacity. Design of eccentrically loaded columns: Problem of incremental Collapse, Shake down analysis. Special considerations for design of structures using light gauge metals.

REFERENCE BOOKS :

1. Neal B G, Plastic Methods of Structural Analysis, Chapman Hall, London
2. Manika Selvam V K, Limit Analysis of Structures, Dhanpat Rai Publications, New Delhi, 1997.
3. Arya A S and Ajmani J L, Design of Steel Structures, Nem Chand & Bros, Roorkee.1992.
4. Chandra R, Design of Steel Structures, Vol. I & II Standard Book House, Delhi, 1999.
5. M.P. Nielsen, Limit Analysis and Concrete Plasticity, CRS Press, London, 1998.

BTCE16F8400	Project	L	T	P	C
Duration:16 Weeks					

Description of the course:
Project consists of several aspects of civil engineering courses studied by taking up topic of interest related to field of civil engineering. The student with the concepts of differenct courses and carrying out the literature review, will complete the Project work with submission of report and presentation of the project work taken up in civil engineering.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO 4
BTCE16F8400	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3