REVA UNIVERSITY
Bengaluru, India

SCHOOL OF CIVIL ENGINEERING

B.Tech. in Civil Engineering

HANDBOOK

2015 - 19

Rukmini Knowledge Park,
Kattigenahalli, Yelahanka, Bangalore - 560 064
Phone No: +91-080-46966966

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.

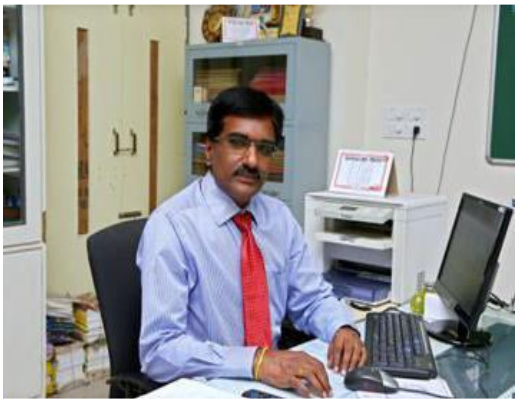
With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We 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!

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.

Dr. Y. Ramalinga Reddy
Director
School of Civil Engineering

CONTENTS

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
1	**Dr.Y.Ramalinga Reddy** Director, School of Civil Engineering, REVA University	**Chairperso**n	Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9448508996 Email: ramalingareddy@reva.edu.in
2	Dr.V.Ramachandra Zonal Head, Technical Services, Ultra Tech Cement Ltd.,	Member	Zonal Head, Technical Services, Ultra Tech Cement Ltd., Industry House, 6th floor, #45, Race Course Road, Bangalore 560 001, (M)97432-47985 Email: ramachandra.v@adityabirla.com
3	Dr.G.Anand Director, APT Consulting Engineering Service,	Member	No. 55/2, 3rd fkiir, East Park Road, Malleshwaram, Bangalore- 560055 (M): 9845128153 Email: gananda36@gmail.com
4	Sri. N.Ranganath Managing Director, EIT Technology Pvt. Ltd.,	Member	35th 'C' Cross, 4th T block, Jyaynagar, Bangalore- 560041 (M): 9449021149 Email: nranganatha@eitech.in
5	Dr.R.V.Ranganath Professor , Department of Civil Engineering, BMS College of Engineering	Member	Professor , Dept. of Civil Engineering, BMS College of Engineering, Bull Temple Road,Bangalore-560 019 (M) 98450-86602 Email: rangarv@yahoo.com
6	Dr.K.M.Krishna Murthy RAASTA- Centre for Road Technology	Member	Volvo Equipment Campus, Phase-1, Peenya Industrial area, Bangalore-560058 (M): 9844119221 Email: group.rasta@raastaindia.com
7	Dr.Sunil Kumar Tengli Professor, REVA University	Member (Internal)	School of Civil Engineering,

			Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9844057122 Email: dr.sktengali@reva.edu.in
8	Dr.P.Shivananda Professor, REVA University	Member (Internal)	School of Civil Engineering, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9448047250 Email:pshivananda @reva.edu.in
9	Dr.N.Naga Maruthi Kumari Professor, REVA University	Member (Internal)	School of Applied Science, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 876200582 Email: nagamaruthi.kumari@reva.edu.in
10	Dr.Gayathri K Professor, REVA University	Member (Internal)	School of Applied Science, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 8762004285 Email: gayathri.k @reva.edu.in

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

PEO-1	To have successful professional careers in construction industry, government, academia and military as innovative engineers.
PEO-2	To successfully solve engineering problems associated with planning, design & construction of civil engineering projects by executing construction works effectively either leading a team or as a team member
PEO-3	To continue to learn and advance their careers through activities such as participation in professional organizations, attainment of professional certification for life long learning and seeking higher education.
PEO-4	To be active members ready to serve the society locally and internationally and will take up entrpreneurship for the growth of economy and to generate employment.

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

Sl. No.	Name of Members
1	**Dr. A.Veeraraghavan** Professor, Department of Civil Engineering, IIT Madras, Room No:#234, Building Sciences Block, IIT Madras, Chennai-600036 (o) 044-22574272 Fax:044-22570509 Email: av@iitm.ac.in
2	**Mr. Nagaraj Kulkarni** Vice-President DivyaSree Developers (P) Ltd., DivyaSree Chambers, A Wing, #11, O'Shaugnessy Road, Shanthi Nagar, Bangalore 560 025. (M) 98452 11750 Email: nagaraj@divyasree.com
3	**Dr. V. Ramachandra** Zonal Head, Technical Services, Ultra Tech Cement Ltd., Industry House, 6th floor, #45, Race Course Road, Bangalore 560 001, (M)97432-47985 Email: Ramachandra.v@adityabirla.com
4	**Dr. Mattur C Narasimhan,** Professor, Department of Civil Engineering, NIT, Surathkal, Karnataka 575 025 (O) 0824-2474000Ext 3336 (R) 0824-2474336 (M) 94491-63427 Email: mattur.cn@gmail.com mattur@nitk.ac.in
5	**Dr.R.V.Ranganath** Dean (Academic), Principal Professor & HOD, Department of Civil Engineering, BMS College of Engineering, Bull Temple Road, Bangalore-560 019 Currently Principal BMSIT, Yelahanka, Bangalore (M) 98450-86602 Email: rangarv@yahoo.com

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.

   (i) 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** = 24x6.83+24x7.29+24x8.11+26x7.40+26x8.29+24x8.58+24x9.12+24x9.25 = 8.10
196

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

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 Management)	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 / Computer Science
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	P 0 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
BTEM 15F1 100	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
BTEC 15F1 200	CO1	3	2	3	1	1	3	-	-	-	-	-	2	3			
	CO2	3	3	2	2	1	1	-	-	-	-	-	2	3			
	CO3	3	3	-	-	1	1	-	-	-	-	-	-	3			
BTBE 15F1 300	CO4	3	2	1	1	1	-	-	-	-	-	-	1	3			
	CO1	3	3	3	3	2								1	1	1	1
	CO2	3	3	3	3	3									1	2	
	CO3	3	2	3	3	3										1	1
BTCC 15F1 400	CO4	3	2	3	3	2										1	1
	CO1	3	3	2	3	3	-	1	-	-	-	-	3	3	3	3	3
	CO2	3	2	2	3	2	-	-	-	-	-	-	3	3	3	3	3
	CO3	2	3	2	1	2	-	2	-	-	-	-	3	3	3	3	3
BTES 15F1 500	CO4	3	2	1	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				

BTTE 15F1 600	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
BTED 15F1 700	CO4	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO1	3	2	3	2									3	3	3	3
	CO2	2	2		2								1	3	3	3	3
	CO3	3	3	2	3	1								3	3	3	3
BTCL 15F1 800	CO4	2	2	3	3		2					1	2	3	3	3	3
	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
BTCL 15F1 900																	
	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
BTEP 15F2 100	CO4	2	2	1		1	-	-	-	-	-	-	-	3	2	1	2
	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
	CO1	3	3		1									3	3	3	3
	CO2	3	2	1										3	3	3	3

BTEP 15F2 200	CO3	3	2					1						3	3	3	3
BTCV 15F2 300	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
BTCV 15F2 400	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
BTEE 15F2 500	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			
BTIC1 5F26 00	CO1						2		3				2	-	-	-	-
	CO2								3		3		2	-	-	-	-
	CO3	2					2		3		2		3	-	-	-	-
	CO4	2					2		3				2	-	-	-	-
BTCE 15F2 700	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				
	CO1	3	3		1									3	3	3	3
	CO2	3	2	1										3	3	3	3

BTEP 15F2 800	CO3	3	2					1						3	3	3	3
	CO4	3	2					1						3	3	3	3
BTEW 15F2 900	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			
BTCE 15F3 100	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
BTCE 15F3 200	CO1	3	1	2	1					2	2		2	3	1	2	2
	CO2	3	1	2	2					2	2		3	3	1	2	2
	CO3	3	2	3	1					2	2		2	3	1	2	2
	CO4	3	2	3	1					2	2		3	3	1	2	2
BTCE 15F3 300	CO1	3	1	2	1					2	2		2	3	1	2	2
	CO2	3	1	2	2					2	2		3	3	1	2	2
	CO3	3	2	3	1					2	2		2	3	1	2	2
	CO4	3	2	3	1					2	2		3	3	1	2	2
BTCE 15F3 400	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
	CO1	3	3	1	1	1	2	1		1	2		3	3	3	3	2

BTCE 15F3 500	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
BTCE 15F3 600	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
BTCE 15F3 700	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
BTCE 15F3 800	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
BTCE 15F4 100	CO1	3	3	1										3	2	1	1
	CO2	3	2	1										3	1	1	1
	CO3	3	3	2	3									3	3	3	2
	CO4	3	3	3	2									3	3	3	1
BTCE 15F4 200	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
	CO1	3	2	2						2			3	3	3	3	3

BTCE 15F4 300	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
BTCE 15F4 400	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
BTCE 15F4 500	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
BTCE 15F4 600	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
BTCE 17F4 700	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
BTCE 15F4 800	CO1	3	3	2	-	-	-	-	-	2	-	-	3	2	2	3	3
	CO2	3	3	2	-	-	-	-	-	2	-	-	3	2	2	3	3
	CO3	2	2	2	2	-	-	-	-	2	-	-	2	2	2	2	2
	CO4	2	2	2	2	-	-	-	-	2	-	-	2	2	2	2	2

BTCE 15F5 100	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
BTCE 15F5 200	CO4	3	3	3	2	3	2	2	2	1	2	1	2	3	3	3	3
	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
BTCE 15F5 300	CO4	1	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	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
BTCE 15F5 400	CO4	3			3	3	3	3	2	2	3		2	3	3		1
	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
BTCE 15F5 500	CO4	3	2	2	1		2		1		2	3		2	3	3	2
	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
BTCE 15F5 600	CO4	3	2	3	3		2	1			2			3	3	3	2
	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

BCE15F5710	CO4	3	3	1		3	2						2	3	3		3
	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
BTCE15F5720	CO 4	3	1		1	1		3	2	1	1		3	3	2	1	3
	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
BTCE15F5730	CO4	2	2	-	1	1	-	-	-	-	-	-	-	3	3	1	2
	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
BTCE15F5740	CO4	3	3	1	2	3	2	3		2			3	3	3	3	3
	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
BTCE15F5750	CO4	3	3	1	2	3	2	3		2			3	3	3	3	3
	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
	CO1	3	2	2						2			3	3	3	3	3
	CO2	3	2	3	2					2			3	3	3	3	3

BTCE 15F4 300	CO3	3	2	3	2					2			3	3	3	3	3
BTCE 15F5 900	CO4	3	2	3	1					2			3	3	3	3	3
	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
BTCE 15F5 300	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
BTCE 15F6 200	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
BTCE 15F6 300	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
BTCE 15F6 400	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
	CO1	3	2	2	-	-	-	-	-	2	-	-	3	3	3	3	3

BTCE 15F6 510	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
BTCE 15F6 520	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
BTCE 15F6 610	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
BTCE 15F6 620	CO4	2	3	3	2	3	2	3	2	1	1	1	2	3	3	3	3
	CO1	2	3	1										2	3		
	CO2		2	2										3		1	2
	CO3	1	2					1						2		1	
BTCE 15F6 630	CO4	1	2	1										2			1
	CO1	3	1	1	2					1				3	3	3	3
	CO2	2	2	2	1		1				1		1	3	3	3	3
	C03	3	3	2	2			1			1	1		3	3	3	3
BTCE 15F6 640	CO4	3	3	2	2			1			1	1		3	3	3	3
	CO1	3	1	1	2					1				3	3	3	3
	CO2	2	2	2	1		1				1		1	3	3	3	3
	C03	3	3	2	2			1			1	1		3	3	3	3
	CO4	3	3	2	2			1			1	1		3	3	3	3

BTCE 15F6 650	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
BTCE 15F6 700	CO4	3	3	2	2	2		2					3	3	3	3	3
	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
BTCE 15F6 800	CO4	3	2					1						3	3	3	2
	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
BTCE 15F7 100	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO1	3	1	1	2					1				3	3	3	3
	CO2	2	2	2	1		1				1		1	3	3	3	3
	C03	3	3	2	2			1			1	1		3	3	3	3
BTCE 15F7 210	CO4	3	3	2	2			1			1	1		3	3	3	3
	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
BTCE 15F7 310	CO4	2	3	3	1		2	3	1	1	1		2	3	3	3	1
	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

BTCE 15F7 320	CO4	3	1	2	1	3	1	2	1			3	3	3	3	3	3
	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
BTCE 15F7 410	CO4	3	2	3	3		2	1			2			3	3	3	2
	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
BTCE 15F7 420	CO 4	3	1		1	1		3	2	1	1		3	3	2	1	3
	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
BTCE 15F7 430	CO4	3	2	3	2			1					3	3	3	3	3
	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
BTCE 15F7 440	CO4	3	2	3	2			1					3	3	3	3	3
	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
	CO1	3	3	3	2						1		1	3	2	3	2
	CO2	3	3	3	2			2		3	3			3	3	3	2

BTCE 15F7 450	CO3	3	3	2	2		1			2	1			3	3	3	2
BTCE 15F7 510	CO4	3	3			2					2	3	2	3	3		1
	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
BTCE 15F7 520	CO4	3	2	3	1	1		1		1				3	3	3	2
	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
BTCE 15F7 530	CO4	3	3	1		3	2						2	3	3		3
	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
BTCE 15F7 540	CO4	3	3	1		3	2						2	3	3		3
	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
BTCE 15F7 550	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	3
	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

BTCE 15F7 800	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	3
	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
BTCE 15F7 900	CO4	3	2	-	2			1						3	3	3	2
	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
BTCE 15F8 100 / BTCE 15F8 200 BTCE 15F8 310	CO4	3	3	3	3	3		3					3	3	3	3	3
	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	3	3											3	3			3
	3	3	1										3	3			3
BTCE 15F8 320	3	3	2			1					1		3	3		1	3
	2	2	1	2	3	2	1	2	1	1		2	3	3	3	2	2
	CO1	2				2		3				2		3	2	1	2
	CO2	2	2	1		2		2						3	2	1	2
BTCE 15F8 330	CO3	2				3		2						3	3	3	1
	CO4	2				3		1						3	3	3	2
	CO1	3	3	2	3	3							3	3	3	3	3
	CO2	3	3	2	3	2							3	3	3	3	3

BTCE 15F8 340	CO3	3	3	2	1	2		2					3	3	3	3	3
	CO4	3	3	1	2	2		2					3	3	3	3	3
	CO1	3	3	3	2						1		1	3	2	3	2
	CO2	3	3	3	2			2		3	3			3	3	3	2
BTCE 15F8 410	CO3	3	3	2	2		1			2	1			3	3	3	2
	CO4	3	3			2					2	3	2	3	3		1
	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
BTCE 15F8 420	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
	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
BTCE 15F8 510	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
	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
BTCE 15F8 520	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
	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
	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3

BTCE 15F8 530	CO2	3	3	2	3	2	1	1	1		1	1	3	3	3	3	3
BTCE 15F8 530	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
	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3
BTCE 15F8 540	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
	CO1	3	3	2	2	2	1	1			1	1	3	3	3	3	3

Mapping of PEOS with Respect to POs & PSOs

	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	PSO 2	PSO 3	PSO 4
PEO1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

B. Tech in Civil Engineering
Scheme of Instructions

Sl. No.	Course Code	Course Title	Types of course HC/ SC/OE	Credit Pattern and Value				Weekly Contact Hours	Teaching School/Dept.
				L	T	P	C		
First Semester: CHEMISTRY CYCLE									
1	BTEM15F1100	Engineering Mathematics – I	HC	3	1	0	4	5	Mathematics
2	BTEC15F1200	Engineering Chemistry	HC	2	1	0	3	4	Chemistry
3	BTBE15F1300	Basic Electronics Engineering	HC	2	1	0	3	4	Electronics
4	BTCC15F1400	Computer Concepts & C Programming	HC	2	1	0	3	4	CSE
5	BTES15F1500	Environmental Sciences	FC	1	1	0	2	3	Civil
6	BTTC15F1600	Technical Communication and Documentation	FC	1	1	0	2	3	Humanities
7	BTED15F1700	Computer Aided Engineering Drawing	HC	2	0	2	4	8	Mechanical
8	BTCL15F1800	Chemistry Lab	HC	0	0	2	2	3	Chemistry
9	BTCP15F1900	Computer Programming Lab	HC	0	0	2	2	3	CSE
Total Credits for the First Semester:							25	35	
Second Semester: Chemistry Cycle									
1	BTEM15F2100	Engineering Mathematics – II	HC	3	1	0	4	5	Mathematics
2	BTEP15F2200	Engineering Physics	HC	2	1	0	3	4	Physics
3	BTCV15F2300	Elements of Civil Engineering	HC	2	1	0	3	4	Civil
4	BTME15F2400	Elements of Mechanical Engineering	HC	2	1	0	3	4	Mechanical

5	BTEE15F2500	Basic Electrical Engineering	HC	2	1	0	3	4	Electrical
6	BTIC15F2600	Indian Constitution and Professional Ethics	FC	1	1	0	2	3	Humanities
7	BTCE15F2700	Communicative English	FC	1	1	0	2	3	Humanities
8	BTPL15F2800	Physics Lab	HC	0	0	2	2	3	Physics
9	BTEW15F2900	Basic Electrical Engineering lab and Workshop Practice	HC	0	0	2	2	3	Electrical and Mechanical
Total Credits for the Second Semester:							**24**	**33**	

III SEMESTER

Sl. No	**Course Code**	**Title of the Course**	**HC/FC/SC/OE**	**Pre requisite**	**Credit Pattern & Credit Value**				**Contact Hours / Week**	**Teaching School/Dept.**
					L	**T**	**P**	**Total**		
1	BTCE15F3100	Engineering mathematics-III	HC	BTEM15F1100	3	1	0	4	5	Mathematics
2	BTCE15F3200	Building Materials & Construction Technology	HC	-	2	1	0	3	4	Civil
3	BTCE15F3300	Engineering Earth Science	HC	-	2	1	0	3	4	Civil
4	BTCE15F3400	Surveying	HC	-	2	1	0	3	4	Civil

5	BTCE15F3500	Strength of Materials	HC	BTCV15F2300	3	1	0	3	5	Civil
6	BTCE15F3600	Fluid Mechanics	HC	BTCV15F2300	2	1	0	3	4	Civil
7	BTCE15F3700	Basic Materials Testing Lab	HC	BTCE15F3200	1	0	1	2	3	Civil
8	BTCE15F3800	Surveying Practice Lab	HC	BTCE15F3400	1	0	1	2	3	Civil
Total Credits for the Third Semester								**24**	**31**	

IV SEMESTER

Sl. No	Course Code	Title of the Course	HC/ FC/ SC/ OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours / Week	Teaching School/Dept.
					L	T	P	Total		
1	BTCE15F4100	Concrete Technology & Alternative Building Materials	HC	BTCE15F3200	2	1	0	3	4	Civil
2	BTCE15F4200	Applied Surveying & GIS	HC	BTCE15F3400	2	1	0	3	4	Civil
3	BTCE15F4300	Building Planning & Drawing	HC	BTCE15F3200	1	2	0	3	5	Civil
4	BTCE15F4400	Water Supply Engineering & Introduction to EIA	HC	-	2	1	0	3	4	Civil
5	BTCE15F4500	Basic Structural Analysis	HC	BTCE15F3500	3	1	0	4	5	Civil
6	BTCE15F4600	Hydraulic Machines	HC	BTCE15F3600	3	1	0	4	5	Civil
7	BTCE15F4700	Advanced Surveying Lab	HC	BTCE15F4200	1	0	1	2	3	Civil
8	BTCE15F4800	Engineering Earth Science Lab	HC	BTCE15F3300	1	0	1	2	3	Civil
Total Credits for the Fourth Semester								**24**	**34**	

V SEMESTER

Sl. No	Course Code	Title of the Course	HC/ FC/ SC/ OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours/ Week	Teaching School /Dept.
					L	T	P	Total		
1	BTCE15F5200	Used water treatment & Solid Waste Management	HC	BTCE15F3600	2	1	0	3	4	Civil
2	BTCE15F5300	Transportation Engg-I	HC	-	2	1	0	3	4	Civil
3	BTCE15F5400	Hydrology & Irrigation Engineering	HC	BTCE15F3600	2	1	0	3	4	Civil
4	BTCE15F5500	Geotechnical Engg-I	HC	BTCE15F3600, BTCE15F3500	2	1	0	3	4	Civil
5	BTCE15F5600	Intermediate Structural Analysis	HC	BTCE15F3500	2	1	0	3	4	Civil
6	BTCE15F5710	Design of Masonry Structures	SC	BTCE15F3500	2	1	0	3	4	Civil
	BTCE15F5720	Advanced Surveying		BTCE15F4200	3	1	0	4	5	Civil
	BTCE15F5730	Remote Sensing and GIS		BTCE15F4200	3	1	0	4	5	Civil
	BTCE15F5740	Ground Water Hydraulics		BTCE15F5200	3	1	0	4	5	Civil
	BTCE15F5750	Urban Transport Planning		-	3	1	0	4	5	Civil
7	BTCE15F5800	CAD Lab	HC	BTCE15F3200	3	1	0	4	5	Civil
8	BTCE15F5900	Geotechnical Engineering Lab	HC	BTCE15F5500	1	0	1	2	3	Civil
Total Credits for the Fifth Semester								**26**	**35**	

VI SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours/ Week	Teaching School/Dept.
					L	T	P	Total		
1	BTCE15F6100	Transportation Engg-II	HC	BTCE15F5300	2	1	-	3	4	Civil
2	BTCE15F6200	Geotechnical Engg-II	HC	BTCE15F5500	2	1	-	3	4	Civil
3	BTCE15F6300	Design of steel structures	HC	BTCE15F3500	2	1	-	3	4	Civil
4	BTCE15F6400	Estimation and project management	HC	-	2	1	-	3	4	Civil
5	BTCE15F6510	Design of Hydraulic structures	SC	BTCE15F3600	2	1	-	3	4	Civil
	BTCE15F6520	Earth and Rock Fill Dams		BTCE15F3600	2	1	-	3	4	Civil
	BTCE15F6610	Repair & rehabilitation of structures		BTCE15F3500	2	1	-	3	4	Civil
	BTCE15F6620	Structural Dynamics		BTCE15F3500	2	1	-	3	4	Civil
6	BTCE15F6630	Earth & Earth retaining structures	SC	BTCE15F5500	2	1	-	3	4	Civil
	BTCE15F6640	Transportation Economics		BTCE15F5300	2	1	-	3	4	Civil
	BTCE15F6650	Air and noise pollution		-	2	1	-	3	4	Civil
	BTCE15F6700	Extensive survey Practice		BTCE15F4200	2	1	-	3	4	Civil
7	BTCE15F6800	HHM Lab	HC	BTCE15F3600	1	0	2	3	3	Civil
Total Credits for the Sixth Semester								**24**	**32**	

VII SEMESTER

Sl. No	Course Code	Title of the Course	HC/FC/SC/OE	Pre requisite	Credit Pattern & Credit Value				Contact Hours/Week	Teaching School/Dept.
					L	T	P	Total		
1	BTCE15F7100	Transportation Engineering-III	HC	BTCE15F6100	2	1	0	3	2	MBA
2	BTCE15F7200	Design & Drawing of RCC & steel Structures	HC	BTCE15F5710, BTCE15F6300	1	1	0	2	1	Civil
3	BTCE15F7310	Design of precast & pre-stressed concrete structures	SC	BTCE15F6300	3	1	0	4	3	Civil
	BTCE15F7320	Advanced Design of Shallow Foundations		BTCE15F6200	3	1	0	4	3	Civil
4	BTCE15F7410	Theory of elasticity	SC	BTCE15F3500	3	1	0	4	3	Civil
	BTCE15F7420	Open channel hydraulics		BTCE15F3600	3	1	0	4	3	Civil
	BTCE15F7430	Foundation engineering in difficult ground		BTCE15F6200	3	1	0	4	3	Civil
	BTCE15F7440	Solid & hazardous waste management		-	3	1	0	4	3	Civil
	BTCE15F7450	Road safety & Management		-	3	1	0	4	3	Civil
5	BTCE15F7510	Design of bridges & water tanks	SC	BTCE15F3500	3	1	0	4	3	Civil
	BTCE15F7520	Matrix methods of structural analysis		BTCE15F3500	3	1	0	4	3	Civil
	BTCE15F7530	Reinforced earth structures		BTCE15F6200	3	1	0	4	3	Civil
	BTCE15F7540	Pavement management system		-	3	1	0	4	3	Civil
	BTCE15F7550	Environmental impact assessment		-	3	1	0	4	3	Civil
6	XXXXXXXXX	Open Elective-II	HC	-	4	0	0	4	4	Civil

7	BTCE15F7800	Concrete & Highway Materials Lab	HC	BTCE15F4100	1	0	1	2	1	Civil
8	BTCE15F7900	Environmental Engineering Lab	HC	-						
Total Credits for the Sixth Semester								**25**	**32**	

VIII SEMESTER

Sl. No	**Course Code**	**Title of the Course**	**Practical /Term Work / Sessions**	**Pre requisite**	**Credit Pattern & Credit Value**				**Contact Hours/ Week**	**Teaching School/ Dept.**
					L	**T**	**P**	**Total**		
1	BTCE15F8100	Seminar	HC	-	0	0	2	2	0	Civil
2	BTCE15F8200	Project Work	HC	-	0	1	5	6	0	Civil
3	BTCE15F8310	Finite Element Analysis	SC	BTCE15F3500	3	1	0	4	3	Civil
	BTCE15F8320	Ground Improvement Techniques		BTCE15F5500	3	1	0	4	3	Civil
	BTCE15F8330	Industrial Waste Water Treatment		-	3	1	0	4	3	Civil
	BTCE15F8340	Highway Geometric Design		-	3	1	0	4	3	Civil
	BTCE15F8410	Advanced Design of pre-stressed concrete structures	SC	-	3	1	0	4	3	Civil
	BTCE15F8420	Analysis And Design Of Deep Foundation		BTCE15F6200	3	1	0	4	3	Civil
	BTCE15F8430	Earthquake Geotechnical Engineering		BTCE15F6200	3	1	0	4	3	Civil
	BTCE15F8510	Computer Applications in	SC	-	3	1	0	4	3	Civil

		Civil Engineering								
	BTCE15F8520	Environmental Geotechnology		-	3	1	0	4	3	Civil
	BTCE15F8530	Traffic Engineering & Management		-	3	1	0	4	3	Civil
	BTCE15F8540	Earthquake Resistant Design Of Structures		-	3	1	0	4	3	Civil
Total Credits for Eigth Semester								**20**	**24**	
Total credits for all Eight semesters								**192**		

B. Tech in Civil Engineering

DETAILED SYLLABUS

(Effective from Academic Year 2015 - 19)

Semester – I

Course Code: BTEM15F1100	Engineering Mathematics – I	C	L	T	P	CH
Duration: 16 Weeks		3	2	1	0	5

Prerequisites:

Knowledge of basics limits, continuity, differentiation, integration, matrices, determinants, and geometry.

Course Objectives:

1. To understand the concepts of differential calculus and its applications.
2. To familiarize with partial differentiation and its applications in various fields.
3. To familiarize with linear algebraic applications and different reduction techniques.
4. To familiarize with concept of vector calculus and its applications.

Course Outcomes:

1. Apply the knowledge of differential calculus in the field of wave theory and communication systems.
2. Apply the knowledge of Differential Equations in the field of Engineering.
3. Analyze and implement the concepts of Divergence and curl of vectors which play significant roles in finding the Area and volume of the closed surfaces.
4. Apply the knowledge of convergence of the series, which help in forming JPEG image compression.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTEM 15F1 100	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: Differential Calculus-I **[14hrs]**

Successive differentiation, standard results, Leibnitz Theorem (without proof) and problems, Taylors series, Maclaurins series expansion, Indeterminate forms and solution using L'Hospital's rule. Tangents and Normal-Cartesian curves, polar curves, Angle between polar curves, Pedal equation for polar curves. Derivative of arc length – concept and formulae without proof, Radius of curvature-Cartesian, parametric, polar and pedal forms**.**

UNIT-II: Differential Calculus-II **[14hrs]**

Curve Tracing-Cartesian, Parametric and polar forms -examples. Applications – Area, Perimeter, surface area and volume. Computation of these in respect of the curves – (i) Astroid(ii) Cycloid and (iii) Cardioids

Partial Differentiation: Partial derivatives-Euler's theorem-problems, total derivative and chain rule, Jacobians-direct evaluation. Taylor's Expansion of function of two variables. Maxima and Minima for a function of two variables.

UNIT-III:Differential Equations : **[14hrs]**

Exact Equations, Equation reducible to Exact form, Orthogonal Trajectories in Cartesian and polar.

Linear Differential Equations: Definitions, Complete solution, Operator D, Rules for finding the complementary function, Inverse operator, Rules for finding the particular integral, Method of variation of parameters, Method of undetermined coefficients, Cauchy's and Legendres linear equations, simultaneous linear equations with constant coefficients.

Non-Linear Differential Equations(*p*-*y*-*x* forms):.Equations solvable for *p*, *y* and *x*, Singular solution, Clairauts equation.

UNIT-IV: Vector Calculus **[14hrs]**

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.

Applications: Line integral-Circulation-work, Surface integral-Flux, Green's Theorem in the plane, Stokes Theorem, Volume integral, Divergence theorem, Green's Theorem, Irrotational and Solenoidal fields, Orthogonal curvilinear coordinates.

Reference Books:

Text books:

1. B.S. Grewal, Higher Engineering Mathematics, 42nd edition, Khanna Publishers, 2013.
2. Erwin Kreyszig, Advanced Engineering Mathematics, 9th edition, Wiley Publications, 2012.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", 1st edition, Tata McGraw Hill Publications 2010.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", 4th edition, Narosa Publishing House, 2002.

Course Code: BTEC15F1200	Engineering Chemistry	C	L	T	P	CH
Duration: 16 Weeks		3	2	1	0	4

Prerequisites:

Basics of 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	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
BTEC 15F1 200	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: Cells and Batteries: [**11hrs]**

Introduction to electrochemistry, Basic concepts, Battery characteristics –primary, secondary and reserve batteries, Super capacitors, Lithium batteries.

Fuel cells-Difference between battery and fuel cell, types of fuel cells- construction working, applications, advantages& limitations of Solid oxide fuel cells and phosphoric acid fuel cell.

Photovoltaic cell-Production of single crystal semiconductor by Crystal pulling technique (Czocharlski method), zone refining of si, antireflective coatings,Construction and working of photovoltaic cells and its applications and advantages using elemental si and semiconductors.

UNIT-II: Corrosion & its control & metal finishing. [10hrs]

Introduction: Electrochemical theory of corrosion, Galvanic series Types of Corrosion- Differential metal corrosion Differential aeration corrosion(Pitting & water line),Stress corrosion (Caustic embrittlement), and Grain boundary corrosion, Factors affecting rate of corrosion-Primary, secondary, pilling bed worth role, Energy concept (Pourbiax) under different pH conditions. Corrosion Studies on Al, Fe with phase diagram Corrosion control: Inorganic coating -Anodizing & Phosphating, metal coating- galivanzing & tinning, cathodic protection, Anodic Protection. Role of secondary reference electrode in corrosion studies (calomel ,Ag/AgCl)

Metal Finishing-Technological importance, significances of polarization. Decomposition potential & overvoltage in electroplating, theory of electroplating. Effect of plating variables on the nature of electrodeposit- electroplating process, Electroplating of gold, Introduction to Electro less plating-Cu.

UNIT-III: Introduction to Nano science and Nanotechnology [11 hrs]

Introduction to Nanomaterials, Properties –optical, electrical, magnetic and thermal .Chemical synthesis of Nanomaterials – sol gel (MOx NPs), phase transfer method (Au NPs). Carbon Nanomaterials-Fullerenes, graphene, CNT. Applications of nano materials- nano catalysis, nano-electronics, energy conversion materials (in batteries, solar cells), nano sensors.

Introduction to electromagnetic spectrum-material analysis, Instrumentation-principle, working and applications of UV-Visible, XRD, SEM.

UNIT-IV: polymers: [10 hrs]

Introduction, Types of polymerization-Addition and Condensation, Ziegler's natta catalyst, molecular weight determination by viscosity method, glass transition temperature, Structure and Property relationship. Synthesis &Applications of -Bakelite, ABS, Nylon6,6, PMMA.

Adhesives-Synthesis and applications of epoxy resins, Polymer composites- Synthesis and applications of Kevlar and Carbon fibers, Conducting polymers-Definition, Mechanism of conduction in polyacetylene , Synthesis & applications of conducting Polyaniline,Polymer liquid crystals, Biopolymers, Polymer membranes-ion exchange & ionic conductivity,

REFERENCES:

1. R.V. Gadag and Nithyananda Shetty, Engineering chemistry, 2, revised, I.K. International Publishing House Pvt. Limited, 2010

2. S.F. Jadhav and H.C. Shashidhara, Engineering Chemistry, Himalaya publishing house, First edition,

96, (2004).

3. B.S. Jai Prakash, R. Venugopal, Shivakumaraiah and Pushpa Iyengar, Chemistry for Engineering Students, Subhas publishers, Third edition, 239, (2010).

4. Mars G. Fontana, Corrosion Engineering, Tata McGraw-Hill publishers, Third edition, 12, (2005).

5. Introduction to Nanotechnology by Charles P. Poole Jr., Frank J. Owens Wiley India Publishers

6. Theory and practice in applied chemistry by O.P. Vermani and Narulla, New age international publications

7. Vogel's text book of quantitative chemical analysis by G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney.

Course Code: BTBE15F1300	**Basic Electronics Engineering**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**3**	**2**	**1**	**0**	**4**

Prerequisites:

Basics of Physics.

Course Objectives:

1. To familiarize with the number systems, Boolean algebra and digital circuit design.
2. To understand the diode characteristics and its applications.
3. To learn the working principles of various electronic circuits.
4. To understand the transistor characteristics and its applications.
5. To compare the different biasing methods of transistors.
6. To understand the working of amplifiers and communication systems.
7. To understand the power electronic devices.

Course Outcomes:

1. To Design the digital circuits using various logic gates.
2. To analyze various diode circuits and work on various application based on electronic instruments.
3. To design of amplifier circuit based on BJT and emonstrate the working of amplifiers and the oscillators.
4. To analyze the various communication techniques and Design Zener voltage regulator

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTBE 15F1 300	CO1	**3**	**3**	**3**	**3**	**2**								**1**	**1**	**1**	**1**
	CO2	**3**	**3**	**3**	**3**	**3**									**1**	**2**	
	CO3	**3**	**2**	**3**	**3**	**3**										**1**	**1**
	CO4	**3**	**2**	**3**	**3**	**2**										**1**	**1**

Course Contents:

UNIT-I: Digital Electronics and Number Systems [14hrs]

Digital Electronics: Introduction, Switching and Logic Levels, Digital Waveform. Number Systems: Decimal Number System, Binary Number System, Octal Number System, Hexadecimal Number System.

Number base conversions: Binary to Decimal, Decimal to Binary, Binary to Octal, Octal to Binary, Binary to Hexadecimal, Hexadecimal to Binary, Decimal to Octal, Octal to Decimal, Decimal to Hexadecimal, Hexadecimal to Decimal, Octal to Hexadecimal, Hexadecimal to octal.

Complement of Binary Numbers. Binary addition, binary subtraction. Boolean Algebra Theorems, De Morgan's theorem. Digital Circuits: Logic gates, NOT Gate, AND Gate, OR Gate, NAND Gate, NOR Gate, XOR Gate, XNOR Gate. Algebraic Simplification, NAND and NOR Implementation NAND Implementation, NOR Implementation. Half adder and Full adder Implementations.

UNIT-II: Semiconductor Diodes and Applications [13hrs]

p-n junction diode, Characteristics and Parameters, Diode approximations, DC load line analysis, Half-wave rectifier, Two-diode Full-wave rectifier, Bridge rectifier, Capacitor filter circuit, Zener diode voltage regulators: Regulator circuit with no load, Loaded Regulator, Series and Shunt diode Clipping Circuits, Clamping Circuits: Negative and Positive Clamping Circuits, Numerical examples as applicable.

UNIT-III: Bipolar junction Transistors [13hrs]

BJT configuration: BJT Operation, BJT voltages and currents, BJT amplification, Common Base, Common Emitter and Common Collector Characteristics, Numerical examples as applicable.

BJT Biasing: DC load line and Bias Point, Base Bias, Voltage divider Bias, Numerical examples as applicable.

UNIT-IV: Electronic Devices and Applications [14hrs]

SCR, controlled rectifier-full bridge type. Oscillators and applications. OPAMP-summer, subtractor, integrator and differentiator, and typical applications in measurements.

Communication system, embedded system, cellular communication, satellite communication, remote sensing. (block diagram approach)

REFERENCE BOOKS:

1. David A. Bell, "Electronic Devices and Circuits", Oxford University Press, 5th Edition, 2008.

2. D.P. Kothari, I. J. Nagrath, "Basic Electronics", McGraw Hill Education (India) Private Limited, 2014.

Course Code: BTCC15F1400	Computer Concepts and C Programming	C	L	T	P	CH
Duration: 16 Weeks		3	2	1	0	4

Prerequisites:

Nil

Course Objectives:

1. Introduce the fundamentals of computer hardware and software;
2. Provide an understanding of problem solving with computers;
3. Introduce C programming language;
4. Provide a familiarization with the Unix programming environment;
5. Introduceproblem solving through authoring and executing C programs.

Course Outcomes:

A student who successfully completes the course will have the ability to:

1. Use the basic terminology of computer programming; Explain the different Unix commands, their usage and their syntax;
2. Write, compile and debug programs in C language; Use different data types and operators in a computer program;
3. Design programs involving decision structures, loops and functions; Use procedure calls by value and by reference;
4. Use arrays in applications like sorting and searching; Handling strings; Apply the C language knowledge to solve variety of problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCC 15F1 400	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**1**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**2**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**2**	**3**	**2**	**1**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**2**	**1**	**2**	**2**	**-**	**2**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[11 hrs]**

Introduction to Computer System, Computer Organization, Hardware and Software: Definition of Computer, Early history, Structure of a computer, Information Processing life cycle, Essential computer hardware - Microprocessors, Storage media, Essential computer software, Types and Functions of operating systems, Number systems, Computer processing techniques, Networking.

UNIT-II:Getting started with UNIX – Introduction and Commands: **[10 hrs]**
Introduction to Unix Operating System, Introduction to Basic Command Format, Working with Files, Using the VI text editor, working with Files and Directories, Filename Substitution and Wild Cards, Standard Input, Output & Error, Pipes and redirection, Shell Commands.

UNIT-III: Fundamentals of Problem Solving and Introduction to C Language: **[11 hrs]**
Algorithms and Flow charts, Introduction to C Language – Background, structure of a C Program, Input / Output, Tips and common programming errors, Expressions and Statements, Branching constructs, Looping constructs.

UNIT-IV: More towards C language: **[10 hrs]**
Functions in C, Recursion, Arrays, Strings, Introduction to pointers.

REFERENCE BOOKS:

1. Herbert Schildt, C: The Complete Reference, 4th Edition, Tata McGraw Hill, Published by McGraw-Hill Osborne Media (2000), ISBN 10: 0072121246ISBN 13: 9780072121247

2. Sumitabha Das, UNIX Concepts and Applications, 4th Edition; Tata McGraw-Hill Education **Published Date :** 2006-05-01

3. Reema Thareja, Computer fundamentals and programming in C, Second Edition, Oxford University press, 2016.

4. Kernighan, Dennis Ritchie, The C Programming Language ,2nd edition, Englewood Cliffs, NJ: Prentice Hall, 1988

Course Code: BTES15F1500	Environmental Sciences	C	L	T	P	CH
Duration: 16 Weeks		2	1	1	0	3

Prerequisites:

Pre University Science.

Course Objectives:

1. To gain knowledge on the components of environment and importance of environmental studies.
2. To understand the various types of energy and natural resources.
3. To acquire knowledge with respect to biodiversity, its threats and its conservation and appreciate the concept of ecosystem.
4. To get knowledge about environmental pollution-sources, effects and control measures of environmental pollution.
5. To explore ways for protecting the environment.

Course Outcomes:

On completion of this course the students will be able to:

1. Analyze the environmental conditions and protect it.
2. Find new renewable energy resources.
3. Analyze the ecological imbalances and protect it.
4. List the causes of environmental pollution and design pollution controlled products.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				

BTES 15F1 500	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				

Course Contents:

UNIT-I: Introduction:

Basic definitions, Objectives and Guiding principles of Environmental Studies, Components of Environment, Structures of atmosphere, Man-Environment relationship, Impact of Technology on the environment, sustainable environment, Environmental Protection - Role of Government, Initiatives by Non - Governmental Organizations (NGO).

UNIT-II: Energy & Natural Resources:

Energy - Different types of energy, Electro-magnetic radiation. Conventional and Non-Conventional sources - Hydro Electric, Fossil fuel based, Nuclear, Solar, Biomass and Bio-gas. Hydrogen as an alternative future source of Energy, Natural Resources- Water resources, Mineral Resources, Forest Wealth.

UNIT-III: Ecology & Ecosystems:

Ecology- Objectives and Classification, Concept of an ecosystem - structure & function, Balanced ecosystem, Components of ecosystem - Producers, Consumers, Decomposers, Bio-Geo- Chemical Cycles & its Environmental significance (Carbon Cycle and Nitrogen Cycle), Energy Flow in Ecosystem, Food Chains: Types & Food webs Ecological Pyramids.

UNIT-IV: Environmental Pollution:

Introduction, Types, Concepts -Air Pollution, Water Pollution& Noise Pollution. Environmental Degradation- Global Warming, Green Houses Effects, Acid Rain, and Depletion of Ozone Layer.

REFERENCE BOOKS:

1. Benny Joseph, Environmental Studies, Tata McGraw – Hill Publishing Company Limited, 2005
2. Meenakshi P, Elements of Environmental Science and Engineering, Prentice Hall of India Private Limited, New Delhi, 2006
3. Rajagopalan R, Environmental Studies – From Crisis to Cure, Oxford University Press, 2005
4. Raman Sivakumar, Principles of Environmental Science and Engineering, Second Edition, Cengage learning, Singapore, 2005
5. Ranjit Daniels R.J. and JagdishKirshnaswamy, (2009), Environmental Studies, Wiley India Private Ltd., New Delhi, 2009
6. Prakash S.M, Environmental Studies, Elite Publishers, Mangalore, 2007
7. ErachBharucha, Text Book of Environmental Studies, for UGC, University Press, 2005

8. Tyler Miller Jr. G. Environmental Science – Working with the Earth, Eleventh Edition, Thomson Brooks/Cole, 2006

Course Code: BTTE15F1600	Technical Communication and Documentation	C	L	T	P	CH
Duration: 16 Weeks		2	1	1	0	3

Prerequisites:

Pre University English.

Course Objectives:

To make the learning process more practical and participatory.

1. To enhance the process of imparting skills of communication more effective
2. To make the learners aware of the latest communication tools and process.
3. To encourage participation of students and follows an interactive approach.
4. To cater the learners in professionals and academic contexts and in day-to-day interactions.

Course Outcomes:

1. To eradicate their stage fear, able to communicate properly. Students enable to speak, read without any mistakes.
2. To practice LSRW skills and how to use them in a daily life.
3. To exhibits clarity of language, encourages participation of students. And follows an interactive approach.
4. To help standardize the teaching of communication and cater to the learners.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	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

BTTE 15F1 600	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:

UNIT-I : Professional Communication [5hrs]

Introduction to Communication: Types of communication, Barriers to communication, Importance of communication, Technical communication.

UNIT-II: Reading: [5hrs]

Reading skills, Vocabulary, Jargon, Text component: Of Discourse- Francis Bacon, Unity of Minds - Dr. A.P.J Abdul Kalam.

UNIT- III: Writing: [5hrs]

Introduction to writing skills, Common Grammatical errors, Sentence structure, Paragraph writing, Précis, Letter writing, Text component: After Twenty years - O. Henry, The open window- Saki.

UNIT-IV: Listening: [13hrs]

Listening skills, Barriers to Listening, Listening Comprehension and Note- Taking Practice in Listening Comprehension, Enhancing Listening skills Text component: The Refund - Fritz Karinthy.

Speaking: Speaking skills, Phonetics, Stress, Rhythm and Intonation, Practice in speaking skills.

REFERENCE BOOKS:

1. Murphy,Raymond, Intermediate English Grammar, Fourth edition, Cambridge University press, New York, 2012
2. Wren &Martin,English Grammar & Composition, Fifth edition, Cambridge University press, New York, 2001
3. Mudambadithaya G.S., English Grammar and composition, Cambridge University press, New York, 2002
4. Lupton, Mary Jane, *Maya Angelou: A Critical Companion*. Westport, Connecticut: Greenwood Press. ISBN 978-0-313-303225, 1998
5. Booher, Diana. (2004),*Booher's Rules of Business Grammar*, OUP Ur, Penny .(2002),*Grammar Practice Activities*, OUP
6. Glendinning, Eric H. and Beverly Holmstrom, Study Reading: A Course in Reading Skills for Academic Purposes, New Delhi: CUP. Langan, John (1996). College Writing Skills. McGraw Hills, 2008.

Course Code: BTED15F1700	Computer Aided Engineering Drawing	C	L	T	P	CH
Duration: 16 Weeks		4	2	0	2	8

Prerequisites:

Building palnning and Drawing

Course Objectives:

1. To comprehend general projection theory, with emphasis on orthographic projection to represent in two-dimensional views (principal, auxiliary, sections).
2. To dimension and annotate two-dimensional engineering drawings.
3. To understand the application of industry standards and best practices applied in engineering graphics.
4. To emphasize freehand sketching to aid in the visualization process and to efficiently communicate ideas graphically.
5. To introduction of CAD software for the creation of 2D engineering drawings.
6. To the theoretical concepts delivered in this course would help the students to understand the sign considerations and tolerances to be used in the design and manufacture of engineering components.
7. To this course will be very much basics for students to learn and wisely apply for the advanced Computer Aided Engineering (CAE) tools such as ABAQUS, ANSYS etc.

Course Outcomes:

1 To understand the concepts of engineering drawing.
2 To understand the concepts of projection of objects in CAD drawing.
3 To draw the sections of various objects in CAD drawing.
4 To draw the isometric projections of various soilds in view of 2D and simple 3D drawings

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1	3	2	3	2									3	3	3	3
	CO2	2	2		2								1	3	3	3	3

BTED 15F1 700	CO3	**3**	**3**	**2**	**3**	**1**								**3**	**3**	**3**	**3**
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I: Introduction to Drawing: 12Hours

Introduction to Engineering Drawing: Introduction, Drawing Instruments and their uses, BIS conventions, Drawing sheets, Lettering, Dimensioning, Scales, regular polygons and its methods, tangents, ellipse, parabola, hyperbola, loci, cycloids, trochoids, epi and hypocycloids, spirals and involutes, helix, Co-ordinate system and reference planes.

Introduction to Software (solid edge): 12Hours

Computer screen, layout of the software, standard tool bar/menus and description of most commonly used tool bars, navigational tools Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend to next ,split, chamfer, fillet, curves, constraints viz. tangency, parallelism, inclination and perpendicularity. Dimensioning, line conventions, material conventions and lettering.

Orthographic Projection: Projection – Orthographic Projection – Planes of Projection – Four quadrants – First-angle projection – Third-angle projection – Reference line – Conventions employed.

Projection of points: Points in different quadrants.

Projection of Straight Lines (First-angle Projection only): Parallel to one or both planes – Contained by one or both planes – Perpendicular to one plane and parallel to other plane – Inclined to one plane and parallel to the other – Inclined to both planes.

Projection of Planes: Types of Planes – Perpendicular Planes – Oblique Planes – Projection of Planes - Parallel to one Plane – perpendicular to both planes – perpendicular to one inclines to other – Oblique planes (only change of position method).

UNIT-II:Projection of Solids: 12Hours

Polyhedra (Cube – Tetrahedron - Prisms and Pyramids) – Solids of revolution(Cone and Cylinder) – Solids in simple position – Axis perpendicular to a plane – Axis parallel to both planes – Axis parallel to one plane and inclined to the other – Axis inclined to both plane (only change of position method).

UNIT-III: Sections of Solids: **12Hours**

Section Planes – Sections – True Shape of Section – Sections of Prisms – Sections of Pyramids – Sections of Cylinders – Section of Cones.Developments of Lateral Surfaces of Solids - Polyhedra (Cube – Tetrahedron - Prisms and Pyramids) – Solids of revolution (Cone and Cylinder) and their Frustums.

UNIT-IV:Isometric Projection: **12Hours**

Isometric axes - Lines and Planes – Isometric Scale – Isometric Projection of Planes – Prisms – Pyramids – Cylinders – Cones – Spheres - Hemi-Spheres - frustums - Combination of Solids (Maximum Three). Conversion of Orthographic Drawing to Isometric View / Pictorial Drawing of a simple Machine Components. Application Drawings: Civil drawing (building plans), electrical symbols and circuits, electronic symbols and circuits and simple assembly drawing (bolt and nut).

REFERENCE BOOKS:

1. N.D.Bhatt and V.M. Panchal, Engineering Drawing, 48th Edition, Charotar Publishing House, Gujarat, 2005.
2. A Primer on Computer Aided Engineering Drawing-2006, Published by VTU, Belgaum.
3. Dr Balaveer Reddy and Co authors, Computer Aided Engineering Drawing, CBS Publications, 2014
4. K.R. Gopalakrishna Engineering Graphics, 32nd Edition,Subhas Publishers, Bangalore 2005.
5. P. S. Gill, Engineering Drawing, 11th Edition, S. K. Kataria & Sons, Delhi2001.

E-Material:

Computer Aided Engineering Drawing- Vol I, (PPT) by Dr. Rajashekar Patil and Prof Gururaj Sharma T

Course Code: BTCL15F1800	Engineering Chemistry Lab	C	L	T	P	CH
Duration: 16 Weeks		0	0	0	2	3

Prerequisites:

Basics of Engineering Chemistry

Course Objectives:

To provide students with practical knowledge of quantitative analysis of materials by classical and instrumental methods for developing experimental skills in building technical competence

Course Outcomes:

On completion of lab course students will have the knowledge in;

1. Handling of Chemicals and COD can be determined.
2. Handling different types of instruments for analysis of materials for better accuracy and precision
3.
4. Carrying out different types of titrations for quantitative estimations of materials.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTCL15F1800	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:

LAB EXERCISES

1. Potentiometric estimation of FAS using standard $K_2Cr_2O_7$
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

REFRENCE BOOKS:

1. Engineering Chemistry of Wiley India Pvt. Ltd., Vairam and others, 2014 edition (second).
2. S. S. Dara, Mukkanti, "Text of Engineering Chemistry", S. Chand & Co, New Delhi, 12th Edition, 2006
3. C. V. Agarwal, C. P. Murthy, A. Naidu, "Chemistry of Engineering Materials", Wiley India, 5th Edition, 2013.

Course Code: BTCP15F1900	**Computer Programming Lab**	C	L	T	P	CH
Duration: 16 Weeks		2	0	0	2	3

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;
5. Set the Strong Foundation for Software Development in the field of Programming and hence to Create high quality 'C' Professionals.

Course Outcomes:

After completion of this course, the students would be able to

1. Understand the Basic Principles of Problem Solving; Study, understand and identify the Representation of Numbers, Alphabets and other Characters in the memory of Computer System;
2. Understand Analyze, Integrate, Apply and Demonstrate Software Development Tools; like Algorithms, Pseudo Codes and Programming Structures;
3. 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; Offer Engineering Solutions to simple (moderate) mathematical and logical problems using 'C' Programming Language;

4. Study, Understand, Analyze, Integrate, Classify, Compare and Apply simple Data Structures, Pointers, Memory Allocation and Data Handling through files using 'C' Programming Language; Understand and identify the working of different Operating Systems; like Windows and Linux; Enhance their Analytical, Reasoning and Programming Skills;

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCL 15F1 900	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:

1. Unix Commands – execution and learn extra options than what is taught in theory
2. How to edit, compile and execute a C program on UNIX using editors like G-edit, K-write, writing a shell program.
3. Programs on data types, operators, expressions
4. Conditional statements – simple if statement, if-else statement, nested if-else, else-if ladder, switch statement
5. Looping statements – for, while and do-while statements
6. Arrays – 1-D and 2-D arrays
7. Programs on Sorting and searching
8. User defined Functions – pass by value, pass by reference, passing arrays to functions
9. Strings – finding length, string concatenation, string compare, substring search, palindromes etc
10. Programs on pointers.

Recommended Learning Resources:

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.

SEMESTER II

Course Code: BTEM15F2100	**Engineering Mathematics – II**	C	L	T	P	CH
Duration: 16 Weeks		4	3	1	0	5

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**	**P 0 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**P S O 1**	**PS O2**	**PS O3**	**PS O4**
BTEM 15F2 100	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: Linear Algebra [14hrs]

Elementary row and column operations on a matrix, Rank of matrix, Normal form, Inverse of a matrix using elementary operations, Solution of a system of non-homogeneous equations by Gauss elimination and Gauss –Jordan methods. Reduction to diagonal form, Reduction of a quadratic form to canonical form, orthogonal transformation and congruent transformation. Rayleigh Power method to find the largest eigen value and corresponding eigen vector.

UNIT-II : Integral Calculus [14hrs]

Differentiation under the integral sign – simple problems with constant limits. Reduction formulae for the integrals of $\sin^n x$,$\cos^n x \sin^n x \cos^n x$and evaluation of these integrals with standard limits - Problems.

Multiple Integrals **–** Double integrals, change of order of integration, double integrals in polar coordinates, area enclosed by plane curves, Beta and Gamma functions – definitions- relation between beta and gamma functions and problems.

Applications: Volume of solids, Change of variables, Area of a curved surface, Calculation of mass.

UNIT-III: Partial Differential Equation [14hrs]

Introduction: 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,

Applications: vibrations of a stretched string-Wave equation, one dimensional heat flow. Laplace equation using separation of variables.

UNIT-IV: Laplace Transforms: [14 hrs]

Introduction, definition, Transforms of elementary functions, properties of Laplace Transforms, Transforms of derivatives, Transforms of integrals, evaluation of integrals by Laplace transforms, Transforms of periodic functions, Unit step functions and unit impulse functions.

Inverse Laplace transforms- Problems, convolution theorem-problems, solution of linear differential equation using Laplace transforms, simultaneous linear equations, Applications of Laplace transforms.

Text books:

1. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 42nd edition, 2013.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", Wiley Publications, 9th edition, 2012.

Reference Books:

1. B.V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill Publications, 1stedition, 2010.
2. R.K.Jain and S.R.K.Iyengar, "Advanced Engineering Mathematics", Narosa Publishing House, 4th edition, 2002.

Course Code: BTEP15F2200	Engineering Physics	C	L	T	P	CH
Duration: 16 Weeks		3	2	1	0	4

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 wave mechanics.
2. Understand and demonstrate different applications of Laser and optical fibers.
3. Understands the concepts of conductors and nano materials.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTEP 15F2 200	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:Wave mechanics: [10hrs]

Introduction to Wave mechanics, Wave particle dualism. de-Broglie hypothesis,Matter waves and their characteristic properties. Expression for de-Broglie wavelength of an electron in terms of

accelerating potential. Phase velocity and group velocity,Relation between phase velocity and group velocity. Relation between group velocity and particle velocity, Expression for de-Broglie wavelength using the concept of group velocity. Heisenberg's uncertainty principle ,its significance and its applications(non existence of electron inside the nucleus) . Wave function,properties of wave function and physical significance. Probability density and Normalization of wave function, Schrodinger time- dependent and independent wave equation,Eigen values and Eigen functions. Applications of Schrödinger wave equation – energy Eigen values of a free particle, Particle in one dimensional infinite potential well. Numericals.

UNIT-II: Lasers and optical fibers:[11hrs]

LasersInteraction between radiation and matter (induced absorption, spontaneous and stimulated emission). Expressionfor energy density at thermal equilibrium in terms of Einstein's coefficients. Characteristics of laser light, Conditions for laser operation (population inversion and Meta stable state). Requisites oflaser system, Construction and working of Carbon Dioxide (CO_2) laser & semiconductor laser. Applications: Holography (recording and reconstruction of images) and its applications, Numericals.

Optical fibers: Construction and light propagation mechanism in optical fibers (total internal reflection and its importance), Acceptance angle, Numerical Aperture (NA), Expression for numerical aperture in terms of core and cladding refractive indices,Condition for wave propagation in optical fiber, V-number and Modes of propagation,Types of optical fibers, Attenuation and reasons for attenuation,Applications: Explanation of optical fiber communication using block diagram, Optical source (LED) and detector (Photodiode). Advantages and limitations of optical communications, Numericals.

UNIT-III: Electrical properties of conductors and superconductors: [10hrs]

Electrical Conductivity in Metals, Drude-Lorentz classical free electron theory,drift velocity, mean free path, mean collision time and relaxation time.Expression for electrical conductivity in metals,Effect of impurity and temperature on electrical resistivity in metals,Failures of classical free electron theory. Quantum free electron theory, Fermi-Dirac statistics, Fermi level, Fermi energy and Fermi factor, Variation of Fermi factor with energy and temperature, Density of states (qualitative explanation), effective mass, Merits of Quantum free electron theory, Numericals.

Superconductors: Temperature dependence of resistivityin superconductors, variation of critical field with temperature,Properties of superconductors (Isotope effect, Meissner effect, Silsbee effect), Types of superconductors, BCS theory, Applications of super conductors,Maglev vehicle and superconducting magnet.

UNIT-IV: Ultrasonics, Dielectric and Nanomaterials: **[11hrs]**

Ultrasonics: Production of ultrasonics by piezoelectric method, Measurement of velocity of ultrasonics in solid andliquid, Non-destructive testing of materials using ultrasonics.

Dielectricmaterials: Electric dipole and dipole moment, electric polarization (P), dielectric susceptibility (χ,), dielectric constant, relation between χ and P,Electrical polarization mechanisms (electronic,ionic, orientational, space charge polarization),Expression for internal fieldin one-

dimensional solid dielectrics, Ferro, Piezo and Pyro electric materials – their properties and applications, Numericals.

Nanomaterials: Introduction to nanoscience, nanomaterials and their applications, Synthesis of nano materials using bottom-up method (arc method), top-down methods (ball milling method), Carbon Nanotubes: properties andapplications.

Text books:

1. R.K Gaur and S.L. Gupta, Engineering Physics, Dhanpat Rai Publications (P) Ltd, New Delhi.
2. M.N. Avadhanulu and P.G. Kshirsagar, S. Chand and Company, A text book of Engineering Physics, New Delhi.
3. Solid State Physics, S.O. Pillai, New Age International publishers, New Delhi.

Reference Books:

1. Laser Fundamentals, William T. Silfvast, 2nd Edition, Cambridge University press, New York (2004).
2. Fundamentals of Physics, 6th Edition, D. Halliday, R. Resnick and J. Walker, John Wiley and Sons, New York (2001).
3. Introduction to Solid State Physics,7th Edition Charls Kittel, Wiley, Delhi (2007).
4. Arthur Beiser, Concepts of modern Physics, Tata McGraw Hill publications, New Delhi.

Course Code: BTCV15F2300	**Elements of Civil Engineering**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**3**	**2**	**1**	**0**	**4**

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCV 15F2 300	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 [14hrs]

Introduction to basic civil engineering – Scope of civil engineering, role of civil engineer, branches of civil engineering (brief discussion 2 to 3 hours only)

Engineering mechanics

Basic idealizations - Particle, Continuum and Rigid body; Force and its characteristics, types of forces, Classification of force systems; Principle of physical independence of forces, Principle of superposition of forces, Principle of transmissibility of forces; Newton's laws of motion, Introduction to SI units, Moment of aforce, 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 equivalentforce - couple system.

UNIT-II [14hrs]

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 problemson composition of coplanar concurrent force systems, Composition of coplanar - non-concurrent force system, Varignon'sprinciple of moments; Numerical problems on composition of coplanar concurrent force systems.

UNIT-III [14hrs]

Equilibrium of coplanar forces

Definition of static equilibrium and Equilibrant, Conditions of staticequilibrium for different coplanar force systems, Lami's theorem, Concept of Free Body Diagram, Numericalproblems on equilibrium of coplanar – concurrent and non concurrent force systems.

UNIT-IV **[14hrs]**

Centroid and Moment of Inertia

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 Inertiaof rectangle, circle, semi-circle, quarter circle and triangle from method of integration, Moment of inertia of composite areas, Numerical problems.

Text Books:

1. M. N. Shesha Prakash and Ganesh B. Mogaveer, **"Elements of Civil Engineering and Engineering Mechanics"**, PHI Learning, 3rd Revised edition
2. A. Nelson, **"Engineering Mechanics-Statics and Dynamics"**, Tata McGrawHill Education Private Ltd, New Delhi, 2009
3. S. S. Bhavikatti, **"Elements of Civil Engineering"**, New Age InternationalPublisher, New Delhi, 3rd edition 2009.

Reference Books:

1. S. Timoshenko, D.H. Young and J.V. Rao, **"Engineering Mechanics"**, TATA McGraw-Hill Book Company, New Delhi
2. Beer FP and Johnston ER, **"Mechanics for Engineers- Dynamics andStatics"**, 3rd SI Metric edition, Tata McGraw Hill. - 2008
3. Shames IH, **"Engineering Mechanics–Statics & Dynamics"**, PHI–2009.

Course Code: BTME15F2400	**Elements of Mechanical Engineering**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**3**	**2**	**1**	**0**	**4**

Course Objectives:

1. To develop the basic knowledge of working of various turbines and IC engines
2. To incorporate the concepts of metal joining process, their applications and power transmission modes like belt drives, gears and gear trains
3. To understand various mechanical machines and operations.
4. Introduce about lubrication and its importance.
5. To understand basic power transmission concepts.

Course Outcomes:

The student will be able to

1. Apply the concepts of working principle of turbines in the power plants and also of the IC engines in the basic design of the vehicles
2. Have a basic knowledge of metal joining and power transmission and apply them in some basic requirements
3. Gain the knowledge about machine tools and cutting operations.

4. Gain the knowledge about belt and gear drive power transmission.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCV 15F2 400	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:

Properties of steam - Introduction**,** Steam formation, Types of steam. Steam properties, Specific Volume, Enthalpy and Internal energy, Steam table and simple numerical problems

Steam Generators – classification, Lancashire boiler, Babcock and Wilcox boiler, Boiler mountings, accessories and applications

Turbines- Introduction to turbines & prime movers, Classification of turbines, Working principle and applications of impulse and reaction steam turbines, gas turbines (open and closed cycle type) and water turbines (Pelton wheel, Francis and Kaplan), Compounding of impulse turbine

UNIT–II:

Internal Combustion Engines – Introduction, Classification of IC engines, parts of IC engine, Working principle of four stroke (petrol and diesel) and two stroke petrol engines, differences between 4 Stroke & 2 Stroke engines and petrol & diesel engines, Numerical problems on power and efficiencies.

Refrigeration and Air conditioning- Introduction, Principle of refrigeration, parts of refrigerator, Principle and working of vapor compression refrigeration and vapor absorption refrigeration.Refrigerants, Properties of refrigerants, Refrigerating effect, Ton of Refrigeration, COP, Relative COP, UNIT of Refrigeration, Principle and applications of Room air conditioners.

UNIT–III:

Machine Tools- Introduction, working principle and classification of lathe, drilling and milling machines, major parts of a lathe and their functions, lathe operations on lathe - Specifications of lathe, parts of radial drilling machines, drilling operations, parts of horizontal milling machines, milling operations.

Metal joining processes- Introduction, classification of metal joining processes, method of welding (Electric Arc welding), soldering and brazing and their differences.

UNIT-IV:

Lubrication- Necessity, types of lubrications, properties of good lubricant.

Bearings- Classification and application of bearings only.

Power Transmission- Introduction totransmission systems and its classification, types of Belt Drives**,** Definitions of Velocity ratio, angle of contact Creep and slip, Idler pulley, stepped pulley, fast & loose pulley, simple problems.

Gears - Definitions, Spur gear terminology, Types and applications of Gears.

Gear Trains – Simple and compound gear trains, Simple problems on gear trains.

Text Books:

1. K.R. Gopalkrishna, A Text Book of Elements of Mechanical Engineering –Subhash Publishers, Bangalore.

2. Kestoor Praveen and M.R. Ramesh Elements of Mechanical Engineering –2nd Edition, Suggi Publications**,** 2011,

Reference Books:

SKH Chowdhary, AKH Chowdhary , Nirjhar Roy, The Elements of Workshop Technology - Vol I & II , 11th edition 2001, Media Promotors and Publishers, Mumbai.

Course Code: BTEE15F2500	**Basic Electrical Engineering**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**3**	**2**	**1**	**0**	**4**

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.
5. To provide an insight into various sources of power generation.

Course Outcomes:

On completion of this course the students will be able to:

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. Relate the applications of electronic devices and sensors in practical life.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTEE 15F2 500	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: Introduction to Electrical Parameters [11hrs]

Concept of Alternating Voltage and Current, Sinusoidal functions-specifications, Phasor representation, concept of impedance, admittance, conductance and susceptance –series and parallel circuits of RLC. Concept of power and power factor. Kirchoff's laws and network solutions. Electromagnetic induction-laws, direction & magnitude of indused emf, mmf, permeability, reluctance and comparison of electric and magnetic circuits. Self and mutual inductance of a coil, coupling coefficients. Concept of energy storage in L & C, resonance between L &C. Generation of three phase voltages, star-Wye configurations, relation between line and phase quantities and expression for power.

UNIT-II: Electrical Apparatus [11hrs]

DC generator, DC motor- concept of force, torque and mechanical work. Single and three phase induction motors, shaded pole motor, universal motor, stepper motor: Basic construction, principle of operation and applications. Single and three-phase transformers: Principle, emf equation.

UNIT-III: Generation & Distribution: [10hrs]

Block diagram representation of generation, transmission and distribution.Current generation and transmission scenario,need for transmission at high voltage. Block diagram representation of thermal, hydel, nuclear, diesel and renewable power plants. Concept of smart-grid and role of ICT in smart-grid.

UNIT-IV: Tariff, Protective Devices and Sensors [10hrs]

Tariff schemes, basic concepts of domestic wiring and types, earthing, protective fuses, MCB. Sensors: pressure sensor, strain gage, proximity sensor, displacement sensor, rotary encoder and ultrasonic sensors (applications in relevant disciplines- ref to 8 and 9)

References:

1. Theodore Wildi,"Electrical Machines, Drives, and Power Systems",Pearson Education, 5th Edition, 2007
2. Hughes, "Electrical Technology", International Students 9th Edition, Pearson, 2005
3. Kulshreshtha C,"Basic Electrical Engineering"Tata McGraw Hill, 2nd Edition, 2011
4. Mittle V.N. and A. Mittal, "Basic Electrical Engineering" Tata McGraw Hill, 2nd Edition, 2005
5. Kothari D.P., L.J. Nagrath"Basic Electrical Engineering",Tata McGraw Hill, 2009

6. Robert L. Boylestad and Louis Nashelsky, "Introduction to Electricicty, Electronics and Electromagnetics" Prentice Hall, 5th edition, 2001
7. Introduction to smart grid: http://www.occ.ohio.gov/publications/electric/Smart_Grid_An_Introduction.pdf
8. Role of ICT in smart grid: http://users.atlantis.ugent.be/cdvelder/papers/2010/develder2010sgc.pdf

Course Code: BTIC15F2600	Indian Constitution and Professional Ethics	C	L	T	P	CH
Duration: 16 Weeks		2	1	1	0	3

Prerequisites:

Basics of Social Sciences

Course Objectives:

1. Discuss the Fundamental Rights, Duties and other Rights which is been given by our law.
2. Explain the practicality of Constitution perspective and make them face the world as a bonafide citizen.
3. Acquire knowledge about ethics and also know about professional ethics.
4. Explore ethical standards followed by different companies.

Course Outcomes:

1. Interpret the fundamental rights and human rights.
2. Explain the duties of a citizen and more importantly practice it in a right way.
3. Get exposed about professional ethics and know about etiquettes about it.
4. Acquire the knowledge of ethical standards of different companies which will increase their professional ability.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 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
BTIC15F2600	CO1						2		3				2	-	-	-	-
	CO2								3		3		2	-	-	-	-
	CO3	2					2		3		2		3	-	-	-	-
	CO4	2					2		3				2	-	-	-	-

Course Contents:

UNIT-I:Constitution of India : [13 hrs]

Definition,Making of Indian Constitution, Preamble to the Constitution of India, Fundamental Rights under Part III; Rights to Equality, Right to Freedom, Right against Exploitation, Rights to Freedom of Religion, Cultural and Educational Rights, Constitutional Remedies. Fundamental Duties of the Citizen, Significance and Charecteristics.Elements of National Significance; National Flag, National Anthem, National Emblem.

UNIT-II:Union and State : [10 hrs]

Organs of the Government; Legislature, Executive and Judiciary. Union and State Excecutives : President, Vice President, Prime Minister, Supreme Court, Cabinet, Governor, Councill of Ministers, Electoral process, Election Commission. Right to Information (RTI), Consumer and Consumer Protection.

UNIT III:Ethics: [13hrs]

Meaning, Definition, Evoltion, Need of ethics,Aristotlean Ethics, Utilitarianism, Katianism, Professional Ethics, Personal Ethics and Business Ethics, Ethical Standards, Duties of Employers and Employees.

UNIT IV:Engineering Ethics: [10hrs]

Definition Scope and needs, Ethics in Consumer Protection, Due Care theory, Environmental Ethics, Ethical Code of Conduct in ethics.Best Ethical Companiesin India and Abroad; Corporate Social Responsibilities,Code of Conduct and Ethical Excellence.

Reference books :

1. M V Pylee, An introduction to Constitution of India
2. M Govindarajan, S Natarajan, V S Senthil Kumar, Engineering

Course Code: BTCE15F2700	Communicative English	C	L	T	P	CH
Duration: 16 Weeks		2	1	1	0	3

Prerequisites:

Pre University English.

Course Objectives:

ls 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F2 700	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: [7hrs]

Text Component: Lamb to the Slaughter -Roald Dahl, My Mother's Hands-Robert Fontaine, Communicative Component: ,E-Mail Etiquette: Objective, Drafting, Language, Presentation Skills.

UNIT-II: [7hrs]

Text Component: ,Poor Girl-Maya Angelou ,A Glowing Future -Ruth Rendell, Communicative Component**:** *Employment Related Communication***,** Curriculum vitae and cover letters, Facing interviews.

UNIT-III: [7hrs]

Text Component**:** A Story of an Hour -Kate Chopin;,Communicative Component: *Writing:*Note taking/Note making, Report writing, Persuasion skills.

UNIT-IV: [7hrs]

Text Component: La Belle Dame Sans Merci- John Keats,Communicative Component: **Oral** *Communication:* Understanding Communication-Greeting, Introducing one self – others –in formal and informal contexts , Making Requests, Asking for and Giving Permission, Offering Help, Giving Instructions and Directions.

Reference Books:

1. Murphy,Raymond, Intermediate English Grammar,New York1998.
2. Wren &Martin ,English Grammar & Composition, New York 2001.
3. Mudambadithaya G.S., English Grammar and composition 2002
4. Digne, Flinders and Sweeney Cambridge University press2010
5. Lupton, Mary Jane . Maya Angelou: A Critical Companion. Westport, Connecticut:Greenwood Press. ISBN 978-0-313-303225, 1998
6. Booher, Diana. , Booher's Rules of Business Grammar, OUP 2004
7. Ur, Penny ,Grammar Practice Activities, OUP 2002
8. Wren &Martin,English Grammar & Composition, New York 2001
9. Joan Van Emden and Lucinda Becker Palgrave. Effective Communication for Arts and Humanities Students. Macmillan.
10. Glendinning, Eric H. and Beverly Holmstrom, Study Reading: A Course in Reading Skills for Academic Purposes, New Delhi: CUP. 2008
11. Langan, John, College Writing Skills. McGraw Hills 1996.

Course Code: BTPL15F2800	**Engineering Physics Lab**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**2**	**0**	**0**	**2**	**3**

Course Objectives:

1. To make the students gain practical knowledge of Physics to co-relate with the theoretical studies.
2. To provide students with a theoretical and practical knowledge of Physics.
3. To achieve perfectness in experimental Skills and the study of practical applications improve confidence and ability to develop and fabricate engineering and technical equipments.
4. Students should be getting idea of basic electronic circuits, optical instruments and will be able to carry out experiments in optics and verify other important laws of Physics.

Course Outcomes:

At the end of the course a students are able to

1. Develop skills to apply practical knowledge of Physics in real time solution.
2. To understand and verify different laws of Physics using some simple experiments.
3. To design simple electrical circuits and analyze obtained result. Ability to use the knowledge acquired for different applications and projects.
4. Ability to apply knowledge of basic electronics in making simple circuits using diodes and transistors and analyze the responses.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTEP 15F2 800	CO1	**3**	**3**		**1**									**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**1**										**3**	**3**	**3**	**3**
	CO3	**3**	**2**					**1**						**3**	**3**	**3**	**3**
	CO4	**3**	**2**					**1**						**3**	**3**	**3**	**3**

Course Contents:

List of Experiments:

1. Determination of wavelength of the given laser using diffraction grating.

2. I-V characteristics ofZener-diode – (determination of knee voltage breakdown voltage and forward resistance).
3. Determination of Planck's constant using LED.
4. Determination of energy gap of a semiconductor.
5. Measurement of dielectric constant by charging and discharging method.
6. Determination of Fermi energy of copper.
7. I-V characteristics of NPN-Transistor in C-E mode. (Determination of knee voltage input resistance, output resistance, current gain and current amplification factor breakdown).
8. Photo diode characteristics (I-V characteristics in reverse bias, variation of photocurrent as a function of intensity and reverse voltage).
9. Determination of Young's modulus of the material by single cantilever method/uniform bending method.
10. Determination of resonant frequency, band width and quality factor of the given LCR series and parallel resonance circuits.
11. Determination of rigidity modulus of the material and moment of inertia of an irregular body using Torsional pendulum.
12. Measurement of numerical aperture and attenuation in optical fibers. (Demo Expt.)
13. Determination of electrical resistivity by four probe method. (Demo expt.)
14. Measurement of velocity of ultrasonics in the given liquid-acoustic grating method. (Demo Expt.)

Text Books:

1. C. L. Arora, "Practical Physics", S. Chand & Co., New Delhi, 3rd Edition, 2012.
2. Vijay Kumar, Dr. T. Radhakrishna, "Practical Physics for Engineering Students", S M Enterprises, 2nd Edition, 2014.

Reference Books:

1. C.F. Coombs,"Basic Electronic Instrument Handbook", McGraw-Hill Book Co., 1972.
2. C.H. Bernard and C.D. Epp, John Wiley and Sons, "Laboratory Experiments in College Physics" Inc., New York, 1995.

Course Code: BTEW15F2900	**Basic Electrical Engineering Lab and Workshop Practice**	**C**	**L**	**T**	**P**	**CH**
Duration: 16 Weeks		**2**	**0**	**0**	**2**	**3**

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTEW 15F2 900	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 -Electrical

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.

.

WORKSHOP PRACTICE	
Objectives	1. To train students in metal joining process like welding, soldering etc. 2.To impart skill in fabricating simple components using sheet metal.

	3.To cultivate safety aspects in handling of tools and equipment.
Expected outcome	On completion of this course, the students will be able to 1.Welding and soldering operations. 2.Fabrication of simple sheet metal and wood parts.
Course Contents:	
UNIT-I	Welding Shop
1.Instruction of standards and reading of welding drawings. 2.Making Butt joint, Lap joint, Corner joint.	
UNIT-II	Sheet Metal and Soldering shop
1.Making of Cube, Prism, Cone, Cylinder, Funnel using development of lateral surfaces. 2. Instruction of standards and reading of soldering tools. 3.Soldering of sheet metal models.	
UNIT-III	Fitting/Carpentering
1.Introduction to Fitting tools. 2.Making V Joint, Square Joint. 3.Introduction to carpentry tools. 4.Making T Joint, Dovetail Joint.	
UNIT-IV	BOSCH Tools
1.Demonstration of all BOSCH tools and their applications.	

Text Books:

Workshop Manual Prepared by REVA University Staff	
Mode of Evaluation	Tutorials/Class Tests/Lab exam

BTCE15F3100	**Engineering Mathematics -III**	**L**	**T**	**P**	**C**	**Hrs/Wk**
Duration :16 Wks		**3**	**1**	**0**	**4**	**5**

Prerequisites:

BTCE15F1100, BTCE15F2100

Course Objectives:

To study and understand the application approach of the concepts of Numerical methods, curve fitting, and statistics.

Course outcomes:

At the end of the course the students would

1. Be capable of mathematically formulating certain practical problems.
2. Recognize and understand the methodologies of various numerical techniques and associated error estimation analysis.

3. Understand the importance of statistical analysis in engineering and other fields, the nature of uncertaintly and the concept of propability, numerical techniques for solving first-order differential equations.

4. Be able to solve the problems in dynamics of rigid bodies, optimization of orbit's and vibration problems.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 100	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

UNIT - I: Numerical Methods

Introduction, solution of algebraic and transcendental equation, Bisection method, Regula false method.

Finite differences and Interpolation :-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 and Problems.

UNIT-II: Curve Fitting

Introduction, graphical Method, Principles of Least Squares, Method of Least squares, fitting of other curves, Methods of group averages, fitting a parabola, Method of Moments

UNIT-III: Probability and Information Theory:

Introduction, Principal of counting, and combinations, basic terminology, definition and probability, set notations. Addition law of probability, independent events, multiplication law of probability, Baye's Theorem, Random variables, Discrete Probability distribution, continuous probability distribution, Expectation, variance, Moments generating functions, Probability generating functions, repeated trials, Binomial distribution, Poisson Distribution, Normal Distribution.

UNIT-IV: Sampling and inference:

Introduction, sampling distribution, standard error, testing of hypothesis, errors, level of significance, tests of significance, confidence limits, simple sampling of attributes, test of significance for large samples, comparison of large samples, sampling of variables, central limit theorem, confidence limits, test of significance for means of two large samples, sampling variables, student-t- distribution, significance test of a sample mean, significance test of difference between sample means, chi-square test, goodness of fit.

Text Books:

1. B.S.Grewal, "Higher Engineering Mathematics" Khanna Publishers, latest edition
2. Erwin Kreyzig, "Advanced Engineering Mathematics", Wiley Pub lications, Latest edition

Reference Books:

1. B.V.Ramana, Higher Engineering Mathematics", Ist edition, Tata McGrraw Hill Publications,2010
2. R.K.jain and S.R.K.Iyengar, "Advanced Engineering Mathematics" ,Narosa Publishing House, 4th Edition

BTCE15F3200	Building Materials & Construction Technology	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

None

Course Objectives:

1. To learn about types of bricks, stones, cement and Concrete
2. To understand about types of foundations and brick and stone masonry.
3. To know about the lintels, stairs, roofs, doors and windows.
4. To understand the concepts of flooring and plastering.

Course Outcomes:

1. To identify the types of foundations and construction process.

2. To assess the different types of members of structures.
3. To Provide Suitable doors and windows
4. To carry out the Suitable type of paints.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 200	CO1	3	1	2	1					2	2		2	3	1	2	2
	CO2	3	1	2	2					2	2		3	3	1	2	2
	CO3	3	2	3	1					2	2		2	3	1	2	2
	CO4	3	2	3	1					2	2		3	3	1	2	2

Course contents

UNIT1: Foundation and Masonry

Function and requirements of a good foundation, Types of foundations, Preliminary investigation of soil, Safe Bearing Capacity of Soil, Introduction to spread, combined, strap, mat and pile foundations. (Basic Concepts and Sketches only)

Classification of Masonry, Definition of terms used in Masonry, Introduction to classification and qualities of bricks, Bonds in Brick work - English Bond, Flemish Bond, Reinforced Brick Masonry, Common building stones, their properties and uses, Classification of stone masonry, Joints in stone masonry, load bearing, cavity and partition walls.

UNIT2: Arches, Lintel, Balcony, Roofs and Floors

Elements of an arch, Classification of arches, Definition and classification of Lintels, Definition and functions of Chejja, Canopy & Balcony. Types of Roofs & Roofing materials, Flat roof (RCC), Types of pitched roofs, Wooden truss, Steel truss, Types of flooring, Factors affecting selection of flooring materials. (Classification and sketches only)

UNIT3: Doors, Windows , Stairs and plastering

Location of doors and windows with a plan of typical residential building (line diagram only), Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows & properties of wood. Definition of technical terms related to stairs, Types of Stairs, Geometrical design of RCC Dog legged and open well stairs (Plan and sectional elevation).Purpose of plastering, Materials of plastering, Methods of plastering, Defects in plastering,

UNIT4: Painting and Miscellaneous topics

Types of Paints, Constituents of paints, Purpose of Painting, Defects in Painting, Application of Paints to new and old surfaces.

Properties and uses of plastics, aluminum, glasses, varnishes, Introduction to smart materials and its application, Introduction to formwork and scaffolding, Formwork details for RCC Column, Beams and Floors, Shoring and under pinning, Damp Proofing - Causes of Dampness, Effects of Dampness, Methods of Damp Proofing

REFERENCE BOOKS

1. Rangawala P.C, Engineering Materials, Charter Publishing House, Anand, India.
2. Sushil Kumar, Engineering Materials, Standard Publication and Distributors, New Delhi.
3. M..S. Shetty, S. Chand and Co, Concrete technology – Theory and practice, New Delhi, 2002.
4. P.G. Varghese,A Text Book Building Materials, Prentice-Hall of India Pvt. Ltd., Publication.
5. Mohan Rai and M.P. Jain Singh, Advances in Building Materials and Construction publication by CBRI, Roorkee.
6. byNeville A.M and Brooks J.J , Concrete Technology ELBS Edition, London
7. byGambhir M.L, Concrete Technology–Dhanpat Rai and Sons, New Delhi.
8. C B Kukreja and Ravi Chawla, Material Testing Laboratory Manual by Standard Publishers Distributors, New Delhi.
9. H.M. Raghunath, Strength of Materials Lab Testing, Theory & Problems, New Age International (P) Ltd, 2010, New Delhi.

BTCE15F3300	Engineering Earth Science	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Course Prerequisite: PUC with Science

Course Learning Objectives:

- To learn about Geomorphology and interior of the Earth.
- To study the origin, properties and uses of minerals.
- To study the origin, properties and uses of rocks.
- To study the causes and effects of earth quakes.
- To understand the various structures developed in rocks.
- To know the Geological details in the selection of dam and tunnel sites.
- To study the groundwater formation, exploration and exploitation.
- To study the Geomatics and its applications in the field.

Course Outcome:
At the end the course the students

1. Students will have knowledge about Engineering properties of Rocks and their Minerals.
2. Student will be appraised about Dam, reservoir, tunnel
3. Student will understand about Earthquake phenomena.
4. Student will able to carry out Physical exploration CE304.5 Student will able to estimate various geological parameters by use of modern tools & techniques

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 300	CO1	3	1	2	1					2	2		2	3	1	2	2
	CO2	3	1	2	2					2	2		3	3	1	2	2
	CO3	3	2	3	1					2	2		2	3	1	2	2
	CO4	3	2	3	1					2	2		3	3	1	2	2

Course Contents:

UNIT-I: **12hrs**

Introduction: Role of Earth Science in Civil Engineering Practices, Understanding the earth, interior of the earth, composition and density of crust, mantle and core layers.

Mineralogy: Quartz Group (Glass); Feldspar Group (Ceramic wares and Flooring tiles); Kaolin (Paper, paint and textile); Asbestos (AC sheets); Carbonate Group (Cement) ; Gypsum (POP, gypsum sheets, cement); Mica Group (Electrical industries); Ore minerals - Iron ores (Steel); Chromites (Alloy); Bauxite (aluminum); Chalcopyrite (copper). Mineral properties, composition and uses, in the manufacture of construction materials of above minerals.

Petrology: Strength Characteristics of rocks - Compressive, Tensile and Shear strengths and Hardness. Formation, Classification of Engineering properties and uses of rocks in construction : Igneous Rocks - Granite, Dolerite, Gabbro, Basalt; Sedimentary rocks - Sandstone, Shale, Limestone, Laterite; Metamorphic rocks - Gneiss, Quartzite, Slate, Charnockite: Decorative stones - Porphyries, Marble and Quartzite.

UNITII:12hrs

Geomorphology: Geomorphological agents: River valley, Drainage development and patterns; Coastlines and their engineering considerations , deserts and its features. Rock weathering and its effect on Civil Engineering projects;

Seismology: Introduction, seismic waves, Engineering problems related to Earthquakes, Earthquake intensity, causes and effects, Seismograph: , Seismic zones- World and India, Tsunami. Reservoir Induced Seismicity, Plate Tectonics.

Unit-III: 12hrs

Rock Mechanics: Concept of stress and strain, deformation of rocks, Development of Joints, Folds, Faults and Unconformity and their impact on the selection of sites for Dams, Reservoirs, Tunnels, Highways and bridges.

Construction Materials: Introduction, Selection of good quality rocks based on geological and engineering properties for use in the construction of Dams, Roads, Railway lines; Flooring slabs, Masonry, aggregates; Decorative stones-Colour, texture, hardness and durability.

Unit -IV: **12hrs**

Hydrogeology: Hydrological cycle, Occurrence of Groundwater in different terrains - Weathered, Hard and Stratified rocks. Groundwater pollution, Groundwater Exploration- Electrical Resistivity Method, Resistivity curves, Aquifer and its types, Springs and Artesian Wells, Rain water harvesting and recharge of Groundwater, Sea water intrusion and remedies.

Toposheets and Geological Maps: Study of Toposheets, Geological maps, Use of maps in Civil Engineering, Disaster Management – types of Disasters early warning system and their mitigation.

References:

1) Principles of Engineering Geology and Geotechnics by Dimitri P Krynine and William R Judd, CBS Publishers and Distributors, New Delhi.
2) Earthquake Tips - Learning Earthquake Design and Construction by C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
3) Bureau of Indian Standards, IS: 1893, IS: 4326, IS: 13827, IS: 13828, IS: 13920, IS: 13925, IS: 15662-2006.
4) Principles of Engineering Geology by K V G K Gokhale, BS Publications, Hyderabad
5) Fundamentals of Geology by A B Roy, Narosa Publishing House, New Delhi
6) Text book of Remote Sensing and Geographical information System by M Anji Reddy, BS Publications, Hyderabad
7) Physical Geology by Arthur Holmes, Tata Mac Grow Hill, New Delhi
8) Ground Water by K. Todd, Tata Mac Grow Hill, New Delhi
9) Structural Geology by M P Billings, CBS Publishers and Distributors, New Delhi
10) Engineering Geology by D. Venkata Reddy, New Age International Publications, New Delhi

BTCE15F3400	Surveying	L	T	P	C	Hrs/Wk
Duration:16 Wks		2	1	0	3	4

Prerequisites:

Basic Mathematics, and Basic science

Course Objectives:

1. To provide basic knowledge about principle of surveying for location, design and construction of engineering projects and also study about chain and compass surveying.
2. To develop skills for using surveying instruments including levelling instruments, plane tables etc.
3. To develop skills for using theodolite instruments to find horizontal and vertical angles and determine the elevation and distances.
4. To make students to set out various types of curves.

Course Outcomes:

1. Gain the basic surveying and application of chain and compass surveying for various different conditions.
2. Gained the ability to use plane table and levelling equipment with their accessories and to meet various requirements.
3. Gain the ability to use of theodolite to measure angles, elevation and distances.
4. Set out horizontal and vertical curves for various engineering projects.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 400	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**

UNIT – I: Introduction to Surveying

Importance of surveying to Civil Engineering – Definition– Classification– Concepts of plane and geodetic surveying – Principles of surveying –Plans and maps – Surveying equipments, their type and uses (Chain, Tape, Ranging rod, Cross staff, Optical square, Prism square, Offset rod) – Obstacles in chain surveys. Meridians, Bearings, Dip, Declination, Local attraction - Chain & Compass traverse, Local attraction, Calculation of bearings and included angles with numerical examples

UNIT – II: 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: Theodolite Survey, Trignometric Levelling and Tacheometry

Theodolite – Types of adjustments and objectives - Horizontal and Vertical angle measurements by repetition and reiteration – Trigonometric levelling - Single and Double plane for finding elevation of objects – Application of tacheometry– Finding constants K & C – Computation of distances and elevations using Tacheometric methods, only concepts.

Calculation of areaand 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 – Volume calculation from spot levels and contour plans. Problems on Railway and Highway embankments.

UNIT – IV : 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.

Text 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.

Reference Books:

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

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

3.M. Chandra, "Plane Surveying"– New age international (P) Ltd.

BTCE15F3500	Strength of Materials	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 500	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 1: 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 2: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 3: Compound Stresses , Bending and shear stresses in beams
Compound Stresses: Introduction, Stress components on inclined planes, General two dimensional stress system, Principal planes and stresses.
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 'I' and 'T' beam sections.
UNIT 4: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.

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Basavarajaiah and Mahadevappa, Strength of Materials, University Press (2009).
2. B.C Punmia Ashok Jain, Arun Jain, Mechanics of Materials, Lakshmi Publications, New Delhi.
3. Subramanyam, Strength of Materials, Oxford University Press, Edition 2008

BTCE15F3600	Fluid Mechanics	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

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	P 0 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 15F3 600	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-1: BASIC PROPERTIES OF FLUIDS

Introduction, Definition of Fluid, Systems of units, properties of fluid: Mass density, Specific weight, Specific gravity, Specific volume, Viscosity, Cohesion, Adhesion, Surface tension,& capillarity. Newton's law of viscosity (theory & problems).Capillary rise in a vertical tube and between two plane surfaces (theory only).

PRESSURE AND ITS MEASUREMENT

Definition of pressure, Pressure at a point, Pascal's law, Variation of pressure with depth. Types of pressure. Vapour pressure. Measurement of pressure using simple, differential & inclined manometers (theory & problems). Introduction to Mechanical and electronic pressure measuring devices. .

HYDROSTATIC PRESSURE ON SURFACES

Basic definitions, equations for hydrostatic force and depth of centre of pressure for Vertical and inclined submerged laminae (plane and curved) - Problems.

UNIT-2: 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. Momentum equation problems on pipe bends.

UNIT-3: 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.

UNIT-4: UNIFORM FLOW IN OPEN CHANNELS

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

TEXT BOOKS:

1. R.K.Rajput, S.Chand & Co, 'A Textbook of Fluid mechanics & Hydraulic Machines'-, New Delhi, 2006.
2. N.Narayana Pillai, 'Principles of Fluid Mechanics and Fluid Machines'- Universities Press (India), Hyderabad, 2009 Edition.
3. Madan Mohan Das, 'Fluid Mechanics and Turbomachines'- PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

REFERENCE BOOKS:

1. Bruce R. Munson,Donald F.Young, Theodore H. Fundamentals of Fluid Mechanics' –Okiishi, Wiley India, New Delhi, 2009 Edition.
2. Edward j.Shaughnessy, jr; Ira m. Katz 'Introduction To Fluid Mechanics' –:; James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.
3. R.K.Bansal, 'Text Book Of Fluid Mechanics& Hydralic Machines'- Laxmi Publications, New Delhi, 2008 Edition.
4. Streeter, Wylie, 'Fluid Mechanics' –Bedford New Delhi,2008(Ed)

BTCE15F3700	Basic Material Testing Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

Prerequisites:

Building Materials and Strength of Materials.

Course Objectives:

1. Ability to apply knowledge of mathematics and engineering in calculating the mechanical properties of structural materials
2. To provide an opportunity to learn how to measure hardness of ferrous and non-ferrous materials.
3. To study the behaviour of mild steel under impact load, torsion, tension, compression and shear.
4. 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 700	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

Laboratory Experiments:

1. Tension test on Mild steel and HYSD bars.
2. Compression test of Mild Steel, Cast iron and Wood.
3. Torsion test on Mild Steel circular bar
4. Bending Test on Wood under two point loading
5. Shear Test on Mild steel.
6. Impact Test on Mild Steel (Charpy & Izod)
7. Tests on Bricks and Tiles
8. Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking
9. Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.
10. Demonstration of Strain Gauges.

Reference Books:

1. Davis, Troxell and Hawk, Testing of Engineering Materials, International Student Edition – McGraw Hill Book Co, New Delhi.
2. Fenner, Mechanical Testing of Materials, George Newnes Ltd. London.
3. Holes.K.A, Experimental Strength of Materials, English Universities Press Ltd. London. Relevant IS Codes.
4. M.L.Gambhir, Concrete Manual, Dhanpat Rai & Sones, New Delhi.

BTCE15F3800	Surveying Practice Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F3 800	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**

LIST OF PRACTICALS:

1. To measure distance between two points using direct ranging, to set out perpendiculars at various points on given line and thus to calculate the area of a plot by cross-staff survey.
2. Measurement of bearing of the sides of a closed traverse using prismatic compass.
3. To locate points using Radiation and Intersection method of plane tabling and to solve 3-point problem in plane tabling using Bessel's graphical solution.
4. To determine difference in elevation between two points using fly levelling & to conduct Fly back levelling to check the accuracy of levelling work. Booking of levels using both H I & Rise and fall methods.
5. To conduct profile levelling for water supply/sewer line and to draw the longitudinal section to determine the depth of cut/fill for a given gradient.
6. Measurement of horizontal angles using method of Repetition and reiteration & measurement of vertical angles using Theodolite.
7. To determine the distance & elevation of an object using single plane and double plane methods.

Text 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.

Reference Books:

1. S K Roy, "Fundamentals of Surveying", Prentice Hall of India, New Delhi. 2009
2. S K Duggal, "Surveying", Vol. 1, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2008.

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

SYLLABUS IV SEMESTER

BTCE15F4100	Concrete Technology & Alternative Building Materials	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Civil engineering materials and Engineering Construction.

Course Objectives:

1. To learn about different alternative building materials and its characteristics
2. To understand about properties of lime-pozzolana cements
3. To know the factors and properties of structural masonry and equipment for the production of alternative materials.
4. To understand the different alternative building technology and cost effective building design.

Course Outcomes:

1. Have learnt about different alternative building materials.
2. Be able to understand properties of lime-pozzolana cements.
3. Be able identify the equipment's for the alternative building materials.
4. Able to explain the different technology and their design.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F4 100	CO1	3	3	1										3	2	1	1
	CO2	3	2	1										3	1	1	1
	CO3	3	3	2	3									3	3	3	2
	CO4	3	3	3	2									3	3	3	1

Course Contents:

UNIT1:Cement and Aggregates:

Cement and aggregates, Chemical composition, hydration of cement, Types of cement, manufacture of OPC by wet and dry, process (flow charts only) .Testing of cement and grades of cement, Quality of mixing water. Fine aggregate testing, deleterious materials. Coarse aggregate – Importance of size, shape and texture. Grading of aggregates - Sieve analysis, specific gravity, Flakiness and elongation index, crushing, impact and abrasion tests.

UNIT :Properties of concrete:

Workability - factors affecting workability, Measurement of workability, Segregation and bleeding, Process of manufactures of concrete: Batching, Mixing, Transporting, Placing, Compaction and Curing, RMC concrete.

Chemical admixture, Mineral admixtures, Factors affecting strength, w/c ratio, gel/space ratio, maturity concept, Effect of aggregate properties, relation between compressive strength, and tensile strength, bond strength, modulus of rupture, Accelerated curing, aggregate - cement bond strength, Testing of hardened concrete by various methods.

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson's Ratio, Shrinkage and creep concepts only.

UNIT3:Durability of Concrete and mix design:

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, structural design deficiencies.

Concept of Concrete Mix design, variables in proportioning, exposure conditions, Procedure of mix design as per IS 10262, Numerical examples of Mix Design**.**

UNIT4: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, Characteristics of building different blocks for wall, Alternative for wall construction, Types, Construction method, Masonry mortars,

Ferro-cement - materials, techniques of manufacture, properties and. Fiber reinforced concrete - Fibers types and properties, Self compacting concrete concept, materials, tests, properties, application and Typical mix.(theoretical concepts only). Nansu method of mix design for SCC (procedure only)

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, New Age International Publishers Ltd, New Delhi.
7. Relevant IS Codes
8. Gambhir, M.L., Concrete Manual: Laboratory Testing for Quality Control of *Concrete*, 4th Edn., Dhanpat Rai and Sons, Delhi, 1992.

Sood, Hemant, Mittal L N and Kulkarni P D, **Laboratory Manual on Concrete Technology** CBS Publishers, New Delhi, 2002.

BTCE15F4200	Applied Surveying & GIS	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Basic Mathematics, and Basic science

Course Objectives:

1. To provide basic knowledge about principle of surveying for location, design and construction of engineering projects and also study about chain and compass surveying.
2. To develop skills for using surveying instruments including levelling instruments, plane tables etc.
3. To develop skills for using theodolite instruments to find horizontal and vertical angles and determine the elevation and distances.
4. To make students to set out various types of curves.

Course Outcomes:

1. Gain the basic surveying and application of chain and compass surveying for various different conditions.
2. Gained the ability to use plane table and levelling equipment with their accessories and to meet various requirements.
3. Gain the ability to use of theodolite to measure angles, elevation and distances.
4. Set out horizontal and vertical curves for various engineering projects.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F4 200	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

UNIT – I : Introduction

General requirements and specifications for engineering project surveys, reconnaissance. Preliminary and locations survey for highway, earthen bund and canals. (brief types and concepts only)

Setting out of Construction works-Setting out of a bridge, determination of the length of the central line and the location of piers, Setting out of a tunnel – surface setting out and transferring the alignment underground.

EDM: Principles of EDM's. Total Station-salient features and capabilities. Digital levels-salient features and capabilities.

UNIT – II: Hydrographic Survey and Aerial Photogrammetry

Hydrographic Survey- horizontal and vertical control. Soundings and location Shoreline and river survey, Methods of soundings, equipments, three point problem. Tidal and Stream Discharge measurement

Aerial Photogrammetry -Introduction, Principle, Uses, Aerial Camera, Aerial Photographs, Definitions, Scale of vertical and tilted photograph, ground co-ordinates, ground control procedure for aerial survey.

UNIT – III : **Remote Sensing and GPS**

Definition and concepts. Concept of signatures. Multi-spectral concept. Remote sensing systems. Remote sensors and platforms. Data products generation and analysis. Application of remote sensing in agriculture, water resources, wet land management, land cover/use mapping and forestry. Global Positioning System-Advantages of GPS, Components of GPS-Space, control and user segments. Relative and differential positioning. Factors affecting GPS, GPS applications.

Unit 4: GIS

Introduction to GIS, GIS terminology, concepts, Geographic data-data input, processing – data base structure-vector and raster data structure, database management-layer concepts, spatial manipulation and analysis and graphical output and visualization.

Use of GIS in Management and monitoring of land, air, change detection, water and pollution studies, conservation of resources, geological applications, coastal zone management - Limitations.

Text 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.Anji Reddi, "Remote Sensing and GIS", BS publications, 2001

Reference Books:

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

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

3.M. Chandra, "Plane Surveying"– New age international (P) Ltd.

BTCE15F4300	Building Planning & Drawing	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	2	0	3	5

Prerequisites:

Prerequisite: Building Material and Construction Technology

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, water supply, sanitary and electrical layouts 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. To prepare water supply, sanitary and electrical layouts.
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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F4 300	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:

UNIT-1

Preparation of geometrical drawing of components of buildings i) Stepped wall footing and isolated RCC column footing, ii) Fully paneled and flush doors, iii) Half-paneled and half-glazed window, iv) RCC dog legged and open well stairs, v) Steel truss.

UNIT-2

Functional design of building (Residential, Public and Industrial), positioning of various components of buildings, orientation of buildings, building standards and bye-laws, set back distances and calculation of carpet area, plinth area and floor area ratio.

UNIT-3

Development of plan, elevation, section and schedule of openings from the given line diagram of residential building: i) Two bed room building, ii) Two-storeyed building.

Preparation of water supply, sanitary and electrical layouts for a given single line diagram.

UNIT-4

Functional design of buildings using inter-connectivity diagrams (bubble diagram), development of line diagram for following buildings i) Primary health centre, ii) Primary school building, iii) College canteen iv) Office building.

Note: The drawings shall be prepared using AUTOCAD or any other drafting software.

Examination & Evaluation:

1. Based on manual drawing practice & submission of drawing sheets of Unit I & Unit-II C1 Assessment has to be done.
1. Based on manual drawing practice & submission of drawing sheets of Unit III & Unit-IV C2 Assessment has to be done.
2. C3 examination must be with Auto CAD 3hours lab examination for UNIT-III & UNIT-IV only (TWO problems must be given one from UNIT-III (35 Marks) , One from UNIT-IV 15 Marks . UNIT-III (Plan – 10 marks, front elevation- 5 marks, Sectional elevation – 10 marks , dimensioning – 5 marks and Schedule of openings – 5 marks)

REFERENCE BOOKS:

1. Shah M.H and Kale C.M, **Building Drawing**, Tata Mc-Graw Hill Publishing co. Ltd., NewDelhi.
2. Gurucharan Singh, **Building Construction,** Standard Publishers &distributors, New Delhi.
3. **National Building Code**, BIS, New Delhi.
4. 4. N.Kumarswamy and A. Kameswara Rao, **Building Planning And Drawing,** Chartor Publishing House Pvt. Ltd.
5. Dr.*Balagopal and T.S.Prabhu*, ***Building Drawing and Detailing*** - *Spades Publishers*, Calicut.

BTCE15F4400	Water Supply Engineering & Introduction to EIA	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Water and Waste Water Engineering

Course Objectives:

1. Identify the various Water sources, water borne diseases, types of pumps for rural water supply and Water treatment methods to control contamination of water.
2. Describe Principles of rural sanitation and rain water harvesting.
3. Identify the Methods of communicable diseases and Refuse collection system
4. Describe the Milk Sanitation principle and identify the insects control measures.

Course Outcomes:

1. Understanding the concepts of protected water supply. Estimate water demand for a particular town and forecast the population.
2. Exposure to various sources of water, the methods of collection and its conveyance and Calculate the economical diameter of rising main.
3. Ability to identify the various physical chemical and biological parameters of water and the drinking water standards. Select and design appropriate water treatment unit processes.
4. Understanding the concepts of EIA and the methodology of preparation of a systematic EIA report. Exposure to standard laboratory methods of water quality analysis.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO	PSO2	PSO3	PSO4
BTCE15F4400	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: INTRODUCTION : Need for protected water supply, Concepts of rural water supply scheme, Types of water demands- domestic demand in detail, institutional and commercial, public uses, fire demand, per capita consumption and design period –factors affecting, population forecasting, Numerical on population forecast, different methods with merits &demerits- variations in demand of water, peak factors.

Sources and Collection of Water

Surface and subsurface sources – suitability with regard to quality and quantity, Intake structures – different types, sketches, factors of selection and location of intake

UNIT-II:CONVEYANCE OF WATER: Pipes – Design of the economical diameter for the rising main; Pipe appurtenances, various valves, type of fire hydrants, pipe fitting, layout of water supply pipes in buildings; systems of water supply, methods of layout of distribution systems.

QUALITY OF WATER: Objectives of water quality management, Water quality parameters – Physical, chemical and Microbiological, Sampling, Water quality analysis (IS: 3025 and IS: 1622), Drinking water standards BIS & WHO guidelines. Health significance of Fluoride, Nitrates and heavy metals like Mercury, Cadmium, Arsenic etc and toxic / trace organics, water borne diseases, Objectives of Water Treatment, Flow chart of treatment units.

UNIT-III:WATER TREATMENT :

Aeration- Principles, types; Sedimentation- theory, types, Coagulant aided sedimentation-jar test, feeding, flash mixing and clariflocculator; Filtration-theory, types, construction, operation and maintenance of filters; Disinfection- theory, types, minor methods, treatment of swimming pool water; Design criteria of all treatment units, numerical

Miscellaneous treatments -Softening- definition, lime soda process, zeolite process, RO and membrane techniques, - removal of colour, odour and taste, Fluoridation and Defluoridation

UNIT-IV:INTRODUCTION TO EIA :

Environment Impact Assessment, step by step procedure for conducting EIA , Rapid and comprehensive EIA, EIS, FONSI, Need for EIA, , Limitations of EIA, Methodologies- adhoc, checklist, matrix, networks, index, overlay, simulation modeling

EIA guidelines for Development Projects, Public participation in Project activities, Case Studies.

TEXT 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 - (1986), Mc Graw Hill Book Co.
4. Anjaneyalu Y; BS Publications, Environmental Impact Assessment- Hyderabad.

REFERENCES

1. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi

2. Hammer, M.J., (1986), Water and Wastewater Technology –SI Version, 2nd Edition, John Wiley and Sons.
3. Karia, G.L., and Christian, R.A., (2006), Wastewater Treatment – Concepts and Design Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Sincero, A.P., and Sincero, G.A., (1999), Environmental Engineering – A Design Approach– Prentice Hall of India Pvt. Ltd., New Delhi.
5. E.W.Steel,Mc Ghee, Terence -'Water Supply Engineering and Sewerage; Mc.Graw Hill
6. Fair, Geyer and Okun-'Water and Wastewater Engineering: Water Supply and Wastewater Removal, 3rd Edition, John Wiley and Sons.
7. Larry. W .Canter, Environmental Impact Assessment, Mc Graw Hill Publications.
8. Ministry of Environment and Forests Notification on EIA of Developments Projects.

BTCE15F4500	Basic Structural Analysis	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	3	4

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F4 500	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 1:Introduction: Conditions of equilibrium, Degrees of freedom, Linear and Nonlinear Structures, One, Two, Three-dimensional structural systems, Determinate and indeterminate structures , Static and Kinematic indeterminacy, and simple numerical examples. Strain energy and complementary strain energy, Strain energy due to axial load, bending and shear, Law of conservation of energy, Principle of virtual work, First and second theorems of Castigliano, Maxwell's theorem of reciprocal deflection, Betti's law.(theoretical concepts only)

UNIT 2:Slope and Deflection of Beams

Moment area method, Conjugate beam method, unit load method, simple Numerical examples.

Deflection of Trusses:

Unit load method, simple Numerical examples.

UNIT 3:Three-hinged arches

Three hinged circular and parabolic arches with supports at same level and different levels, Determination of normal thrust, radial shear and bending moment, Numerical problems.

Two-hinged arches:

Two hinged parabolic arch and circular arch, Numerical problems.

UNIT 4:Analysis of statically indeterminate beams:

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

TEXT 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.
5. B.C. Pumia, R.K., Jain, Strength of Materials and theory of structures Vol I & II, Laxmi Publication New Delhi

REFERENCE BOOKS:

1. Norris and Wilbur, Elementary Structural Analysis, International Student Edition, McGraw Hill Book Co., New York
2. Wang and Chu Kia, Intermediate Structural Analysis by McGraw Hill, New York.
3. R C Hibbeler, Structural Analysis Prentice Hall, New Jersey.

BTCE15F4600	Hydraulic Machines	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	3	4

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 Code	POS/ COs	PO 1	P 0 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 15F4 600	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-1: 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, Direct impact 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-2: PELTON WHEEL

Introduction to Turbines, Classification of Turbines. Pelton wheel- components, working and velocity triangles. Maximum power, efficiency, working proportions- problems.

KaplanTurbine-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-3: 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-4: CENTRIFUGAL PUMPS

Introduction, Classification, Priming, methods of priming. Heads and Efficiencies. Equation for work done, minimum starting speed, velocity triangles. Multistage Centrifugal Pumps (Pumos in Series and Pumps in parallel). Characteristic Curves for a Single stage Centrifugal Pumps- numerical examples.

TEXT BOOKS:

1. R.K.Rajput, S.Chand & Co, 'A Textbook of Fluid mechanics & Hydraulic Machines'- New Delhi, 2006 Edition.
2. R.K.Bansal, ' Text Book Of Fluid Mechanics& Hydralic Machines'Laxmi Publications, New Delhi, 2008 Edition.
3. Madan Mohan Das, 'Fluid Mechanics and Turbomachines'- PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

REFERENCE BOOKS:

1. Robert w. Fox: Philip j. Pritchard: Alan t. 'Introduction to Fluid Mechanics' –McDonald, Wiley India, New Delhi, 2009 Edition.
2. Edward j.Shaughnessy,jr; Ira m. Katz 'Introduction To Fluid Mechanics' – James p Schaffer, Oxford University Press, New Delhi, 2005 Edition.
4. Dr. P.N. Modi& Dr S.M. Seth, 'Hydraulics and Fluid Mrchanics' –Standard Book House- New Delhi. 2009 Edition.

BTCE17F4700	Advanced Surveying Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

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	P 0 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 17F4 700	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

LIST OF PRACTICALS:

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 Water Resources Engineering Water Resources Engineering.
10.Office work-Design and plotting using AutoCAD.

Text Books:

1. Punmia B C., "Surveying", Vol. 1 & 2, Laxmi Publications Pvt. Ltd., New Delhi. 2009 5T
2. P Kanetkar & S P Kulkarni., "Surveying", Vol. 1 & 2, Tata McGraw Hill Publishing Co. Ltd, New Delhi. 2009.

Reference Books:

1. S K Roy, "Fundamentals of Surveying", Prentice Hall of India, New Delhi. 2009
2. S K Duggal, "Surveying", Vol. 1, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2008 3.M. Chandra, "Plane Surveying"– New age international (P) Ltd.

BTCE15F4800	Engineering Earth Science Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

Prerequisites:

Engineering Earth Science

Course Objectives:

To make the students capable to identify and study properties of rock and minerals . They also should be able to use modern tools line microscope

Course Outcomes:

1. Student should acquire knowledge about engg. properties of rocks and their minerals.
2. Student should be able to identify rocks and minerals
3. Student should be able to use modern tools live microscope to explore samples.
4. Student should be able to interpret map

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F4 800	CO1	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**2**	**2**	**3**	**3**
	CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**2**	**2**	**3**	**3**
	CO3	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**2**
	CO4	**2**	**2**	**2**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**2**	**2**	**2**	**2**	**2**

Exp. No.	Name of the Experiment	No. of classes
1.	Identification of Minerals as mentioned in theory, their properties, uses and manufacturing of construction materials	2
3.	Identification of rocks as mentioned in theory, their engineering properties and uses in construction and decorative purposes	2
4.	Dip and Strike problems: Determination of dip and strike direction in Civil Engineering projects (Railway lines, tunnels, dams, reservoirs) - graphical method	2
5.	Bore hole problems: Determination of subsurface behavior of rocks, their attitude related to foundation, tunnels, reservoirs and mining(Triangular & Square Method)	2
6.	Calculation of bifurcation ratio, drainage density and drainage frequency of a river basin	2
7.	Interpretation of geological maps related to Civil Engineering projects	2
8.	Viva Voce	--
	Total	12

References:

11) Principles of Engineering Geology and Geotechnics by Dimitri P Krynine and William R Judd, CBS Publishers and Distributors, New Delhi.
12) Earthquake Tips - Learning Earthquake Design and Construction by C V R Murthy Published by National Information Centre of Earthquake Engineering, Indian Institute of Technology, Kanpur.
13) Bureau of Indian Standards, IS: 1893, IS: 4326, IS: 13827, IS: 13828, IS: 13920, IS: 13925, IS: 15662-2006.

V SEMESTER

BTCE15F5100	Design of RCC Structural Elements	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTCE15F5100	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

UNIT 1:GENERAL PRINCIPLES OF REINFORCED CONCRETE:

Introduction, Materials for Reinforced Concrete, Design Loads, Limit States, Philosophy of limit state design, Partial safety factors, Characteristic and design loads, Characteristic and design strengths, Codal Provisions.

ULTIMATE STRENGTH OF R.C. SECTION: General aspects of Ultimate strength, Stress block parameters for limit state of collapse, Ultimate flexural strength of singly reinforced rectangular sections, Ultimate flexural strength of doubly reinforced rectangular sections, Ultimate flexural strength of flanged sections, Ultimate shear strength of RC sections, Ultimate torsional strength of RC sections, Concepts of development length and anchorage.

UNIT-II:LIMIT STATES OF COLLAPSE AND SERVICEABILITY:

Numerical problems on flexural strength of singly reinforced, doubly reinforced rectangular sections, flanged sections, shear strength and development length.

Codal provisions for flexural design of beams - practical requirements, size of beam, cover to reinforcement-spacing of bars. General aspects of serviceability, Deflection limits in IS: 456–2000, Calculation of short-term and long-term deflections of flexural members, cracking in structural concrete members, Calculation of crack widths.

UNIT-III:DESIGN OF R.C. BEAMS: Codal provisions for critical sections for moment and shears. Anchorages of bars, check for development length, Reinforcement requirements, Slenderness limits for beams to ensure lateral stability, Numerical problems on design of simply supported and cantilever beams (rectangular and flanged sections).

DESIGN OF R.C. SLABS: General considerations of design of slabs, Rectangular slabs spanning one direction, Rectangular slabs spanning in two directions with various boundary conditions. Design of simply supported, cantilever and continuous slabs as per IS: 456–2000.

UNIT-IV:DESIGN OF R.C. COLUMNS: Codal provisions, effective length of column, loads on columns, slenderness ratio, minimum eccentricity, design of short axially loaded columns, design of columns subject to combined axial load and uniaxial moment and biaxial moment using SP–16 charts.

DESIGN OF ISOLATED R.C. FOOTINGS: Introduction, Codal provisions, Design of isolated square and rectangular footings for axial load and uniaxial moment by limit state method, Numerical problems.

DESIGN OF STAIR CASES: General considerations, types of stair case, Codal provisions, live loads, effective span, distribution of loading on stairs, Design of stairs with waist slab.

REFERENCE BOOKS:

1. Unnikrishna Pillai and Menon, Reinforced concrete Design TMH Education Private Limited, New Delhi.
2. P.C. Varghese, Limit State Design of Reinforced concrete PHI Learning Private Limited 2008-2009
3. M.L.Gambhir, Fundamentals of Reinforced concrete Design PHI Learning Private Limited 2008-2009.
4. S.N.Shinha, Reinforced concrete Design TMH Education Private Limited, New Delhi.
5. Karve & Shah, Reinforced concrete Design Structures Publishers, Pune.
6. S. S. Bhavikatti, Design of RCC Structural Elements Vol-I, New Age International Publications, New Delhi.
7. IS:456-2000 and SP-16

BTCE15F5200	Used Water Treatment & Solid Waste Management	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

BTCE14F4400

Course objectives: -

1. Gain an understanding on types of sewerage system, dry weather flow, wet weather flow and design of hydraulic elements of sewers.
2. Understand the various sewer materials, sewer appurtenances and the basic principles of house drainage.
3. Acquire an understanding on the physical, chemical and biological parameters of wastewater and on the self purification of natural streams.
4. To be able to select and design appropriate used water treatment unit processes and understand the objectives of used water reuse and recycle.
5. To learn about solid waste, different methods of collection, treatment, disposal and reuse.
6. Understand the various analytical methods for wastewater analysis.\

Course outcome: -

1. Exposure to the necessity of sanitation, types of sewerage system, dry weather flow and wet weather flow and design of hydraulic elements of sewers.
2. Ability to analyze the various sewer materials, sewer appurtenances and the basic principles of house drainage.
3. Acquire an understanding of the physical, chemical and biological parameters of wastewater and on the self purification of natural streams.
4. Ability to select and design appropriate wastewater treatment unit processes and understand objectives of wastewater reuse and recycle. Acquire knowledge on solid waste management. Exposure to standard laboratory methods of wastewater quality analysis.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS / COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTCE15	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	2	2	3	3	-	3	-	-	-	-	3	3	3	3	3

F5200	**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 1: INTRODUCTION

Necessity for sanitation, types of sewerage systems and their suitability. Dry weather flow-factors affecting dry weather flow, flow variations and their effects on design of sewerage system; computation of design flow, wet weather flow, Hydraulic formulae for velocity, effects of flow variations on velocity, self cleansing and non scouring velocities, Design of hydraulic elements for circular sewers flowing full and flowing partially full.

Sewer Materials and Sewer Appurtenances

Sewer materials, shapes of sewers, laying of sewers, joints and testing of sewers, ventilation and cleaning of sewers, Catch basins, manholes, flushing tanks, oil and grease traps, Drainage traps, Basic principles of house drainage, Typical layout plan showing house drainage connections.

Unit 2: USED WATER CHARACTERIZATION

Sampling-significance, techniques and frequency; Physical, Chemical and Biological characteristics of used water; Aerobic and Anaerobic activity, BOD and COD, their significance & problems; self-purification phenomenon, Oxygen sag curve, Zones of purification, , Effluent Disposal standards for land, surface water & ocean, Numerical Problems on Disposal of Effluents, Streeter Phelps equation.

Preliminary Treatment of Used Water

Flow diagram of municipal waste water treatment plant, Preliminary & Primary treatment-Screening, grit chambers, skimming tanks, primary sedimentation tanks – Design criteria & Design examples.

Unit 3: TREATMENT OF USED WATER-REUSE AND RECYCLE

Trickling filter – theory and operation, types and designs; Activated sludge process- Principle and flow diagram, Modifications of ASP, F/M ratio. Design of ASP; Anaerobic Sludge digestion, Sludge digestion tanks, Design of Sludge drying beds; Low cost waste treatment method; Septic tank, Oxidation Pond and Oxidation ditches – Design

Reuse and recycle of used water- Zero effluent discharge systems - Quality requirements for used water reuse, Examples, Sewage farming, sewage sickness, Recreational Reuse, Uses of Sewage in Pisciculture, Groundwater recharge of Sewage Effluents.

Unit 4: SOLID WASTE MANAGEMENT

Definition of solid waste, scope and importance of solid waste management, functional elements, classification and characteristics, collection and transportation, treatment / processing techniques-component separation, volume reduction, size reduction, chemical reduction, biological processing. Disposal methods – open dumping, ocean disposal, incineration, composting, sanitary landfill, biomedical waste disposal, Recycle and reuse of Solid waste – material and energy recovery operations, plastic waste recycle.

TEXT BOOKS

1. S.K.Garg,Sewage Disposal and Air Pollution Engineering –Khanna Publishers
2. B C Punima and Ashok Jain, Wastewater Engineering –Lakshmi Publishers
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., Environmental Engineering - (1986), Mc Graw Hill Book Co.
4. Integrated Solid Waste Management- Tchobanoglous, Mc.Graw Hill

REFERENCES

1. Manual on Wastewater Treatment –CPHEEO, Ministry of Urban Development, New Delhi
2. E.W.Steel,Mc Ghee, Terence -'Water Supply Engineering and Sewerage; Mc.Graw Hill
3. Fair, Geyer and Okun-'Water and Wastewater Engineering: Water Supply and Wastewater Removal, 3rd Edition, John Wiley and Sons.
4. Metcalf and Eddy: 'Waste Water Treatment, Disposal and Reuse'; Tata McGraw Hill Publications.
5. Solid Waste Management in Developing Countries; Bhinde and Sunderashan

BTCE15F5300	Transportation Engineering-I	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

NONE

Course Objectives:

1. To educate students about the importance of transportation, various modes of transportation with emphasis on road transportation.
2. To make students familiar with the components of railway tracks along with the basic geometric features.
3. To give students an overview of the planning and working of airports, along with the geometric features of runways and taxiways.
4. To make students appreciate the effects of natural phenomena on the components of harbours and ports and the basic aspects of tunneling.

Course Outcomes:

1. Compare the various modes of transportation; explain the principles of transportation planning and the need for integration of the various modes of transportation, with emphasis on highway geometrics and road traffic.
2. Describe the characteristics of rail transportation and the requirements of the components, simple track junctions; compute the geometric features of railway tracks and the permissible speeds.

3. 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.
4. Enumerate the different types of harbours and their components; illustrate the effects of wind, waves and tides on water front structures and the protection measures; outline the methods of tunneling, tunnel lining, drainage and ventilation

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 300	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**

UNIT – 1

Importance of transportation, comparison of various modes of transportation, importance and scope of highway engineering, highway planning and alignment, importance of highway geometric design and scope of traffic engineering, principles of urban transportation, mass transit facilities, integration of different modes of transportation – numerical examples.

UNIT – 2

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, design calculations of turnouts - numerical examples.

UNIT – 3

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 – 4

Classification of harbours, layout of harbours, component parts, effects of natural phenomena on harbour structures, breakwaters, 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", Dhanpat Rai 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, Anand.
5. Kadiyali L.R, "Traffic Engineering and Transportation Planning", Khanna Publishers, Delhi.
6. Satish, Chandra and Agarwal M M, "Railway Engineering", Oxford University Press, New Delhi.
7. Horonjeff, "Planning and Design of Airports", McGraw Hill Publications, New Delhi. William W. Hay, "An Introduction to Transportation Engineering", Toppan Company Ltd., Tokyo.

BTCE15F5400	Hydrology & Irrigation Engineering	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

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 Code	POS/ COs	PO 1	P 0 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 15F5 400	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**

Course Contents:

UNIT 1

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 (Blaney criddle method) Infiltration: Definition, factors affecting, measurement (double ring infiltrometer), infiltration indices, Horton's equation of infiltration.

UNIT 2

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 3

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 4

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

TEXT BOOKS:

1. Subramanya.K Engineering Hydrology – Tata Mcgraw Hill NewDelhi-2008 (Ed)
2. Madan Mohan Das, Mim Mohan Das Hydrology- -PHI learning private Ltd. New Delhi-2009 (Ed)
3. Jayarami Reddy, A Text Book Of Hydrology- Laksmi Publications, New Delhi-2007 (Ed)
5. P.N.Modi Irrigation, water Resources and water power Engineering-standard book house, New Delhi.
6. Madan Mohan Das & Mimi Das Irrigation and Water Power Engineering- Saikia; PHILearning pvy. Ltd. New Delhi 2009 (Ed).

REFERENCE BOOKS:

1. Ghanshyam Das- Hydrology & Soil Conservation Engineering- PHI Learning Private Ltd., New Delhi-2009 (Ed)
2. Patra K.C.Narosa Hydrology & Water Resources Engineering- Book Distributors Pvt. Ltd. New Delhi-2008 (Ed)
3. R.K.Sharma & Sharma, Hydrology & Water Resources Engineering- Oxford and Ibh, New Delhi
4. S. K.garg-Irrigation Engineering and Hydraulic structures- Khanna Publication, New Delhi.

BTCE15F5500	Geotechnical Engineering-I	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 500	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 - INTRODUCTION

Formation of soil – types of soil – clay mineralogy and soil stucture**:** Soil-Water system, Electrical diffuse double layer, adsorbed water, base-exchange capacity, Common clay minerals in soil and their structures- **INDEX PROPERTIES**-Three phase system of soil and their relationships –Grain size analysis – Stoke's law and hydrometer analysis – Consistency of soils –Determination of consistency indices – Classification of coarse grained and fine grained soil as per BIS

08 hours

UNIT II - PERMEABILITY AND SEEPAGE

Permeability –Definition – Assumption - one dimensional flow through soil – Darcy's law – Limitations - Discharge velocity and seepage velocity – factors affecting the permeability – permeability determination - lab and field methods – permeability in stratified soil deposits – Introduction of flow net and its properties - application of flow net.

08 hours

UNIT III - COMPACTION AND CONSOLIDATION

Compaction – field and lab methods – Proctor's test – factors affecting the compaction – effect of compaction in soil properties – **Consolidation** – Terzaghi's theory of one dimensional consolidation

- partial differential equation (no analytical solution) – Lab method - coefficient of consolidation – Determination - √t and log t methods.

8 hours

UNIT IV – EFFECTIVE STRESS AND SHEAR STRENGTH

Introduction – stresses in soil – concept of effective and neutral stresses – Introduction. Shear strength – shear strength of cohesive and cohesion less soils – Mohr coulomb's theory –Direct shear, Triaxial, unconfined shear strength – Lab and field vane shear test - factors affecting the shear strength.

08 hours

TEXT 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**;, Fifth Edition, Thomson Business Information India (P) Ltd., India(2002)

REFERENCES BOOKS:

1. Bowles J.E. **Foundation Analysis and Design**- 5th Edition, McGraw Hill Pub. Co. New York. (1996),

2. Alam Singh and Chowdhary G.R. **Soil Engineering in Theory and Practice**, CBS Publishers and Distributors Ltd., New Delhi. (1994)

4. Donold P Coduto **Geotechnical Engineering**- Phi Learning Private Limited, New Delhi

5. Shashi K. Gulathi & Manoj Datta. **Geotechnical Engineering**, Tata Mc Graw Hill(2009).

7. Narasimha Rao A. V. & Venkatrahmaiah C.**Numerical Problems, Examples and objective questions in Geotechnical Engineering**, Universities Press,Hyderabad (2000).

8. **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.

BTCE15F5600	**Intermediate Structural Analysis**	**L**	**T**	**P**	**C**	**Hrs/Wk**
Duration :16 Wks		**2**	**1**	**0**	**3**	**4**

Prerequisites:

Basic Structural Analysis

Course Objectives:

1. To learn about the basic concepts and principles of vibration of structures.
2. To learn about mathematical modeling of vibratory systems.
3. To analyze the free vibration of SDOF system (undamped and damped)

Course Outcomes:

1. To learn about the advantages and disadvantages of statically indeterminate structures
2. To determine the degree of static and kinematic indeterminacy of skeletal structures
3. To analyze statically indeterminate beams and rigid-jointed plane frames by slope deflection, moment distribution and Kani's methods.
4. To analyze plane trusses and axially rigid plane frames by stiffness and flexibility matrix methods (system approach only)

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 600	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:

UNIT1:Introduction: Statically indeterminate structures**,** Advantages and advantages**,** Concept of compatibility, determination of degree of static and kinematic determinacies of plane trusses, rigid frames and grids.

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

UNIT2:Moment Distribution Method: Introduction, Definition of terms Stiffness factor, Distribution factor, Carry-over factor, Analysis of beams and rigid jointed plane frames with and without side sway. Numerical examples.

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

UNIT3:Flexibility Method: Introduction, system and element approaches, Analysis of plane trusses and axially rigid plane frames by flexibility method (system approach only). Numerical Problems

Stiffness Method: Introduction, system and element approaches, Analysis of plane trusses and axially rigid plane frames by stiffness method (system approach only). Numerical examples,

UNIT4:Basic principles of structural dynamics: Vibrations and causes, periodic and aperiodic motion, harmonic and non-harmonic motion, Basic elements of a vibratory system, Concepts of free and forced Vibration, Viscous damping, Mathematical modeling, Dynamics degrees of freedom, Free vibration of Single Degree of Freedom System with and without damping, Simple Numerical Problems.

REFERENCE BOOKS:

1. Devdas Menon, Advanced Structural Analysis Narosa Book Distributors Pvt.Ltd, (2009).
2. Reddy C.S. Basic Structural Analysis - Second Edition, Tata McGraw Hill Publication Company Ltd.
3. Wang and Chu-Kia, Intermediate Structural Analysis McGraw Hill, New York.
4. Theory of Structures Vol. 2 - Tata McGraw Hill Publication Company Ltd.
5. S.P. Gupta, G.S. Pandit and R.Gupta, Structural Dynamics Mario Paz, & William League, Kluwer Academic Publishers.
6. S. S. Bhavikatti – Structural Analysis-II - Vikas Publishers, New Delhi.
7. D.S. Prakash Rao, Structural Analysis- A Unified Approach,University Press Structural Analysis, 4th SI Edition by Amit Prasanth & Aslam Kassimali, Thomson Learning.

BTCE15F5710	Design of Masonry Structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Knowledge of Alternate 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 710	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:

UNIT1: Masonry Units, Materials, Types, Masonry Construction, Strength and Stability:

Brick, stone and block masonry units, strength, modulus of elasticity and water absorption of masonry materials, classification and properties of mortars, selection of mortars, Defects and errors in masonry construction, cracks in masonry, types, reasons for cracking, methods of avoiding cracks. Strength and Stability of concentrically loaded masonry walls, effect of unit strength, mortar strength, joint thickness, rate of absorption, effect of curing, effect of ageing, workmanship, strength formulae and mechanism of failure for masonry subjected to direct compression.

UNIT 2: Permissible stresses, Design considerations:

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.

UNIT 3: Load considerations for masonry, Design of masonry walls:

Wall carrying axial load, eccentric load with different eccentricity ratios, walls with openings, freestanding wall, Design of load bearing masonry for building up to 3 storeys using IS: 1905 and SP: 20 procedure.

UNIT 4: Reinforced masonry, Masonry walls in composite action:

Application, flexural and compression elements, shear walls, Composite wall – beam elements, infilled frames.

REFERENCE BOOKS:

1. Hendry, A.W, "**Structural Masonry**" Macmillan Education Ltd, Oxford, 1990.
2. Dayaratnam P, "**Brick and Reinforced Brick Structures**", Oxford & IBH, 1987.
3. Arnold W. Hendry, B.P Sinha & S.R.Davies,E "**Design of Masonry structures**" & Fn SPON, London.
3. **IS 1905–1987,** "Code of practice for structural use of un-reinforced masonry- (3rd revision) BIS, New Delhi.
4. **SP 20 (S&T) – 1991**, "Hand book on masonry design and construction (1st revision) BIS, New Delhi.

BTCE15F5720	Advanced Surveying	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

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.

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 720	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

UNIT - I

THEORY OF ERRORS AND TRIANGULATION ADJUSTMENT: Errors and classification of errors Precision and accuracy, Laws of weights and accidental errors.

PROBABILITY: Probability distribution function and density function- normal distribution. RMS error-measure of precision. Rejection of observations-principles of least squares-Normal equations

UNIT – II

METHOD OF CORRELATES: Triangulation adjustment. Angle adjustment, station adjustment and figure adjustment. ELECTRONIC DISTANCE MEASUREMENT (EDM): Introduction, Electro Magnetic (EM) Waves. Phase comparison and modulations. Instruments – Geodimeter – Tellurimeter – Distomat – Range finders – Radars.

UNIT – III

FIELD ASTRONOMY: Earth celestial sphere. Solar system Position by altitude and azimuth system-spherical triangle and spherical trigonometry. Astronomical triangle. Nepiers rule. TIME: Siderial time, day and year-solar time and day-Greenwich mean time-standard time. Meridian and azimuth-their determination - latitude and its determination.

UNIT – IV

Photogrammetry – Introduction, basic definitions, terrestrial photogrammetry, phototheodolite, horizontal and vertical angles from terrestrial photographs, horizontal position of a point from photographic measurements, elevation of ponts by photographic measurements, determination of focal length. Aerial Photogrammetry- advantages, vertical, tilted and oblique photographs, geometry of vertical photographs, scale of vertical photograph over flat and variable terrain, ground coordinates, computation of length of a line, computation of flying height, relief displacement, overlaps, flight planning, computation of required number of photographs for a given area, ground control in photogrammetry. Basics of stereoscopy, stereoscopes, uses, parallax. Basic elements in photographic interpretation. Introduction to digital photogrammetry.

Reference Books:

1. Punmia B C., “Surveying”, Vol. 2 & 3, Laxmi Publications Pvt. Ltd., New Delhi. 2009.
2. T P Kanetkar & S P Kulkarni., “Surveying”, Vol. 2 & 3, Tata McGraw Hill Publishing Co. Ltd, New Delhi. 2009.
3. S K Duggal, “Surveying”, Vol. 2, Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2008.
4. Mikhail E., J. Bethel, and J.C. McGlone, “Introduction to modern photogrammetry”, Wiley, 2001.
5. Wolf P.R, and B.A. Dewitt, “Elements of photogrammetry: with applications in GIS”, 3rd ed, McGraw-Hill, 2000.

Wolf P.R, and B.A. Dewitt, “Elements of photogrammetry: with applications in GIS”, 3rd ed, McGraw-Hill, 2000.

BTCE15F5730	Remote Sensing and GIS	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 730	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

UNIT - I

Introduction, Ideal remote sensing system, basic principles of electromagnetic remote sensing, electromagnetic energy, electromagnetic spectrum, interaction with earth's atmosphere, interaction with earth- surface materials, spectral reflectance of earth surface materials. Remote sensing platforms and sensors: Introduction, platforms- IRS, Landsat, SPOT, Cartosat, Ikonos, Envisat etc. Sensors-active and passive, MSS, AVHRR, LISS, TM, PAN, WIFS, microwave sensors, sensor resolutions (spatial, spectral, radiometric and temporal).

UNIT – II

Properties of digital image data, data formats, Basics of digital image processing- radiometric and geometric corrections, image enhancements, image transforms based on arithmetic operations,

image filtering. Remote sensing image interpretation, thematic classification (supervised and unsupervised) , maximum likelihood classification, introduction to accuracy assessment of classification. Applications of Remote sensing: applications in land use & land cover analysis, change detection, water resources, urban planning, environmental and geological applications.

UNIT – III

Geographic Information system concepts and spatial models. Introduction, Spatial information, temporal information, conceptual models of spatial information, representation of geographic information. GIS Functionality – Introduction, data acquisition, preliminary data processing, data storage and retrieval, spatial search and analysis, graphics and interaction.

Computer Fundamentals of GIS and Data storage, Fundamentals of computers vector/raster storage character files and binary files, file organization, linked lists, chains, trees. Coordinate systems and map projection : Rectangular polar and spherical coordinates, types of map projections, choosing a map projection.

UNIT – IV

GIS DATA MODELS AND STRUCTURES – Cartographic map model, Geo-relation model, vector/raster methods, non-spatial data base structure viz., hierarchal network, relational structures. DIGITIZING EDITING AND STRUCTURING MAP DATA – Entering the spatial data (digitizing), the non-spatial, associated attributes, linking spatial and non-spatial data, use of digitizers and scanners of different types.

Reference Books:

1. Lillesand T.M., and R.W. Kiefer, “Remote sensing and image interpretation”, 4th ed, John Wiley & Sons, 2000.
2. Jensen J.R., “Introductory digital image processing: a remote sensing perspective”, 2nd ed Prentice Hall, 1996.
3. Richards J.A., and X. Jia, “Remote sensing digital image analysis: an introduction”, 3rd ed Springer, 1999.
4. Mather P.M., “Computer processing of remotely-sensed images: an introduction”, Wiley, 1988.
5. Peter A Burrough and Reachael A Mc. Donnel, “Principles of GIS”, Oxford publications.
6. George Joseph, “Fundamentals of Remote Sensing”, Universities Press, Hyderabad.
7. C.P.Lo. Albert K.W. Yeung, “Concepts and Techniques of Geographic Information Systems” 2nd Edition, PHI Learning, New Delhi – 2009

BTCE15F5740	Ground Water Hydraulics	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Fluid Mechanics

Course Objectives:

1. To learn aboutvarious types of Aquifers,
2. Darcy's Law and related technical terms and related problems,
3. Ground water recharge, runoff and balance, ground water development and management,
4. ground water exploration Techniques. Saline water intrusion.

Course Outcomes:

Students will be able to solve problems related

1. To permeability and transmissibility,
2. How to carry out ground water recharge, measurement of runoff and ground water balance.
3. Construction of different types of wells,
4. modeling in ground water management by different methods, Ground water exploration, saline water intrusion and pretension.

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 740	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 1: 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 2: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 3: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 4: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.

TEXT BOOK:

1. K Todd- Wiley & sons Ground water hydrology, 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

REFERENCE BOOK:

1. Bower H, Ground water Hydrology: McGraw hill, New Delhi.
2. Garg satya prakesh Ground water and tube well :– oxford & IBH, New Delhi

BTCE15F5750	Urban Transport Planning	L	T	P	C	Hrs/Wk
Duration:16 Wks		3	1	0	4	5

Prerequisites:

NONE

Course Objectives:

1. To make students familiar with the basic definitions of urban system components, elements; to give an idea about land use and traffic
2. To educate students about the various surveys and their interpretation
3. To give students an overview of the various models used to know the trip generation and distribution.
4. To make students appreciate the factors affecting modal split, traffic assignment techniques and the economic evaluation

Course Outcomes:

On successful completion of this course, students should be able to:

1. Discuss the interdependence of land use and traffic, difficulties in transport planning and the system approach to urban planning along with the stages involved
2. Describe the procedure and suitability of various types of surveys, transport demand and supply
3. Appreciate the methods of trip generation and distribution, comparison of various models used to generate O-D matrix
4. Enumerate the different factors affecting modal split, traffic assignment techniques, consideration of evaluation and expressing evaluation in economic terms.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 750	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

UNIT – 1 **[12]**

Introduction to urban system components, concepts and definitions, scope of urban transport planning, elements of urban transportation 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- Inventory of Existing Conditions

UNIT – 2 **[12]**

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, Traffic surveys for mass transit system planning,

UNIT – 3 **[12]**

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, Problems - Category analysis.

UNIT – 4 **[12]**

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. Problems

Evaluation: Need for evaluation, Identification of corridor; Formulation of plans; Economic evaluation.

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"- PHI, New Delhi, 3rd Indian Edition, 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. M.J.Bruton; Introduction to Transportation Planning –Hutchinson of London Ltd.

BTCE15F5800	CAD Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

Prerequisites:

Building planning Drawing

Course Objective:

1. Preparation of drawings of building components
2. Functional design of buildings (residential, public and industrial)
3. Development of plan, elevation and sectional views, water supply, sanitary and electrical layouts 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. To prepare water supply, sanitary and electrical layouts.
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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1	3	2	2						2			3	3	3	3	3
	CO2	3	2	3	2					2			3	3	3	3	3

BTCE 15F4 300	CO3	**3**	**2**	**3**	**2**					**2**			**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**2**	**3**	**1**					**2**			**3**	**3**	**3**	**3**	**3**

1.AUTOCAD: Basics of AUTOCAD, Drawing Tools- Lines, Circle, Arc, Polyline, Multiline, Rectangle, Ellipse, **Modify Tools**–Erase, copy, Mirror, offset, Array, Move, Rotate, Scale, Stretch, Lengthen, Trim, Extend, Break, Chamfer and Fillet. **Using Text**: Single Line Text, Multiline text, Spelling, Edit Text: Special features, View Tools, Layers, Concept, Dimension tools, Hatching, Customizing toolbars, working with multiple drawings.

2.Use of AUTOCAD in Civil Engineering: Cross Section of Foundation, Staircases, Lintel and Chejja, Slab and Beams, Plan, Elevation, Cross Section of TWO Story Building.

3.Use of EXCEL In Civil Engineering: SFD & BMD for Cantilever, Simply Supported Beams, Design of Singly & doubly reinforced beams, Computation of earth work, design of horizontal curves and design of super elevation.

REFERENCE BOOKS:

1. Shah M.H and Kale C.M, **Building Drawing**, Tata Mc-Graw Hill Publishing co. Ltd., NewDelhi.
2. Gurucharan Singh, **Building Construction,** Standard Publishers &distributors, New Delhi.
3. **National Building Code**, BIS, New Delhi.
4. 4. N.Kumarswamy and A. Kameswara Rao, **Building Planning And Drawing,** Chartor Publishing House Pvt. Ltd.Dr.*Balagopal and T.S.Prabhu*, ***Building Drawing and Detailing*** - *Spades Publishers*, Calicut.

BTCE15F5900	**Geotechnical Engg Lab**	**L**	**T**	**P**	**C**	**Hrs/Wk**
Duration :16 Wks		**1**	**0**	**1**	**2**	**3**

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	P 0 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 15F5 900	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. Basic and Applied Soil Mechanics- GopalRanjan and Rao A.S.R. (2000), New Age International (P) Ltd., New Delhi
3. Shamsherparekh – Geotechnical Manual.
4. Manual of Soil Laboratory Testing- Head K.H., (1986)- Vol. I, II, III, Princeton Press, London
5. Relevant BIS codes.

BTCE15F6100	Transportation Engg-II	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Transportation Engg-1

Course Objectives:

1. 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.
2. To make students familiar with different bituminous mix design procedures commonly adopted, the method of deciding gradation requirements.
3. To make students appreciate the design methodologies adopted for designing flexible and rigid pavements for both new and overlay constructions.
4. To give students an overview of the different drainage measures, failures in pavements and methods of maintenance of pavements

Course Outcomes:

On successful completion of this course, students should be able to:

1. 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.
2. Describe, analyze and compute: requirements of gradation for bituminous mixes, design aggregate gradation of bituminous mixes, conduct mix design and determine volumetric properties of bituminous mixes as per IRC and AASHTO standards
3. Discuss and compute: design factors of design of pavements, thickness design of new pavements for flexible and rigid pavements, design of overlay for pavement up gradation.
4. Enumerate: 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F5 300	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**

UNIT – 1

Soil: importance and desirable properties of subgrade soil, HRB method of soil classification, – numerical examples. **Aggregates:** Requirements, properties and tests on road aggregates. **Bitumen and modified bitumen:** Requirements, properties and tests, criterion for selection of different binders. **Emulsions and Cutbacks:** Preparation, characteristics, uses and tests.

UNIT – 2

Bituminous Mixes: Requirements of bituminous mixes, Mechanical properties and tests, dense and open textured mixes, General design of bituminous mixes, design methods using Rothfuch's method only, Bituminous mix design methods – Marshall method and Superpave method, Numerical problems - numerical examples.

UNIT – 3

Design: Design factors, CBR method of flexible pavement design as per IRC 37 guidelines, Design of CC pavement as per IRC 58 guidelines, design of joints, dowel bars and tie bars, Overlay design of pavements as per IRC 81 guidelines, Numerical problems on above- numerical examples.

UNIT – 4

Drainage: design and construction of surface and sub-surface drainage system for highways, drainage materials, design procedures and IRC guidelines for drainage of urban roads, **Failures:**

General causes, different types of failures in flexible and rigid pavements, **Maintenance:** methods of maintenance of different types of pavements, special repairs

REFERENCE 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, "Principles of Highway Engineering", 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 and AASHTO codes

BTCE15F6200	Geotechnical Engg-II	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials and Fluid Mechanics and Structural Analysis.

Course Objectives:

1. To create an ability to apply knowledge of geotechnical engineering;
2. To analyze and interpret data related to designing foundations and earth retaining structures using geotechnical principles;
3. To analyse the stresses and bearing capacity of soils.

Course Outcomes:

The students will able to,
1. To examine the subsurface of the earth.
2. To analyse the earth pressure
3. To determine Bearing capacity and stresses in the soils.
4. To design the Various foundations

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
	CO1	3	3	1	3	2	2	1			2			3	3	3	2

BTCE 15F6 200	**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:

UNIT1:SUBSURFACE EXPLORATION: Importance of exploration program, Methods of exploration: Boring, Seismic refraction method of grophysical exploration, Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearance, Stabilisation of boreholes - Typical bore log. Number and depth of borings for various civil engineering structures, soil exploration report. **DRAINAGE AND DEWATERING:** Determination of ground water level by Hvorselev's method, Control of ground water during excavation: Dewatering - Ditches and sumps, well point system, Vacuum method, Electro- Osmosis method.

12 hours

UNIT II:LATERAL EARTH PRESSURE: Active and Passive earth pressures, Earth pressure at rest. Rankine's and Coulomb's Earth pressure theories-– Graphical solutions for active earth pressure (cohesionless soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesionless soils, **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 Methodof slices and Friction Circle method, Taylor's stability number, Fellineous method,.

12 hours

UNIT III: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. **BEARING CAPACITY AND SHALLOW FOUNDATION** Introduction – Bearing capacity- definition – types of shear failure – Bearing capacity of shallow foundation on homogeneous deposits - Methods: Terzaghi's , Skempton's and BIS methods – Effect of water table on bearing capacity – Plate load test – Bearing capacity from in-situ tests - SPT, SCPT and plate load test –Types of foundation – contact pressure distribution below isolated footing –

12 hours

UNIT IV: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.

PROPORTIONING SHALLOW AND PILE 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, Classification of pile foundation, Pile load capacity, Proportioning pile foundation

12 hours

TEXT 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 Delhi2005.
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.

REFERENCES BOOKS:

1. Gopal Ranjan and Rao A.S.R. **Basic and Applied Soil Mechanics**, New Age International (P) Ltd., Newe Delhi, 2000.
2. Venkatrahmaiah C.**Geotechnical Engineering**, 3rd Edition New Age International (P) Ltd., Newe Delhi, 2006.
3. Craig R.F. **Soil Mechanics**, Van Nostrand Reinhold Co. Ltd, 1987.
4. Braja M. Das **Principles of Geotechnical Engineering**- (2002), 5th Edition, Thomson Business Information India (P) Ltd., India.
5. Iqbal H. Khan **Text Book of Geotechnical Engineering**- (2005), 2nd Edition, PHI, India

BTCE15F6300	Design of Steel Structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Basic Structural Analysis

Course Objectives:

4. To learn about the concepts and principles of limit state design of steel structures
5. To learn about the provisions of I.S.Codes 800, 875
6. To learn about the concepts and principles of plastic analysis
7. To analyze statically indeterminate beams by plastic methods
8. To analyze and design bolted and welded connections
9. To analyze and design tension members
10. To analyze and design compression members (laced and battened) including splices etc.
11. To design column bases and foundation
12. To design laterally supported beams

Course Outcomes:

At the end of the course, the student
1. Has learnt about the concepts and principles of limit state design of steel structures Has learnt about the provisions of I.S.Codes 800, 875
2. Has learnt about the concepts and principles of plastic analysis, Is able to analyze statically indeterminate beams by plastic methods
3. Is able to analyze and design bolted and welded connections, Is able to analyze and design tension members

4. Is able to analyze and design compression members (laced and battened) including splices etc., Is able to design column bases and foundation, Is able to design laterally supported beams

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 300	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-1

Introduction to Plastic Analysis: Introduction, Plastic theory, Plastic hinge concept, Plastic collapse load, Shape factor, conditions of plastic analysis, upper bound, lower bound and uniqueness theorems, Methods of Plastic analysis, Plastic analysis of statically indeterminate beams including continuous beams.

Introduction: Advantages and Disadvantages of Steel structures, Loads and Load combinations, Design considerations, Limit State Method (LSM) of design, Failure criteria for steel, Codes, Specifications and section classification.

UNIT-2

Bolted Connections: Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections, Simple Connections, Moment-resistant connections, Beam to Beam connections, Beam and Column splices, Semi rigid connections

Welded connections: Introduction, Welding process, Welding electrodes, Advantages of Welding, Types and Properties of Welds, Types of joints, Weld symbols, Weld specifications, Effective areas of welds, Design of welds, Simple joints, Moment resistant connections, Continuous Beam to Column connections, Continuous Beam to Beam connections, Beam Column splices, Tubular connections

UNIT-3

Design of Tension Members: Introduction, Types of tension members, Design of strands, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Other sections, Design of tension member, Lug angles, Splices, Gussets.

Design of Compression Members: Introduction, Failure modes, Behaviour of compression members, Elastic buckling of slender compression members, Sections used for compression members, Effective length of compression members, Design of compression members, laced and battened built up columns. Column splices.

UNIT-4

Design of Column Base and Foundation: Design of simple slab base and gusseted base, Design of foundation.

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 laterally supported beams.

References:

1. N Subramanian, Design of Steel Structures, Oxford,2008
2. Duggal,Limit State Design of Steel Structures, Tata Mcgraw Hill 2010
3. Bhavikatti,Design of Steel Structures , I.K. International Publishing House Pvt. Ltd
4. Pasala Dayaratnam S. Design of Steel Structures, Chand, 1999
5. Bureau of Indian Standards, IS800-2007, IS 875-1987
6. Steel Tables

BTCE15F6400	Estimation and Project Management	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

A thorough knowledge of the subject Building planning and drawing.

Course Objectives:

To learn study various drawing with estimates, methodsof taking out quantities and preparation of detailed and abstract estimates for different civil engineering works. To learn about specifications and carry out rate analysis, measurement of earth work. Importance and significance of various terms related to contracts. Basics and importance of project management.

Course Outcomes:

Students will learn how to study the

1. various drawings and taking out quantities,
2. Work out the cost and preparation of abstract for the estimated cost for the various civil engineering works, how to write specifications, c
3. Carry out rate analysis, obtain measurement of earth work for roads by various standard methods and preparation of contract document related to a project.
4. Documents preparation for tenders.
5. **Mapping of Course Outcomes with programme Outcomes**

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 400	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:

UNIT1:ESTIMATION: Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost –center line method, long and short wall method or crossing method. Preparation of detailed and abstract estimates for the following Civil Engineering works – Buildings – RCC framed structures with flat, sloped RCC roofs with all Building components

UNIT2:ESTIMATE: Different type of estimates, approximate methods of estimating buildings, cost of materials. Estimation of wooden joineries such as doors, windows & ventilators.
ESTIMATES: Steel truss (Fink and Howe truss), manhole and septic tanks, RCC Culverts.
SPECIFICATIONS: Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.

UNIT3:RATE ANALYSIS: Definition and purpose. Working out quantities and rates for the following standard items of works – earth work in different types of soils, cement concrete of different mixes,

bricks and stone masonry, flooring, plastering, RCC works, centering and form work for different RCC items, wood and steel works for doors, windows and ventilators.

MEASUREMENT OF EARTHWORK FOR ROADS: Methods for computation of earthwork – cross sections – mid section formula or average end area or mean sectional area, trapezoidal &prismoidal formula with and without cross slopes.

UNIT4:CONTRACTS: Types of contract – essentials of contract agreement – legal aspects, penal provisions on breach of contract. Definition of the terms –Tender, earnest money deposit, security deposit, tender forms, documents and types. Acceptance of contract documents. Termination of contract, completion certificate, quality control, right of contractor, refund of deposit. Administrative approval – Technical sanction. Nominal muster roll, measurement books – procedure for recording and checking measurements – preparation of bills. Valuation- Definitions of various terms, method of valuation, Freehold & Leasehold properties, Sinking fund, depreciation and method of estimating depreciation, Outgoings.

Project management- Introduction, meaning, nature and characteristics, scope and functional areas, rolls, levels, development of management and modern management approaches.

REFERENCE BOOKS:

1. B. N. Dutta, Estimating & Costing, Chand Publisher
2. P.L. Basin S. Quantity Surveying- Chand : New Delhi.
3. S.C. Rangwala Estimating & Specification Charotar publishing house, Anand.
4. G.S. Birde, Text book of Estimating & Costing- DhanpathRai and sons : New Delhi.
5. D.D. Kohli and R.C. Kohli S A text book on Estimating, Costing and Accounts Chand : New Delhi.
6. B. S. Patil, Contracts and Estimates, University Press, 2006.

BTCE15F6510	Design of Hydraulic structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Fluid Mechanics and Hydrology & Irrigation Engineering

Course Objectives:

1. The reservoir planning and various reservoir operations.
2. About analysis and design of gravity dam
3. About salient features of earth & rock fill dams, and seepage analysis
4. Types and salient features of spillways and energy dissipation below spillways

Course Outcomes:

1. Analyse the requirements and techniques for reservoir operations
2. Analyse and design high and low gravity dams
3. Identify the suitable methods for seepage control through earth and rock fill dams.
4. Suggest suitable type of spillway and its capacity or a given condition

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 510	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

UNIT 1:RESERVOIR PLANNING: Introduction, classification of reservoir, Storage zones of a reservoir, masscurve, fixing capacity of a reservoir, safe yield, problems, density currents,trap efficiency, reservoir sedimentation, life of a reservoir, economic heightof a dam, problems, environmental effects of reservoir, diversion head works- introduction and component parts. Cross drainage works- introduction and types.

Unit 2:GRAVITY DAMS: Introduction, forces on a gravity dam, stress analysis in gravity dams,problems, combination of forces for design. Elementary and practicalprofiles of a gravity dam, stability analysis (without earthquake forces),problems, galleries in gravity dams.

UNIT 3: EARTH AND ROCKFILL DAMS: Introduction, types of earth dams, construction methods, design criteria forearth dams, causes of failure of earth dams, section of dam, preliminarydesign criteria, problems, control of seepage through earth dams, safetymeasures.Rockfill damsand its components.

UNIT4:SPILLWAYS: Introduction, types and energy dissipation below spillways

TEXT BOOKS:

1. R.K. Sharma, Text book of irrigation Engineering & Hydraulic Structures –Oxford & IBH Publishing Company, New Delhi (2002).

2. G.L. Asawa, Irrigation and Water Resources 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 –New Age International Publishers, New Delhi.

REFERENCE BOOKS:

1. Garg, S.K., Irrigation Engineering & Hydraulic Structures –Khanna Publishers, New Delhi.
2. Madan Mohan Das & Mimi Das Saikia, Irrigation and Water Power Engineering –PHI Learning Pvt. Ltd., New Delhi (2009).

BTCE15F6520	Earth & Rock fill Dams	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Soil mechanics, Hydrology & Irrigation Engineering

Course Objectives:

1. The reservoir planning and various reservoir operations.
2. About analysis and design of gravity dam
3. About salient features of earth & rock fill dams, and seepage analysis
4. Types and salient features of spillways and energy dissipation below spillways

Course Outcomes:

1. Enumarate the types of dams
2. Analyse and design of earth dams with suitable foundations
3. Identify the suitable methods for seepage control through earth and rock fill dams.
4. Suggest suitable ways to construct the embankments

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 520	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

UNIT I: INTRODUCTION-Types of dams, Homogeneous earth Dams, Zoned Earth dams, Rockfill Dams. Typical Embankment, Dam sections, Site selection and exploration, Influence of topography and subsoil conditions on location and alignment of the dam. Foundation sub surface exploration and studies of embankment construction material.

DESIGN OF EARTH DAMS-Material available for embankment construction, character of foundation, climate, shape and size of the valley, River diversion, probable wave action time available for construction function of reservoir and earthquake activity, location and inclination of earth core & shell materials, embankment side slopes, free board and crest width. Filter Zones, Design provisions Draw down pore pressures. Berms, Upstream and down stream slope protection. Internal drainage systems, Seismic design considerations, ground movements, seiches, problems in loose sand and soft clay.

UNIT II:EARTH DAMS ON PERVIOUS FOUNDATION SOIL-Methods of foundation treatment, preventing under seepage with complete vertical barriers and grouting, Reducing under seepage with partial vertical cutoffs and horizontal upstream impervious blankets, controlling under seepage by regulation of leaks and relief wells.

STABILITY ANALYSIS-Stability of infinite slopes. Zones of planes of weakness in foundation, stability analysis of embankment by Taylor's method, Swedish' method including side forces between slices, simplified method suggested by Sherard et. Al., Morgensterm-price method, wedge method, Zone of planes of weakness in foundation, stability during construction, full reservoir and drawdown, settlement and horizontal movements. Special design problems and details

UNIT III:MEASUREMENTS OF PORE WATER PRESSURE AND MOVEMENTS-Purposes and types of instruments, piezometer, devices for measuring movements, USBR measurements of pore water pressure and embankments compression, compression of rock fill embankment sections, during construction and post construction foundation settlement, foundation spreading, observation and measurement of leakage.

TREATMENT OF ROCK FOUNDATIONS AND ABUTMENTS-Types of rock, foundation object of grouting, evaluation of necessity of grouting, planning grouting details, blanket grouting, drilling equipment, size and direction of holes, washing and pressure testing of holes, grouting equipment, procedures for grouting, pressure and consistency of grout, stopping surface leakage, surface treatment of rock foundation and abutments. Earth compaction against rock foundations and abutments, grouting through completed earth embankments, drainage holes, grouting and drainage galleries.

UNIT IV:EMBANKMENT CONSTRUCTION-Equipments for excavating, hauling spreading, blending, compacting and separating over sized rocks and cobbles, construction procedures and quality control of impervious and semi pervious embankments sections, handing dry and wet materials.

Construction procedures and quality control of pervious embankment sections, construction problems caused by fines, construction procedures of hard and soft rockfill embankments, field test on rockfill embankments, slope treatment and riprap.

References

1. Sherard, J.L., Woodward, R.J., Gizienski, S.F. and Clevenger, W.A. Earth and earth-rock dams, John Wiley & Sons, New York., 1963
2. Sowers, G.P. and Sally, H.L. Earth and rockfill dam engineering, Asia Publishing House, New Delhi., 1970
3. Creager, W.P., Justin, J.D. and Hinds, J. Engineering for dams, John Wiley & Sons, New York., 1945.
4. Earth & Rock fill dams – Principles of design and construction by Christian Kutzner Published Oxford and IBH
5. Design of small dams – united states department of the Interior Bureau of Reclamation Published by Oxford and IBH Publishing Company
6. Earth Manual – CBS Publishers and distributors
7. E.N.Bromhead The stability of slopes published by Blackie Academic and Professional
8. Earth and Rock fill dams by Sherad
9. Bharat Singh Earth and Rock fill dams
10. Winterkorn and Fang Foundation Engineering Hand Book,

BTCE15F6610	Repair & rehabilitation of structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Concrete Technology & Alternative Building Materials

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 610	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-1: General:

Introduction, cause of deterioration of concrete structures, diagnostic methods and analysis, preliminary investigations, experimental investigations using NDT, load testing, corrosion mapping, core drilling, partial destruction techniques and other instrumental methods.

Quality assurance for concrete construction, concrete properties- strength, permeability, thermal properties and cracking,

UNIT-2: Influence on Serviceability and Durability:

Effects due to climate, temperature, chemicals, wear and erosion, Design and construction errors, corrosion mechanism, Effects of cover thickness and cracking, Methods of corrosion protection, corrosion inhibitors, corrosion resistant steels, coatings, cathodic protection.

Maintenance and Repair Strategies:

Definitions, Maintenance, Repair and rehabilitation, Facets of maintenance, Importance of maintenance, Protective measures on various aspects.

UNIT-3: Inspection, Assessment procedure for evaluating a damaged structure, causes of deterioration, testing techniques

Materials for repair:
Special concretes and mortars, concrete chemicals, special elements for accelerated strength gain, Expansive cement, polymer concrete, sulphur infiltrated concrete, ferro-cement, Fibre reinforced concrete.

UNIT-4: Techniques for repair:
Rust eliminators and polymer coating for rebars during repair, foamed concrete, dry pack technique, vacuum concrete, Gunite and Shotcrete, Epoxy injection, Mortar repair for cracks, shoring and underpinning.

Examples of repair to structures:

Repairs to overcome low member strength, Deflection, Cracking, Chemical disruption, weathering, wear, fire, leakage and marine exposure, engineereddemolition techniques for dilapidated structures, Case studies.

REFERENCE BOOKS:

1. Sidney, M. Johnson, Deterioration, Maintenance and Repair of Structures McGraw- Hill, London.
2. Denison Campbell, Allen & Harold Roper, Concrete Structures – Materials, Maintenance and Repair Longman Scientific and Technical, London.
3. R.T.Allen and S.C. Edwards, Repair of Concrete Structures, Blakie and Sons, Hampshire.
4. B.Vidiveli, Rehabilitation of concrete structures Standard Publishers & Distributors, New Delhi.
6. B.L Gupta & Amit Gupta, Maintenance Repair of Civil Structures Standard Publishers & Distributors, New Delhi.
7. P.S Gahlot & Sanjay Sharma, Building Repair and Maintenance Management, CBS Publishers & Distributors Pvt. Ltd., New Delhi.
8. P Davaratnam. N.V Ramana Rao, Maintenance and Durability of concrete structures" Universities Press (India), 1997.
9. M.S.Shetty, Concrete Technology - Theory and Practice, S.Chand and Company, NewDelhi.

BTCE15F6620	Structural Dynamics	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Engineering Mechanics, Structural Analysis - I

Course Objectives:

1. To learn about the basic concepts and principles of vibration and mathematical modeling

2. To analyze free vibration of SDOF systems (undamped and damped)

3. To analyze forced vibration of SDOF systems (undamped and damped) due to harmonic and general loading functions including support excitation

4. To learn about the principles and use of vibration measuring instruments

5. To analyze free and forced vibration of MDOF systems (undamped and damped)

6. To analyze the free vibration of continuous systems such as rods and beams

Course Outcomes:

At the end of the course, the student

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 620	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 – 1:Introduction to structural dynamics: Brief history of vibration, Mathematical modeling, basic definitions, simple harmonic motion. D' Alembert's principle, principle of virtual work.

Free vibration of single degree of freedom system: Undamped and damped systems, viscous and Coulomb damping, logarithmic decrement, Evaluation of damping, response to initial conditions, Numerical problems.

UNIT – 2:Forced vibration of single degree freedom systems: Undamped and damped systems, response to harmonic loading, rotating unbalance, reciprocating unbalance. Duhamel's integral, response due to general system of loading, impulsive loadings, dynamic load factor, response spectrum, response of SDOF subjected to harmonic base excitation, vibration isolation and transmissibility, Principle of vibration measuring instrument, Numerical problems.

UNIT – 3:Free vibration of multi degree of freedom systems: Shear buildings modeled as multi degree of freedom systems, natural frequencies, normal modes, orthogonality property of normal modes, modal matrix, Numerical problems.

Forced vibration of multi degree of freedom systems: modal superposition method, response of MDOF systems to harmonic forced excitation, Numerical problems.

UNIT – 4:Free vibration of continuous systems: Longitudinal vibration of uniform bars, derivation of expression, natural frequencies for various boundary conditions, Transverse vibration of uniform beams, derivation of expression, natural frequencies and mode shapes for various boundary conditions.

REFERENCE BOOKS:

1. Mario Paz, Structural Dynamics CBS publishers, New Delhi.
2. W.T.Thomson, Theory of Vibrations with Applications CRC Press
3. M. Mukhopadhaya, Vibrations, Structural dynamics- Oxford IBH, Delhi.
4. Anil Chopra, Structural Dynamics PHI Publishers, Delhi.
5. Clough & Penzen, Structural Dynamics TMH, Delhi.
6. G K Grover, Mechanical Vibrations Nemchand & Bros, Roorkee, India.
7. John M Biggs, Structural Dynamics McGraw-Hill Book Co.

BTCE15F6630	Earth & Earth Retaining Structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials, Fluid Mechanics, Basic geotechnical engineering and Structural Analysis

Course Objectives:

1. Understand the classification of ERS based on load support mechanism,
2. Understand the different types of retaining walls.
3. Understand the various Construction methods of Sheet pile walls.
4. Understanding of the basic principles involved in various techniques of Soil. Nailing.

Course Outcomes:

1. An ability to analyse and design independently common earth retaining structures

2. At the end of this course students are expected to gain an appreciation on the most common retaining wall types available in the industry worldwide.
3. The students will know how to tackle basic retaining wall problems and have the ability to design detaining walls based on Lateral Earth Pressure Theory.
4. The students will also have an appreciation of wall movements and potential impact on the surrounding structures.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 630	CO1	**3**	**1**	**1**	**2**					**1**				**3**	**3**	**3**	**3**
	CO2	**2**	**2**	**2**	**1**		**1**				**1**		**1**	**3**	**3**	**3**	**3**
	C03	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**

Course Content:

UNIT – 1: Introduction to earth retaining structures, Necessity of ERS, classification of ERS based on load support mechanism, construction concept, system rigidity and service life. ERS selection methods, factors affecting ERS selection, Rankine's and Coulomb's Earth pressure theories for cohesive and cohesionless soils, Influence of movement on earth pressure stresses due to compaction and surcharge loads. **12hrs**

UNIT – 2 : Soil properties and lateral Earth pressure. Earth pressures on walls, various types of back fill and condition of loading. Soil tension effects and rupture zones. Effect of flexibility of structures on lateral pressure. Earth pressures due to earthquakes. Conventional Retaining Wall: Types of retaining walls, Stability (sliding, overturning, bearing capacity & overall) of gravity and cantilever walls, Proportioning of retaining walls, Backfill material and drainage.

12hrs

UNIT – 3: Flexible Walls: Sheet pile walls, Construction methods- Cantilever and Anchored sheet pile wall. Reinforced Soil Walls/Mechanically Stabilised Earth: - Failure mechanisms bond and rupture failures, Analysis methods, Limit equilibrium method- Internal and external stability, Static and seismic analyses. **12hrs**

UNIT – 4: Analysis and design of cantilever and anchored sheet pile walls. Braced Cuts and Soil Nailing: Lateral earth pressure in braced cuts, Design of various components, Stability of braced cuts, base heave and stability, yielding and settlement of ground surrounding excavation, Diaphragm walls – slurry support; Soil Nailing. **12hrs**

REFERENCE BOOKS:

1. Braja M. Das Principles of Foundation Engineering.
2. Bowles, Foundation analysis and design –JE – McGraw Hill.
3. Terzaghi, K and Rolph, B.peck Soil Mechanics in Engineering Practice 2nd Edn.John Wiley &Co.
4. Analysis and Design of Foundations and Retaining Structures, Mearut.
5. Prakash, S – SarithaPrakashan, Winterkorn, H.F. and Fang, H.Y., Foundation Engineering Handbook, Galgotia Book- source, 2000.
6. Rowe, R.K., Geotechnical and Geoenvironmental Engineering Handbook, Kluwer Academic Publishers, 2001.
7. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge, 1992.
8. Koerner, R.M., Design with Geosynthetics (Third Edition), Prentice Hall, 1997.
9. Day, R.W., Geotechnical and Foundation Engineering: Design and Construction, McGraw Hill, 1999.
10. Das, B.M., Principles of Geotechnical Engineering (Fourth Edition). The PWS series in Civil Engineering, 1998

BTCE15F6640	Transportation Economics	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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 give the students an introduction to transport demand and elasticity concept make to make them capable to forecast demand for transport services

Course outcomes:

1. Elucidate the elements of transport economics: highway transportation costs, rroad 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. Enumerate factors affecting demand and supply, shift in demand and supply, transportation demand model, consumer surplus, marginal cost, average cost

Mapping of Course Outcomes with programme Outcomes

Course Code	**POS/ COs**	**PO 1**	**P 0 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO 10**	**PO 11**	**PO 12**	**P S O 1**	**PS O2**	**PS O3**	**PS O4**
BTCE 15F6 640	CO1	**3**	**1**	**1**	**2**					**1**				**3**	**3**	**3**	**3**
	CO2	**2**	**2**	**2**	**1**		**1**				**1**		**1**	**3**	**3**	**3**	**3**
	C03	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**

UNIT – 1

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. 12 hrs

UNIT – 2

Methods of Economic Analysis: Methods- BCR-NPV-IRR –Their Basic Characteristics, Illustrative applications on above Methods of Economic Analysis, Comparison of the Methods of Analysis when Applied to a Group of Mutually Exclusive Alternatives, Economic Evaluation of Null Alternative.

12 hrs

UNIT – 3

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 and problems. 12 hrs

UNIT – 4

Supply and Demand: Concept-Definition-Factors affecting Demand and Supply- Shift in Demand and Supply- Transportation demand Model- Equilibrium-Sensitivity of Travel Demand- Elasticities- Consumer Surplus- Marginal Cost- Average Cost- Pricing. 12 hrs

REFERENCE BOOKS:

1. Robley Winfrey,`**Economic Analysis for Highways'**, International Textbook Company, Pennsylvania.1990.
2. Kenneth J Button, **"Transportation Economics"**, Edward Elgar publishing
3. Jotin Khisty and Kent Lall '**Introduction to Transportation Engineering'** PHI, New Delhi,2001.
4. Kadiyali.L.R.' **Traffic Engineering and Transport planning'**, Khanna publications.
5. IRC: SP:30-1993, Manual on Economic Evaluation of Highway Projects in India.

Text Books:

1. Das, B.M., Principles of Geotechnical Engineering (Fourth Edition). The PWS series in Civil Engineering, 1998
2. Das, B. M. - Principles of Foundation Engineering
3. Bowles. J. E. - Foundation Analysis & Design
4. Militisky, J. and Woods, R., Earth and Earth retaining structures, Routledge, 1992. Clayton, C.R.I., Militisky, J. and Woods, R.I., Earth pressure and Earth-Retaining structures (Second Edition), Survey University Press, 1993

BTCE15F6650	Air and noise pollution	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 650	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

INTRODUCTION: Definition – Classification and Characterization of Air Pollutants, Concentration of pollutants – Problems. Emission Sources, Behavior and Fate of air Pollutants, Chemical Reactions in the Atmosphere, Photo-chemical Smog, Coal-induced smog, Air Pollution Inventories. **EFFECTS OF AIR POLLUTION:** On Human Health, Animals, Plants and Materials – Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy.

UNIT – II

METEOROLOGY: Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Windrose – pollution roses. General Characteristics of Stack Plumes, Meteorological Models. Numerical problems on Gaussian plume model, plume rise, stack height. Factors to be considered in Industrial Plant Location and Planning. Noise pollution – sources, measurement units, effects and control

UNIT – III

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, Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

UNIT – IV

AIR POLLUTION DUE TO AUTOMOBILES: Air Pollution due to Gasoline Driven and Diesel Driven Engines, Effects, Direct and Indirect Methods of control. **BURNING ENVIRONMENTAL ISSUES:** 1. Acid Rain 2. Global Warming 3. Ozone Depletion in Stratosphere 4. Indoor Air Pollution. **ENVIRONMENTAL LEGISLATION:** Environmental Policy, Environmental Acts, Water, Air and Noise Pollution Standards.

Reference Books:

1. Rao M N. and Rao H V N., "Air Pollution" Tata Mc Graw 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 Mc Graw Hill Publishing Co. Ltd., New Delhi. 1980.
4. Henry C Perkins, "Air Pollution" – Tata Mc Graw 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 Mc Graw 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.

BTCE15F6700	Extensive Survey Practice	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 700	**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:

An extensive survey training involving investigation and design of the following projects is to be conducted for 2 weeks (14 days). The student shall submit a project report consisting of designs and drawings. (Drawings should be done using AutoCAD)

1. General instructions, Reconnaissance of the sites and fly leveling to establish bench marks.

2. NEW TANK PROJECT: The work shall consist of

i) Alignment of center line of the proposed bund, Longitudinal and cross sections of the center line.
ii) Capacity surveys.
iii) Details at Waste weir and sluice points.
iv) Canal alignment.

(At least one of the above new tank projects should be done by using TOTAL STATION)

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 village 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.

4. HIGHWAY PROJECT: Preliminary and detailed investigations to align a new road (min. 1 to 1.5 km stretch) between two obligatory points. The investigations shall consist of topographic surveying of strip of land for considering alternate routes and for final alignment. Report should justify the selected alignment with details of all geometric designs for traffic and design speed assumed. Drawing shall include key plan initial alignment, final alignment, longitudinal section along final alignment, typical cross sections of road.

5. OLD TANK PROJECT: The work shall consist of

i) Alignment of center line of the existing bund, Longitudinal and cross sections of the centre line.

ii) Capacity surveys to explore the quantity.

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- New Age International Publishers, New Delhi (2nd Ed.)

BTCE15F6800	HHM Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F6 800	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:

Hydraulics & Hydraulics Machinery Lab Experiments:

1.Calibration of V-Notch & Rectangular Notch.

2.Calibration of Broad Crested Weir.

3.Calibration of Venturi Flume.

4.Calibartion of Venturi Meter & Orifice Meter.

5.Determinations of Major & minor losses in pipe flow.

6.Determination of hydraulic coefficients of a vertical orifice.

7.Determination of vane coefficients for Flat , Inclined, semi-circular vanes.

8.Performance characteristics of a Single Stage Centrifugal Pump

9. Performance characteristics of a Pelton Wheel Turbine.

10. Performance characteristics of a Francis Turbine

REFERENCE BOOKS:

1. Fluid Mechanics & Machinery Laboratory Manual Prepared by School of Civil Engineering, REVA University, Bengaluru.

2. R.K.Bansal (2004), Fluid Mechanics & Hydraulic Machines; Laxmi Publication (P) Ltd, New Delhi.
3. Hydraulics and Hydraulic Machines Laboratory Manual –R.V.Raikar, PHI Learning Pvt.Ltd.

SYLLABUS VII SEMESTER

BTCE15F7100	Transportation Engineering-III	L	T	P	C	Hrs/Wk
Duration :16 Wks		2	1	0	3	4

Prerequisites:

Transportation-I, Transportation-II

Course Onjectives:

1. To educate students about the importance of highway planning, alignment, and introduce the concepts of highway geometric design.
2. To make students familiar with design elements: sight distance, horizontal curvature, super elevation, grades, visibility on vertical curves, cross section elements.
3. To educate students about the importance of traffic engineering as applied to road transportation and features of traffic characteristics.
4. To give students an overview of transport economics, quantifying various transport costs and benefits, identify the economic feasibility of transport projects.

Course Outcomes:

On successful completion of this course, students should be able to:

1. Explain: the elements and factors affecting geometric design of highways, skid resistance, camber, road margins; illustrate the importance of sight distance; analyze and compute safe stopping sight distance for various design speeds.
2. Describe, analyze and compute: safe overtaking sight distance, super elevation, extra widening of pavement along horizontal curves, horizontal transition curves and setback distances for various design speeds.
3. Outline the scope of traffic engineering, describe the road user characteristics, conduct various traffic studies and design the traffic control measures to the safe and efficient operation of traffic.
4. Identify and compute: the scope of transport economics, various methods of transport project economic cost analysis for determining the economic viable project.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1	3	1	1	2					1				3	3	3	3

BTCE 15F7 100	CO2	**2**	**2**	**2**	**1**		**1**				**1**		**1**	**3**	**3**	**3**	**3**
	C03	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**			**1**			**1**	**1**		**3**	**3**	**3**	**3**

UNIT – 1

Highway planning, location and alignment- Necessity of highway planning, classification of roads, road patterns, Basic requirements of an ideal alignment and factors controlling, engineering survey for highway location, steps in new alignment, necessity of realignment and steps, drawings and report. **Highway geometric design** – Introduction, highway cross-section elements.

UNIT – 2

Highway geometric design – Sight distances – stopping and overtaking sight distances- overtaking zone requirements, **Design of horizontal alignment** – speed, radius, super elevation, extra widening of pavements, transition curves, **Design of vertical alignmen**t – gradient, grade compensation, summit curves and valley curves, **Intersections** –at grade and grade separated intersections, channelization, Numerical examples.

UNIT – 3

Traffic engineering- introduction - traffic characteristics, **Traffic studies** – spot speed, speed and delay, origin and destination, traffic volume, parking, traffic capacity and level of service. **Traffic flow characteristics**. **Traffic operation -** traffic control devices – traffic signs, markings, traffic signals, design of isolated signals by Webster's method. Numerical examples using software on relevant topics

UNIT – 4

Scope of transportation economics, Transportation demand, Demand, supply and equilibrium, Sensitivity of travel demand, Factors affecting elasticities. **Introduction to highway economics** – cost and benefits, highway economic analysis – annual cost method, present worth method, rate of return method, benefit-cost ratio method, Numerical examples.

Text Books:

1. Khanna. S.K. and Justo. C.E.G., Highway Engineering, Nem Chand and Bros, Roorkee.
2. Kadiyali. L. R., Traffic Engineering and Transport planning, Khanna publishers, New delhi.
3. Patha Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI learning.
4. Papacostas, C.A.,, Fundamentals of Transportation Engineering', Prentice-Hall of India Private Limited, New Delhi.
5. Ian G Heggie, Transportation Engineering Economics, McGraw Hill Book Co.
6. Relevant IRC codes

BTCE15F7210	Design & Drawing of RCC & Steel Structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	1	0	2	3

Prerequisites:

Knowledge 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	P 0 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 15F7 210	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-1

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-2

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-3

Detailing of steel connections**:** Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened.

Detailing of column **s**plices, Column-column of same and different sections. Columns, Lacing and battens.

Detailing of column bases**:** Slab base and gusseted base, grillage foundation.

UNIT-4

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 Mc Graw Hill Publishers.
8. Arya and Ajaman- **Design of Steel Structures** - Nem Chand &Bros. Roorkee.
9. S ***Unnikrishna*** Pillai & Devadas ***Menon Reinforced Concrete Design***-. Tata McGraw-Hill, New *Delhi*
10. IS: 456-2000, IS: 800 – 2007, SP(16)-1980, SP 6 (1) – 1984

BTCE15F7310	Design of precast & pre-stressed concrete structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Structural Analysis – I and Design of RCC Elements.

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 310	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 – 1

Materials: High strength concrete and steel, Stress-Strain characteristics and properties. Structural steel and bolts, Non-cementitious materials.

Precast Concrete: Definition of Precast concrete, Joints and connections: Basic mechanisms, Compression joints, Shear joints, Tension joints, Pinned-jointed connections, Moment resisting connections.

Basic principles of prestressing: Fundamentals, Load balancing concept, Stress concept, centre of thrust. Pre-tensioning and post-tensioning systems, Tensioning methods and end anchorages.

Analysis of sections for flexure: Stresses in concrete due to prestress and loads, stresses in steel due to loads, Cable profiles. Numerical problems.

UNIT – 2

Loss of prestress: Various losses encountered in pre-tensioning and post-tensioning methods, determination of jacking force. Numerical problems

Limit state of serviceability:

Deflection of prestressed members**,** Short term and long term deflections, deflections at transfer and working load conditions with different cable profiles. Deflection limits as per IS 1343. Effect of creep on deflection, load versus deflection curve, methods of reducing deflections.

Control of cracking.

UNIT – 3

Limit state of collapse: Codal provisions, Ultimate flexural strength of sections. shear resistance of sections, shear reinforcement.

Design of end blocks: Transmission of prestress in pretensioned members, transmission length, Anchorage stress in post-tensioned members. Bearing stress and bursting tensile force-stresses in end blocks-Methods, Codal provisions, Design of end blocks.

UNIT -4

Design of PSC Beams: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections by working stress method. Permissible stress, design of prestressing force and eccentricity, limiting zone of pre-stressing force cable profile. Introduction to limit state design. Numerical problems.

REFERENCE BOOKS:

1. T.Y. Lin and Ned H. Burns, Design of prestressed concrete structures John Wiley & Sons, New York.
2. N. Krishna Raju, Prestressed Concrete Tata McGraw Publisher, New Delhi.
3. Pre-stressed Concrete Oxford and IBH Publishing Co., New Delhi.

4. P. Dayarathnam, Fundamentals of prestressed concrete by N.C. Sinha & S.K. Roy, S.Chand and Co. Ltd.
5. IS : 1343 : 1980
6. N. Rajagopalan, Pre-stressed Concrete Alpha Science International Ltd.
7. Kim S. Elliott, Precast Concrete Structures, Butterworth-Heinemann
8. CBRI, Building materials and components, India, 1990

BTCE15F7320	Advanced Design Shallow Foundations	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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 Types of shallow foundations.
2. Determine the depth of shallow foundation and its construction.
3. Calculate bearing capacity in field with various experiments.
4. Analyse (bearing capacity and settlement) shallow foundations.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 02	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
BTCE 15F7 320	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:

General requirements of Foundations – Types of shallow foundations, Modes of shear failure, allowable bearing pressure, Ultimate Bearing capacity of concentrically loaded foundations, Influence of ground water table, Bearing capacity of footings on layered soils, steps involved in proportioning of footings

UNIT II:

Contact pressure under footings – Contact pressure under rigid rectangular footing, strip foundation, rigid circular footing, Principles of footing design, Design of non – rigid combined footings.

UNIT III:

Bearing capacity from SPT, CPT and Field load tests, Building codes, Safety factors in foundation design, Bearing capacity of foundations on slopes, with uplift or tension forces.

UNIT IV:

Settlements for shallow foundations, Designing footings on equal settlements, Reliability of settlement computations, Structures on fills, Allowable bearing pressure for permissible total settlement, approaches based on N values from SPT, Terzaghi – Peck approach for footings on sand, settlement prediction for foundation on mixed soils

TEXT 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 Delhi2005.
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.

REFERENCES BOOKS:

1.Gopal Ranjan and Rao A.S.R. **Basic and Applied Soil Mechanics**, New Age International (P) Ltd., Newe Delhi, 2000.
2.Venkatrahmaiah C.**Geotechnical Engineering**, 3rd Edition New Age International (P) Ltd., Newe Delhi, 2006.
3.Craig R.F. **Soil Mechanics**, Van Nostrand Reinhold Co. Ltd, 1987.
4.Braja M. Das **Principles of Geotechnical Engineering**- (2002), 5th Edition, Thomson Business Information India (P) Ltd., India.
5.Iqbal H. Khan **Text Book of Geotechnical Engineering**- (2005), 2nd Edition, PHI, India

BTCE15F7410	Theory of Elasticity	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites;

Strength of Materials

Course Learning Objectives:

1. To analyze the stress and strain at a point in a loaded elastic material (2D)
2. To analyze 2D dimension problems of elasticity in rectangular coordinates
3. To analyze 2D dimension problems of elasticity in polar coordinates
4. To analyze non-circular sections (solid and thin- walled) subjected to torsion

Course outcomes:

At the end of the course, the student is

1. To analyze the stress and strain at a point in a loaded elastic material (2D)
2. To analyze 2D dimension problems of elasticity in rectangular coordinates
3. To analyze 2D dimension problems of elasticity in polar coordinates
4. To analyze non-circular sections (solid and thin- walled) subjected to torsion

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 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 15F7 410	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 -1

Introduction to mathematical theory of elasticity: Definition of continuum, stress at a point, strain at a point, Stress-strain relationship, Generalized Hooke's law, St. Venant's principle. Concepts of Plane stress and plane strain, Principal stresses and strains, measurement of surface strains, strain rosettes, Mohr's circle of stress and strain (2D).

UNIT- 2

Two-dimensional problems in Cartesian coordinates: Differential equations of equilibrium, boundary conditions, strain-displacement relations, compatibility equations, Airy's stress function,

Polynomials, bending of a cantilever beam subjected to end load, Simply supported beam subjected to UDL, effect of shear deformation in beam.

UNIT - 3

Two-dimensional problems in polar coordinates: equilibrium equations, strain-displacement relations, compatibility equation, stress-strain relations, axi-symmetric stress distribution, curved beam, thick cylinders. Effect of circular hole on stress distribution in plates subjected to tension, compression and shear, stress concentration factor.

UNIT - 4

Torsion of non-circular sections: Inverse and Semi-inverse methods, stress function, torsion of circular and elliptical sections, Membrane analogy - Torsion of thin walled open and closed sections.

TEXT BOOKS:

1. Timoshenko. S.P. **Theory of Elasticity - International Students** Editon, and Goodier. J.N. - Edition, McGraw Hill Book Co. Inc., New Delhi.
2. Wang. C.T . **Applied Elasticity**- McGraw Hill Book Co. Inc., New Delhi

REFERENCE BOOKS:

1. Valliappan. C, **Contiuum Mechanics Fundamentals**-: Oxford and IBH Publishing Co. Ltd., New Delhi.
2. Srinath.L.S. **Advanced Mechanics of Solids**-: TatMcGraw Hill Publications Co.Ltd., New Delhi.
3. Venkataraman and Patel **Structural Mechanics with Introduction to Elasticity and Plasticity**-: McGraw Hill Book Inc,New York.
4. Arbind Kumar Singh **Mechanics of Solids** : Prentice Hall of India Pvt. Ltd., New Delhi -2007.
5. Sadhu Singh- **Theory of Elasticity** Khanna publishers, New Delhi.

BTCE15F7420	Open channel hydraulics	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 420	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 – 1: 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 – 2: 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 – 3: 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 – 4: 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.

TEXTBOOKS:

1. Open Channel Hydraulics :Subramanya : Tata McGraw Hill Publishing Co Ltd, New Delhi
2. – Madan Mohan Das, Open Channel Flow Prentice Hall of India Pvt. Ltd., New Delhi 2008 Edition.
3. Rajesh Srivastava, Flow Through Open Channels –Oxford Press, New Delhi 2008 Edition.

REFERENCE BOOKS:

1. Open Channel Hydraulics : French : McGraw Hill Book Company, New Delhi.
2. Modi and Seth : Fluid Mechanics : Standard Book Home, New Delhi.
3. Henderson :Open Channel Hydraulics : Mr. Millan Publishing Co. Ltd., New York.
4. VenTe Chow : Open Channel Hydraulic : McGraw Hill Book Company, New Delhi.

BTCE15F7430	Foundation engineering in difficult ground	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

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

Course Objectives:

Ability to analyze the problems associated with designing foundations on difficult ground such as weak and soft soils, expansive and shrinking soils; to understand the design alternatives available to design foundations on difficult soils.

Course Outcomes:

An ability to

1. determining the characteristics of the ground, remedial measures
2. Design alternatives in expansive soil
3. design Stability of slopes in difficult ground
4. Design for highway and air- field pavements

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTCE 15F7 430	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: Introduction: Classification, swelling and shrinkage, sensitivity, settlement and bearing capacity of clays, fissures in clay, glacial deposits, and difficult rocks Site investigation in difficult ground: Objectives, difficulties in determining the characteristics of the ground, remedial measures
12 hours

UNIT II: Design alternatives in expansive soil: Introduction, drilled pier and beam foundation, mat foundation, under-reamed pile foundation, general conditions for under reamed piles, design and construction.Treatment of expansive soils: Introduction, removal and replacement, remolding and compaction, pre-loading, pre-wetting, stabilization-lime, cement, fly ash, application methods, moisture control, electro chemical treatments
12 hours

UNIT III: Foundations and earth movements: Introduction, creep of rock masses, landslides, earthquake-primary and secondary effects, earthquake resistant design Stability of slopes in difficult ground: Introduction, mechanism of stability, strength of distorted clay, factor of safety, analysis, remedial measures.
12 hours

UNIT IV: Design for highway and air- field pavements: Introduction, general principles of pavement design, design features and treatment methods for expansive soil subgrades, air-field procedures.
12 hours

TEXT BOOKS

1. F.G.Bell, Foundation in difficult ground, Butterworths & Co.
2. F.H. Chen, Foundations on expansive soil, Elsevier Science Publishing Company,NY.
3. E.A. Sorochan, Construction of buildings on expansive soils, Oxford & IBH Publications

REFERENCE BOOKS

1. Expansive soils- Problems and Practice in foundation and pavement Engineering- John.D. Nelson and Debora J. Miller, John Wiley & Sons.

BTCE15F7440	Solid & hazardous waste management	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 440	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 1: Introduction

Composition and Handling of Solid Wastes: Sources and Types of solid wastes, Characteristics of solid waste, Waste generation and handling at source, Problems due to improper disposal of solid waste. Scope and importance of solid waste management

Unit 2: Collection, Transportation, Treatment/Processing

Systemsofcollection, collection equipment,garbagechutes,transferstations–bailingand compacting,routeoptimizationtechniquesandproblems.

Componentsseparation,volume reduction, size reduction, chemical reduction, plastic waste-environmental significance and reuse, reuse of materials in other industries.

Unit 3: Disposal Methods

Opendumping, ocean disposal, feedingtohogs,incineration- Process–3T's,factorsaffectingincinerationprocess, incinerators–types,preventionofairpollution,Pyrolysis, energy recovery operations, composting- Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanicalcompostingprocesses.Vermi-composting, Sanitary landfill-Differenttypes,trencharea,Rampandpit method,siteselection,basicstepsinvolved,celldesign,preventionofsite pollution,leachate&gascollectionandcontrolmethods,geo-syntheticfabrics insanitarylandfills.

Unit 4: Hazardous Waste

Classification, Generation, Toxicology, Bio-medical wastes, Treatment of HW-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. PavoniJ.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. S.K.Garg, Environmental Engineering–Vol. II.
6. Bio medical waste handling rules– 2000.
7. Vesilind.PaWorrell&Reinhart.D;Solid Waste Engineering; Cengage Learning India Private Limited, New Delhi.(2009)

BTCE15F7450	Road safety and management	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Transportation Engg-I and Transportation ENgg-II

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4

BTCE 15F7 450	**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**

UNIT – 1 [Lecture Hours: 12]

Road accidents: Collection and Analysis of Accident Data, Condition and Collision Diagram, Causes and Remedies-influence of roadway and traffic conditions on traffic safety; accident coefficients; Analysis of individual accidents to arrive at real causes; Methods of representing accident rate-Statistical Methods in Traffic Safety Analysis – Regression Methods, Poisson distribution, Chi-Squared Distribution, Statistical Comparisons- Numerical Examples

UNIT – 2 [Lecture Hours: 12]

Road safety issues and various measures for road safety- Engineering, education and enforcement measures for improving road safety-Short term and long term measures-Road safety education and training- Reconstruction and Rehabilitation of Roads, Road Maintenance- Traffic calming techniques and innovative ideas in road safety.

.**UNIT – 3 [Lecture Hours: 12]**

Economic evaluation of improvement measures by "before and after studies" Counter measures at hazardous locations – accident investigation, problem diagnosis, development of counter measures, checklists for counter measures- Operating the road network for safety, highway operation and counter-measures, road safety audit, principles- procedures and practice, code of good practice and checklists.

UNIT – 4 [Lecture Hours: 12]

Traffic management techniques- Local area management-Transportation system management-Low cost measures, area traffic control. Various types of medium and long term traffic management measures and their uses. Evaluation of the effectiveness and benefits of different traffic management measures, management and safety practices during road works. Case studies -Road Safety Improvement Strategies, ITS and Safety

REFERENCE BOOKS:

1. BABKOV, V.F. `Road conditions and Traffic Safety', MIR publications, - 1975.
2. K.W. Ogden, `Safer Roads – A Guide to Road Safety Engg.' Averbury Technical, Ashgate Publishing Ltd., Aldershot, England, 1996.

3. Kadiyali, L.R., `Traffic Engineering and Transport Planning', Khanna Publications.
4. RL, DSIR, `Research on Road Safety', HMSO, London.
5. Papacoastas 'Introduction to Transportation Engineering' –Prentice
6. Transportation Engineering – An Introduction, C.Jotin khisty, B. Kent Lall

BTCE15F7510	Design of bridges & water tanks	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Hydrology and Irrigation Engineering, Design of RCC Structural Elements

Course Objectives:

1. To learn about the various types and components of bridges, IRC standards
2. To perform hydraulic design and structural design of substructures and foundations
3. To design RC T beam bridgeand composite bridge **s**uperstructure
4. To learn about the provisions of IS: 3370
5. To design and detail circular and rectangular water tanks by working stress and limit state methods
6. To design and detail circular overhead water tanks including staging

Course Outcomes:

At the end of the course, the student

1. Has learnt about the various types and components of bridges, IRC standards
2. Is able to perform hydraulic design and structural design of substructures and foundations
3. Is able to design RC T beam bridgeand composite bridge **s**uperstructure, Has learnt about the provisions of IS: 3370
4. Is able to design and detail circular and rectangular water tanks by working stress and limit state methods, Is able to design and detail circular overhead water tanks including staging

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 510	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 – 1: BRIDGE PRELIMINARIES: Classification of bridges and standard loads, Bridge-definition, components of bridges, various classification, types of bridges, forces to be considered for the design, IRC standards.

HYDRAULIC DESIGN: Methods of finding design discharge, natural, artificial and linear water ways, afflux, economic span.

SUBSTRUCTURES AND FOUNDATIONS: Types of abutments, piers and wing walls, forces to be considered for the design, Types of foundations and forces to be considered for the design, depth of scour.

UNIT – 2: DESIGN OF T-BEAM R C BRIDGE with cross beams by Piegaud's and Courbon's method for class-AA loading, empirical design of substructures and foundations.

DESIGN OF COMPOSITE BRIDGE: Design of composite bridge for EUDL, Shear connectors-design requirements for shear connectors.

UNIT – 3: IS: 3370 Codal Provisions, Design and detailing of Circular and Rectangular water tanks resting on ground (Flexible base and Rigid base) and underground by working stress and limit state methods.

UNIT – 4: Design and detailing of Circular overhead water tanks including staging.

TEXT BOOKS:

1. Johnson Victor, Essentials of Bridge Engineering: Oxford IBH Publications, New Delhi.
2. Design of Bridges: Krishna Raju N, Oxford IBH Publications, New Delhi.
3. Jagadish T. R. & Jayaram M. A., Design of Bridge Structures Prentice Hall of India, New Delhi.
4. N. Krishnaraju, Structural Design & Drawing Reinforced Concrete & Steel- University Press.
5. B.C. Punmia – Reinforced Concrete Structures - Laxmi Publishing Co., New Delhi.
6. S.N.Sinha, Reinforced Concrete Design –McGraw Hill Education, Delhi.

BTCE15F7520	Matrix Methods Of Structural Analysis	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Intermediate Structural Analysis

Course Objective:

1. To determine degrees of static and kinematic indeterminacies of framed structures.
2. To determine element flexibility and stiffness matrices, force and displacement transformation matrices and construct structure flexibility and stiffness matrices.
3. To analyze the plane framed structures by the flexibility matrix and stiffness matrix methods (element approach)
4. To analyze the plane framed structures by the direct stiffness method

Course outcomes:

At the end of the course the student is able

1. To determine degrees of static and kinematic indeterminacies of framed structures.
2. To determine element flexibility and stiffness matrices, force and displacement transformation matrices and construct structure flexibility and stiffness matrices.

3. To analyze the plane framed structures by the flexibility matrix and stiffness matrix methods (element approach)
4. To analyze the plane framed structures by the direct stiffness method

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 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 15F7 520	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 – 1:Introduction to flexibility method: Degree of static indeterminacy, Element flexibility matrix, Principle of contragradience, Force Transformation Matrix, Construction of structure flexibility matrix, Determination of the displacement vector, Determination of member forces.

UNIT – 2: Analysis of axially rigid continuous beams, rigid plane frames, trusses by flexibility method using Force Transformation Matrix

UNIT – 3: Introduction to stiffness method: Degree of kinematic indeterminacy, Equivalent joint loads, Displacement Transformation matrix. Member stiffness matrix, Total or System stiffness matrix.

Analysis of axially rigid continuous beams, rigid frames and trusses by stiffness method using Displacement Transformation Matrix**.**

UNIT – 4: Introduction to direct stiffness method: Local and global co-ordinate system, Transformation of variables, Transformation of member displacement matrix, Transformation of member force matrix, Transformation of member stiffness matrix, Transformation of stiffness matrix of the member of a truss, Transformation of stiffness matrix of the member of a rigid frame, Overall stiffness matrix, Boundary conditions, Computation of internal forces.

Analysis of trusses, axially rigid continuous beams and rigid-jointed plane frames by direct stiffness method.

REFERENCE BOOKS:

1. Devdas Menon, Advanced Structural Analysis.
2. W. Weaver J.M. Gere, Matrix Analysis of framed structures CBS Publishers and Distributors, 1986
3. H C Martin, Introduction to Matrix Methods of Structural analysis International text book Company, 1996
4. S Rajshekharan. G Sankara Subramanian, Computational structural Mechanics PHI, 2001
5. G.S Pandit & S P Gupta, Structural Analysis A Matrix Approach Tata Mc Graw-Hill, 1981.
6. C.S Reddy, Basic structural Analysis Tata McGraw-Hill, 1996.
7. L S Negi and R S Jangid, Structural Analysis Tata McGraw-Hill, 1997.
8. M Mukhopadhyay,Matrix, finite elements, Computer and Structural analysis Oxford & IBW, 1984.

BTCE15F7530	Reinforced earth structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

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

Course Objectives

1. To create an understanding of the latest technique such as reinforcing the soil;
2. To analyze the concept of RE so as to ascertain stability of RE structures;
3. To understand the different reinforcing materials that can be used efficiently in soils.

Course Outcomes:

An ability to

1. Understand basics of reinforced earth construction geosynthetics and their functions properties and tests on materials
2. Understand Concept of Reinforced earth retaining wall.
3. Determination of force induced in reinforcement ties
4. Applications to Temporary and Permanent roads

6. Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1	3	3	1		2	2	1					2	3	3		2

BTCE 15F7 530	**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**

UNIT- 1:BASICS OF REINFORCED EARTH CONSTRUCTION: Definition, Historical Background, Components, Mechanism and Concept, Advantages and Disadvantage of reinforced earth Construction, Sandwich technique for clayey soil.**GEOSYNTHETICS AND THEIR FUNCTIONS** Historical developments, Recent developments, manufacturing process woven &non-woven, Raw materials –Classification based on materials type – Metallic and Non-metallic, Natural and Man-made, Geosynthetics – **PROPERTIES AND TESTS ON MATERIALS** Properties – Physical, Chemical, Mechanical, Hydraulic, Endurance and Degradation requirements, Testing & Evaluation of properties **12 hours**

UNIT II: DESIGN OF REINFORCED EARTH RETAINING WALLS Concept of Reinforced earth retaining wall, Internal and external stability, Selection of materials, typical design problems

SOIL NAILING TECHNIQUES

Concept, Advantages & limitations of soil nailing techniques, comparison of soil nailing with reinforced soil, methods of soil nailing, Construction sequence, Components of system, Design aspects and precautions to be taken. **12 hours**

UNIT III: DESIGN OF REINFORCED EARTH FOUNDATIONS AND EMBANKMENTS - Modes of failure of foundation, Determination of force induced in reinforcement ties – Location of failure surface, tension failure and pull out resistance, length of tie and its curtailment, Bearing capacity improvement in soft soils, General guidelines. **Embankments** - Concept of Reinforced Embankments, Internal and external stability, Selection of materials, typical design problems **12 hours**

UNIT IV :GEOSYNTHETICS FOR ROADS,SLOPES AND LAND FILLS Roads - Applications to Temporary and Permanent roads, Role of Geosynthetic in enhancing properties of road, control of mud pumping, Enhancing properties of subgrade, Design requirements Slopes – Causes for slope failure, Improvement of slope stability with Geosynthetic, Drainage requirements, Construction technique.Geosynthetics - Filter, Drain and Landfills-introductory concepts **12 hours**

TEXT BOOKS:

1. Koerner. R.M. - Design with geosynthetics- Prince HallPublication, 2005
2. Koerner. R.M. & Wesh, J.P.- Construction and Geotechnical Engineering using synthetic fabrics- Wiley Inter Science, NewYork, 1980.
3. Sivakumar Babu G. L.,An introduction to Soil Reinforcement and Geosynthetics –Universities Press, Hyderabad, 2006
4. Swami Saran,I. K. Reinforced Soil and its Engineering Applications, International Pvt. Ltd, New Delhi, 2006
5. Venkattappa Rao. G., &Suryanarayana Raju., G. V.S.Engineering with Geosynthetics- - Tata Mc Graw Hill publishing Company Limited., New Delhi.

REFERENCE BOOKS:

1. Jones, Earth reinforcement and Soil structure- CJEPButterworths, London, 1996.
2. Ingold, T.S. & Millar, K.S. - Geotextile Hand Book- Thomas, Telford, London.
3. Shigenori Hayshi & Jen Otani -Earth Reinforcement Practices - Hidetoshi Octial, Vol. I, A.A. Balkema, Rotterdam, 1992.
4. Bell F.G. - Ground Engineer's reference Book- Butterworths, London, 1987.
5. T.S. - Thomas, Reinforced Earth- Ingold, Telford, London.

BTCE15F7540	Payment management system	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

NONE

Course Objectives:

1. To educate students about the importance of pavement evaluation, different methods of evaluating pavements, factors affecting deterioration and measures to reduce them, methods of evaluating surface condition
2. To make students familiar with concept of predicting pavement performance and deterioration modelling, different models for pavement modelling, HDM software and its use for pavement management.
3. To make students appreciate the design objectives, constraints, alternate pavement design strategies and economic evaluation, importance of economic analysis, life cycle costing.
4. To give students an overview of techniques and tools for pavement preservation, role of computers in pavement management, expert systems.

Course Outcomes:

On successful completion of this course, students should be able to:

1. Explain: the structural and functional requirements of pavements, methods of evaluation pavements, effects of pavement deterioration and remedial measures, methods of evaluation.
2. Describe: modeling techniques for pavement performance prediction, use of HDM software for pavement management, comparison of different models
3. Discuss: design objectives, constraints, compare various pavement design strategies, economic evaluation of pavements and life cycle costing methods
4. Enumerate: tools and techniques of road asset management, expert systems in managing pavements, role of computers of pavement management.
5. **Mapping of Course Outcomes with programme Outcomes**

<u>UNIT – 1</u> [Lecture Hours: 12]

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 540	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

Evaluation: Structural and functional requirements of flexible and rigid pavements, various aspects of surface and their importance, causes, factors affecting deterioration and measures to reduce – pavement slipperiness, unevenness, ruts, potholes and cracks. Evaluation of surface condition by MERLIN and 5^{TH} wheel bump integrator methods

UNIT – 2 [Lecture Hours: 12]

Introduction to pavement management system – components, planning and research management, pavement performance prediction – concepts, modeling techniques, structural and functional condition deterioration models, mechanistic and empirical models, HDM and other models, comparison of different deterioration models

UNIT – 3 [Lecture Hours: 12]

Design alternatives and selection – design objectives, constraints, basic structural response models, physical design inputs, alternate pavement design strategies and economic evaluation, reliability concepts in pavement engineering, life cycle costing, and analysis of alternate pavement strategies based on distress and performance

UNIT – 4 [Lecture Hours: 12]

Road asset management – pavement preservation programme, techniques and tools, role of computers in pavement management, applications of expert systems for managing pavements, evaluation and rehabilitation.

REFERENCE BOOKS:

1. Ralph Haas and Ronald W. Hudson, 'Pavement Management System', McGraw hill book co. 1978
2. Ralph Haas, Ronald Hudson and Zanieswki, 'Modern Pavement Management', Kreiger publications

3. Proceedings of the international conference on managing pavements
4. NCHRP, TRR, FHWA and TRB special reports

BTCE15F7550	Environmental impact assessment	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

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	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
BTCE15F7550	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

Unit 1: 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 2: 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 3: DOCUMENTATION AND MONITORING

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 4: CASE STUDIES

Case studies of EIA of developmental projects- EIA for Water resource developmental projects, Highway projects: Nuclear-Powerplantprojects,Miningproject(Coal,Ironore),ThermalPowerPlant, InfrastructureConstructionActivities.

Course Outcome:

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.

References:

1. Canter, L.W., " Environmental Impact Assessment ", McGraw Hill, New York, 1996.
2. Petts, J., " Handbook 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 ofEnvironmentandForests,GOI.

BTCE15F7800	Concrete & Highway Material Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

Preequisites:

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 800	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

LIST OF EXPERIMENTS:

1. Tests on cement: Normal Consistency, Setting time, Specific gravity of cement, Soundness by Autoclave method, Air permeability test for fineness
2. Tests on Aggregates:Crushing, abrasion, impact and Shape tests (Flaky, Elongation, Angularity number)
3. Tests on fresh concrete: Workability by Slump, Compaction factor and, VeeBee tests.
4. Tests on Hardened concrete: Compression strength ,Split tensile tests, Test on flexural strength of RCC beams, Permeability
5. California Bearing Ratio Test
6. Aggregate Impact Test, Los Angeles Abrasion Test , Aggregate Crushing Test
7. Aggregate Shape Tests, Aggregate Specific Gravity and Water Absorption Test
8. Bitumen Specific Gravity Test, Penetration Test , Softening point Test
9. Ductility Test, Elastic Recovery Test, Viscosity Test, Flash and Fire Point Test
10. Stripping Test, Rothfutch's Aggregate Proportioning Method
11. Marshall Method of Mix Design

REFERENCES BOOKS:

1."Laboratory Manual on Concrete Technology" Sood, Hemant, Mittal L N and Kulkarni P D, CBS Publishers, New Delhi, 2002.

2. Gambhir M L "Concrete Manual Laboratory testing for quality control" of concrete 4th edition DhanpatRai and Sons Delhi 1992.

3. Mehta P.K, "Properties of Concrete", Tata McGraw Hill Publications, New Delhi.

4. Neville AM, "Properties of Concrete", ELBS Publications, London.

5. Relevant BIS codes.

6. S K Khanna, C E G Justo and A Veeraragavan, "Highway Materials Testing Laboratory Manual ", Nem

Chand Bros, Roorkee

7. L R Kadiyali, "Highway Engineering ", Khanna Publishers, New Delhi

BTCE15F7900	Environmental Engineering Lab	L	T	P	C	Hrs/Wk
Duration :16 Wks		1	0	1	2	3

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F7 900	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**

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. Chemistry for Environmental Engineering, Sayer and Mccarthy
5. Environmental Engineering Laboratory Manual- Dr.BKotaiah, N Kumara Swamy

SYLLABUS VIII SEMESTER

BTCE15F8100	Seminar	L	T	P	C	Hrs/Wk
Duration :16 Wks		0	0	2	2	4

BTCE15F8200	Project Work	L	T	P	C	Hrs/Wk
Duration :16 Wks		0	1	5	6	5

Description of the course:

Project with seminar 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	PSO1	PSO2	PSO3	PSO4
BTCE15F8100 / BTCE15F8200	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

BTCE15F8310	Finite Element Analysis	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Theory of Elasticity

Course Learning 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
4. To analyze 2D problems of framed structures and continuum
5. To learn about formulation of isoparametric elements
6. To learn about the modules of a standard FEM computer program

Course Outcomes:

At the end of the course, the student

1. Has learnt about 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, Is able to analyze 2D problems of framed structures and continuum
4. Has learnt about formulation of isoparametric elements, Has learnt about the modules of a standard FEM computer program

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 310	3	3											3	3			3
	3	3	1										3	3			3
	3	3	2			1					1		3	3		1	3
	2	2	1	2	3	2	1	2	1	1		2	3	3	3	2	2

Course Contents:

UNIT – 1:Introduction: Basic Concepts, Review of Theory 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 – 2: Displacement models, natural coordinates, construction of shape functions for 2 D truss, beam and rigid frame elements, Lagrangian and Hermitian interpolation, assembly of stiffness matrices and load vectors by direct stiffness method, boundary conditions,
Applications of FEM for the analysis of plane truss, continuous beam and simple plane frame problems.
UNIT – 3: Analysis of 2D Continuum Problems: Plane stress and Plane strain**,** Polynomial displacement functions, Triangular, rectangular and quadrilateral elements, Shape functions, Pascal triangle, convergence requirements of shape functions, Simple numerical problems.
UNIT – 4: Theory of Isoparametric Elements: Isoparametric, subparametric and super-parametric elements, formulation of isoparametric quadrilateral element.
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 Affiliated East West Press Pvt. Ltd., New Delhi.
4. Rajasekharan. S, Finite Element Analysis in Engineering Design- Wheeler Pulishers.
5. Daryl L Logan, A First Course on Finite Element Method –Cengage Learning
6. Zienkeiwicz. 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.

BTCE15F8320	**Ground Improvement Techniques**	**L**	**T**	**P**	**C**	**Hrs/Wk**
Duration :16 Wks		**3**	**1**	**0**	**4**	**5**

Prerequisites:

Basic knowledge Basics of 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 320	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

UNIT I: GROUND IMPROVEMENT: Definition, Objectives of ground improvement, Classification of ground improvement techniques, Factors to be considered in the selection of the best soil improvement technique. Ground modification for Black Cotton soil **DRAINAGE AND DEWATERING:** Determination of ground water level by Hvorselev's method, Control of ground water during excavation: Dewatering - Ditches and sumps, well point system, Vacuum method, Electro- Osmosis method. **DRAINAGE & PRELOADING:** Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

12 hours

UNIT II: COMPACTION: Effect of grain size distribution on compaction for various soil types like lateritic soil, coarse-grained soil and micaceous soil. Effect of compaction on engineering behaviour like compressibility, swelling and shrinkage, permeability, relative density, liquefaction potential. Field compaction – static, dynamic, impact and vibratory type. Specification of compaction. Tolerance of compaction. Shallow and deep compaction, Dynamic Compaction, Vibrofloatation.

12 hours

UNIT III: CHEMICAL MODIFICATION-I: Definition, cement stabilization, sandwich technique, admixtures. Hydration – effect of cement stabilization on permeability, Swelling and shrinkage and strength and

deformation characteristics. Criteria for cement stabilization. Stabilization using Fly ash.**CHEMICAL MODIFICATION-II:** Lime stabilization – suitability, process, criteria for lime stabilization. Other

chemicals like chlorides, hydroxides, lignin and hydrofluoric acid. Properties of chemical components, reactions and effects. Bitumen, tar or asphalt in stabilization.

12 hours

UNIT IV: GROUTING: Introduction, Effect of grouting. Chemicals and materials used. Types of grouting. Grouting procedure, Applications of grouting.**MISCELLANEOUS METHODS (ONLY CONCEPTS & USES):** Soil reinforcement, Thermal methods, Ground improvement by confinement – Crib walls, Gabions and Mattresses, Anchors, Rock bolts and soil nailing. Stone Column, Micropiles.

12 hours

TEXT BOOKS:

1. Purushothama Raj P. Ground Improvement Techniques- Laxmi Publications, New Delhi1999.
2. Koerner R.M. Construction and Geotechnical Method in Foundation Engineering - Mc Graw Hill Pub. Co., New York-1985.

REFERENCE BOOKS:

1. Manfred Hausmann Engineering principles of ground modification - Mc Graw Hill Pub. Co., New York-1990.
2. Bell, F.G. Methods of treatment of unstable ground- Butterworths, London 1975.
3. Nelson J.D. and Miller D.J.Expansive soils- John Wiley and Sons 1975.
4. Ingles. C.G. and Metcalf J.B.Soil Stabilization; Principles and Practice- - Butterworths, London 1972.

BTCE15F8330	Industrial Waste Water Treatment	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Water supply and Sanitation Engineering, Hydraulic machines

Course Objectives:

1. To explain various tertiary treatment unit operations.
2. To explain combined treatment feasibility.
3. 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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 330	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

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

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

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: 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

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

Mahajan S.P., "Pollution Control Processes in industries", Tata McGraw Hill Publications,2004

BTCE15F8340	Highway Geometric Design	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Road safety and management

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	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
	CO1	3	3	3	2						1		1	3	2	3	2

BTCE 15F8340	**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**

UNIT – 1 [Lecture Hours: 12]

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 – 2 [Lecture Hours: 12]

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 – 3 [Lecture Hours: 12]

Vertical alignment - 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 – 4 [Lecture Hours: 12]

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. Khanna S.K and Justo C.E.G, “Highway Engineering”, Nemchand and Bros, Roorkee.
2. Kadiyali L.R, “Highway Engineering”, Khanna Publishers, Delhi.
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.

BTCE15F8410	Advanced design of pre-stressed concrete structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Design of Prestressed Concrete Structures

Course Learning Objectives:

1. To analyze the stresses in the end blocks and design reinforcement
2. To compute shear and torsional strengths and design reinforcement
3. To analyze and design composite sections
4. To analyze and design statically indeterminate prestressed concrete structures
5. To analyze and design tension and compression members, slab and grid floors
6. To analyze and design precast elements

Course Outcomes:

At the end of the course, the student is able

1. To analyze the stresses in the end blocks and design reinforcement, To compute shear and torsional strengths and design reinforcement
2. To analyze and design composite sections, To analyze and design statically indeterminate prestressed concrete structures
3. To analyze and design tension and compression members, slab and grid floors
4. To analyze and design precast elements

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 410	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

UNIT -1

ANCHORAGE ZONE STRESSES IN POST-TENSIONED MEMBERS:

Introduction, stress distribution in end block, investigations on Anchorage Zone stresses, Magnel and Guyon's Methods, Comparative Analysis, Anchorage zone reinforcement.

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

COMPOSITE SECTIONS: Introduction, Advantages, types, analysis of beams at serviceability limit state, stresses due to differential shrinkage, Ultimate moment of resistance, Design for flexural and shear strength.

UNIT – 2

STATICALLY INDETERMINATE STRUCTURES: Introduction, Advantages of continuous members, effect of prestressing in indeterminate structures, methods of analysis for secondary moments, concordant cable profile, Guyon's theorem, Ultimate load analysis, Design of continuous beams and portal frames.

UNIT – 3

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

COMPRESSION MEMBERS: Introduction, Columns, short columns, long columns, biaxially loaded columns, Design specifications.

UNIT – 4

SLAB AND GRID FLOORS: Types of floor slabs, Design of one way, two way and flat slabs. Distribution of prestressing tendons, Analysis and design of grid floors.

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

REFERENCE BOOKS:

1. Lin T.Y. and H. Burns - Design of Prestressed concrete structures - John Wiley & Sons, 1982.
2. N. Krishna Raju - Prestressed Concrete- Tata McGraw Hill, 3rd edition, , New Delhi-1995.
3. P. Dayaratnam, Prestressed Concrete Structures by Oxford & IBH Publishing Co. Pvt. Ltd., 5th Edition, 1991, New Delhi.
4. G.S. Pandit and S.P. Gupta – Prestressed Concrete- CBS Publishers, 1993, New Delhi.
5. N.C. Sinha & S.K. Roy, S.Fundamentals of prestressed concrete Chand and Co. Ltd.
6. by Praveen Nagarajan, Prestressed Concrete Design, Pearson, Delhi.
7. IS: 1343: 1980.

BTCE15F8420	Analysis and design of deep foundation	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Basic knowledge of Engineering Mechanics, Strength of Materials, Structural Analysis, Fluid Mechanics and Geotechnical Engineering

Course Objectives:

1. To analyze and interpret design different types of foundations;
2. To understand the design concepts of deep foundations,
3. To design well foundations and construction techniques of caissons and such other advanced type of foundations that are used in special circumstances

Course Outcomes:

An ability to

1. To analyse the single pile foundation.
2. Understand Dynamic analysis and load testsDynamic analysis.
3. To know efficiency of pile groups
4. Enumarate Constructional aspects of a drilled caissons

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 02	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
BTCE 15F8 420	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

Single pile – Static capacity and lateral loads Introduction, Timber, Concrete, Steel piles, Corrosion of steel piles, Soil properties for static pile capacity, Ultimate static pile point capacity, Skin resistance, Static load capacity using Load – transfer, load test data. Tension piles – Piles for resisting uplift. Laterally loaded piles, Buckling of fully and partially embedded piles and poles. **12 hours**

UNIT II

Single pile – Dynamic analysis and load testsDynamic analysis, Pile driving, rational pile formula, other Dynamic formulae and general considerations. Reliability of dynamic pile driving formulae. The wave equation, pile load tests, Pile driving stresses, General comments on pile driving. **12 hours**

UNIT III

Pile foundations - Group. Single pile Vs Pile group, Pile group considerations, efficiency of pile groups, stresses on underlying strata from piles, settlements of pile groups, Pile caps, Batter piles, Negative skin friction, Matrix analysis for pile groups, Pile cap design by Computer. **12 hours**

UNIT IV

Types of Caissons, Bearing capacity, stress distribution and settlement, Design of drilled caissons elements, forces in drilled Caissons, design of elements of Caissons, Constructional aspects of a drilled caissons, Construction of Caissons, problems associated with installation, advantages and disadvantages of Caissons foundation, Comparison of Caisson types. **12 hours**

TEXT BOOKS

1.Joseph.E. Bowles "Foundation analysis and Design" McGraw Hill, International edition
2. S.P. Brahma "Foundation Engineering" Tata McGraw Hill publishing company Ltd, New Delhi.
3. Narayana M. Nayak "Foundation design Manual" Dhanpat Rai Publications
4. Purushotham Raj "Geotechnical Engineering" Tata McGraw Hill publishing company Ltd, New Delhi.

REFERENCE BOOKS

1. Poulos, H. G., and Davis. E. H., "Pile Foundation Analysis and Design", John Wiley and Sons, 1980.
2. Tomlinson. M. J., "Pile Design and Construction Practice", A view Point Publication, 1987.
3. Bell. F. G., "Methods of Treatment of Unstable Ground", Newnes- Butterworths, London, 1975.

BTCE15F8430	Earthquake Geotechnical Engineering	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Basic knowledge of Engineering Mechanics, Structural Analysis, Fluid Mechanics and Geotechnical Engineering

Course objectives:

1. To create an understanding basic concepts of elementary earthquakes as applied to seismic design of structures;
2. parameters influencing the seismic design;
3. hazards associated with an earthquake.

Course Outcomes:

An ability to

1. Understand the Development of site specification and code-based design
2. Analyse the effect of earthquake on soils, Evaluation of zone of liquefaction in field
3. Seismic design requirements for foundation, Seismic bearing capacity, Seismic settlement.
4. Maintenance and modifications to improve hazard resistance.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 510	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 – 1

Earthquake Seismology – Causes of earthquake – seismic waves and magnitudes, Plate tectonics, Earthquake fault sources, Quantification of earthquake, Intensity and magnitudes, Earthquake source models, soils effects and liquefaction, Seismograph, Characteristics of ground motion. Effect of local site conditions on ground motions, Design earthquake, Design spectra, Development of site specification and code-based design. **12hrs**

UNIT – 2

Theory of vibration - Basic Definition - Governing equation for single degree freedom system - Forced vibrations - Rotating mass type excitation - Base excitation - Isolation vibration measuring instruments.Stress conditions on soil element under earthquake loading, **Liquefaction –** definition, Mechanism of liquefaction. Evaluation of zone of liquefaction in field.Evaluation of liquefaction using Standard Penetration Resistance. Factors affecting liquefaction and measures for anti-liquefaction. **12hrs**

UNIT – 3

Seismic Design of Foundations, Retaining Walls & Slopes

Seismic design requirements for foundation, Seismic bearing capacity, Seismic settlement, Design loads. Seismic slope stability analysis - Internal stability and weakening instability, Seismic design of retaining walls: Dynamic response of retaining walls, Seismic displacement of retaining walls, Seismic design consideration. **12hrs**

UNIT – 4

Earthquake Hazard Mitigation

Seismic risk vulnerability and hazard - Percept of risk - risk mapping - scale - hazard assessment - Maintenance and modifications to improve hazard resistance - Different type of foundation and its impact on safety - Ground Improvement Techniques. **12hrs**

Text Books:

1. KrammerS.L., Geotechnical Earthquake Engineering, prentice hall, international series, Pearson Education (Singapore) Pvt. Ltd., 2004.

2. KameswaraRao, Vibration Analysis and Foundation Dynamics, wheeler Publishing, New Delhi, 1998.
3. R. W. Day - Geotechnical Earthquake Engineering Handbook, McGraw-Hill, 2002.

References:

1. KameswaraRao, N.S.V., Dynamics soil tests and applications, Wheeler Publishing - New Delhi, 2000.
2. Kamalesh Kumar - Basic Geotechnical Earthquake Engineering – New Age International Publishers, 1st Edition, 2008.
3. Dowrick - Earthquake Resistant Design, John Wiley & Sons. Chowdhary, I., and Dasgupta, S. P.- Dynamics of Structures and Foundation

BTCE15F8510	Computer application in Civil Engineering	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Structural Analysis – II, Design of RCC Structural Elements

Course Objectives:

1. To analyze beams, trusses, rigid frames and grids using commercial software

2. To solve civil engineering problems such as SFD and BMD of statically determinate beams etc. using spreadsheets

3. To learn MATLAB and its applications to simple civil engineering problems

Course Outcomes:

1. Analysis of Plane Trusses and beams by using STADD-Pro or ETABS.
2. Analysis of Plane rigid jointed frames and grid frames by using STADD-Pro or ETABS.
4. Use of spread sheet such as EXCEL for solving the following Civil Engineering problems
5. MAT Lab application to simple civil engineering problems

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 510	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 1 : STRUCTURAL ANALYSIS

Analysis of Plane Trusses and beams by using STADD-Pro or ETABS or any other commercial software.

UNIT 2: STRUCTURAL ANALYSIS

Analysis of Plane rigid jointed frames and grid frames by using STADD-Pro or ETABS or any other commercial software.

UNIT3: SOLUTION OF CIVIL ENGINEERING PROBLEMS USING SPREAD SHEETS

Use of spread sheet such as EXCEL for solving the following Civil Engineering problems

i) Plotting of graphs such as SFD and BMD of statically determinate beams.

ii) Design of singly reinforced and doubly reinforced rectangular beam sections

iii) Computation of earthwork.

UNIT 4: APPLICATION OF MATLAB TO CIVIL ENGINEERING PROBLEMS

Introduction to MATLAB, application to simple civil engineering problems.

REFERENCE BOOKS:

1. Dr M.N.Shesha Prakash and Dr.G.S.Suresh, Computer Aided Design Laboratory- Lakshmi Publications
2. M.A.Jayaram, D.S.Rajendra Prasad, CAD Laboratory Sapna Publications, Bengaluru.
3. Roberts JT, -AUTOCAD 2002- BPB publications
4. Sham Tickoo, AUTOCAD 2004- A beginner's Guide, Wiley Dreamtech India Pvt Ltd.,
5. Ramesh Bangia, -Learning Excel 2002- Khanna Book Publishing Co (P) Ltd.,
6. Mathieson SA, Microsoft Excel- Starfire publishers
7. Rudra Pratap, Getting Started with MATLAB: A Quick Introduction for Scientists and Engineers Oxford University Press.

BTCE15F8520	Environmental Geotechnology	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

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

Course Objectives:

1. To create an ability to understand the sources and types of contaminations that are responsible for surface and subsurface contamination;
2. To analyze and interpret data related to the remediation techniques

Course Outcomes:

1. Need for contaminated site characterization
2. Detection of polluted zone, Monitoring and Effectiveness of designed facilities.
3. Planning of phased operation, leachate collection facility, gas collection facility, stability aspects, environmental monitoring systems.

4. Utilization of solid waste for soil improvement.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE15F 8520	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 – 1 **12Hrs**

Sources and Site Characterization:

Introduction to Geo environmental engineering –Scope of Geo-environmental Engineering, Environmental cycle Various Sources of Contaminations, Classification of waste, Characteristics of different wastes and their management, Liquid waste characterization, Solid waste characterization, Hazardous waste characterization, Need for contaminated site characterization; Environmental Concerns with waste, Waste management strategies. Geotechnical properties of solid waste,Waste generation and disposal on land, Impact on environment.

UNIT – 2 **12Hrs**

Subsurface Contamination:

Sources of ground water contamination, Contaminant transport in sub surface – advection – diffusion – dispersion – governing equations – contaminant transformation – absorption – biodegradation – ion exchange – precipitation ground water pollution – pollution of aquifers by mixing of liquid waste – protecting aquifers, Effect of subsurface contamination, Detection of polluted zone, Monitoring and Effectiveness of designed facilities.

UNIT – 3 **12Hrs**

Land fill planning and design consideration:

Introduction, types of landfills, site selection for landfills, shape and size of landfills, landfill layout, landfill section, landfill capacity Liner and liner system, Cover and cover system, Stability of landfills. Site characterization, Planning of phased operation, leachate collection facility, gas collection facility, stability aspects, environmental monitoring systems, construction schedule, material requirement, equipment requirement, environmental control during operation, landfill closure and post closure plan.

UNIT – 4 **12Hrs**

Remediation Techniques:

Objectives of site remediation, various active and passive methods of remediation NAPL sites, Emerging Remediation Technologies. Rational approach to evaluate and remediate contaminated sites – monitored natural attenuation – exsitu and insitu remediation – solidification, bio – remediation, incineration, soil washing, electro kinetics, soil heating, verification, bio venting – Ground water remediation – pump and treat, air sparging, reactive well. Hazardous waste control and storage system – stabilization/ solidification of wastes mechanism of stabilization – organic and inorganic stabilization – utilization of solid waste for soil improvement.

Text Books:

1. Sharma, H. D. and Reddy, K. R. - Geoenvironmental Engineering, John Wiley & Sons (2004)
2. Rowe, R. K. - Geotechnical &Geoenvironmental Engineering Handbook
3. Rowe, R. K. - Geotechnical &Geoenvironmental Engineering Handbook, Kluwer Academic, 2001
4. Reddi, L. N. and Inyang, H. I. - Geoenvironmental Engineering Principles and Applications, Marcel. Dekker, Inc., New York (2000).

References:

1. LaGrega, M. D., Buckingham, P. L. and Evans, J. C. - Hazardous Waste Management, New York: McGraw-Hill, 2001
2. Phillip B. Bedient, Refai, H. S. & Newell C. J. - Ground Water Contamination – Prentice Hall Publications, 4th Edition, 2008
3. Daniel, B.E., Geotechnical Practice for waste disposal, Chapman and Hall, London, 1993.
4. Westlake, K., (1995), Landfill Waste pollution and Control, Albion Publishing Ltd., England, 1995.

BTCE15F8530	Traffic Engineering & Management	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisites:

Traffic Engineering

Course Objectives:

1. To educate students about the importance of traffic engineering as applied to road transportation and features of traffic characteristics.
2. To make students familiar with the various traffic studies conducted and the methods of analyzing and presenting the data.
3. To give students an overview of the requirements of intersections, types of intersections and grade separators.
4. To make students appreciate the necessity of traffic regulations, types of traffic regulations and design of traffic regulations

Course Outcomes:

On successful completion of this course, students should be able to:

1. Outline the scope of traffic engineering, describe the road user characteristics and discuss the characteristics of different classes of vehicles.
2. Explain the necessity and methods of conducting various traffic studies and analyse the data collected to be presented in the form relevant to the purpose.
3. Enumerate: features and requirements of intersections, forms and types of intersections, and outline the features of: grade separators, underpasses, overpasses, interchanges.
4. Associate the traffic regulations to the safe and efficient operation of traffic, to identify the control measures and to design the basic regulatory devices.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 530	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 – 1

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. **12 hrs**

UNIT – 2

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. **12 hrs**

UNIT – 3

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, round about and other at grade intersections, provision for safe crossing of pedestrians and cyclists – grade separated intersection. **12 hrs**

UNIT – 4

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.

12 hrs

LIST OF EXPERIMENTS:

1. Calculation of PCU
2. Spot Speed Survey and Analysis
3. Traffic Volume Survey and Analysis
4. Traffic Growth Rate Estimation
5. Signal Design I
6. Signal Design II

Reference Books:

1. Kadiyali. L. R., "Traffic Engineering and Transport planning", Khanna publishers, New Delhi.
2. Khanna S.K and Justo C.E.G, "Highway Engineering", Nemchand and Bros, Roorkee.
3. Papacostas, C.A., "Fundamentals of Transportation Engineering", Prentice-Hall 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.

BTCE15F8540	Earthquake Resistant Design of Structures	L	T	P	C	Hrs/Wk
Duration :16 Wks		3	1	0	4	5

Prerequisite:

Structural Dynamics

Course Objectives:

1. To learn about causes, types, magnitude and intensity of earthquakes
2. To learn about seismic design provisions of Code
3. To learn about characterization of earthquake ground motion, structural modeling etc.
4. To learn about seismic evaluation and retrofitting methods
5. To learn about seismic design philosophy, seismic performance and methods of seismic analysis
6. To analyze and design RC and masonry buildings for seismic forces

Course Outcomes:

At the end of the course, the student

1. Has learnt about causes, types, magnitude and intensity of earthquakes
2. Has learnt about seismic design provisions of Code

3. Has learnt about characterization of earthquake ground motion, structural modeling etc.Has learnt about seismic evaluation and retrofitting methods
4. Has learnt about seismic design philosophy, seismic performance and methods of seismic analysis and is able to analyze and design RC and masonry buildings for seismic forces

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P 0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	P S O 1	PS O2	PS O3	PS O4
BTCE 15F8 540	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 - 1

Engineering Seismology Earthquake ground Motion,Theory of plate tectonics, seismic waves, Magnitude and intensity of earthquakes, local site effects, seismic zoning map of India. Types of Earthquakes.

UNIT - 2

Seismic Design Parameters, earthquake ground motion characteristics, response spectra and design spectrum. Structural modelling, Code based seismic design methods. Response control concepts, seismic evaluation and retrofitting methods. Numerical problems.

UNIT - 3

Effect of Structural Irregularities on seismic performance of RC buildings, Vertical irregularity and plan configuration problems, Seismo resistant building architecture, lateral load resistant systems, building characteristics.

Seismic design philosophy, Determination of design lateral forces - Equivalent lateral force procedure, dynamic analysis procedure. Step by step procedure for seismic analysis of RC buildings (without infill's), Equivalent static lateral force method, response spectrum methods, Numerical problems.

UNIT – 4

Earthquake resistant design of RC buildings - Codal provisions, loads, load combinations and detailing of reinforcement.

Earthquake resistant design of masonry buildings - elastic properties of structural masonry, Codal provisions, Design of two storied masonry building.

REFERENCE BOOKS:

1. Pankaj Agarwal, **Earthquake resistant design of structures** Manish Shrikande - PHI India.
2. S.K. Duggal, **Earthquake Resistant Design of Structures** Oxford University Press, 2007.
3. Anil Chopra, **Earthquake Dynamics of Structures** EERI,
4. S.F. Borg, **Earth Quake Engineering Damage Assessment and Structural design** (John Wiley and Sons. 1983.
5. IS 1893 (Parts 1 to 5), IS 4326-1993, 13920-1993.