REVA UNIVERSITY
Bengaluru, India

SCHOOL OF CIVIL ENGINEERING

B.Tech. in Civil Engineering

HANDBOOK

2018-22

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.

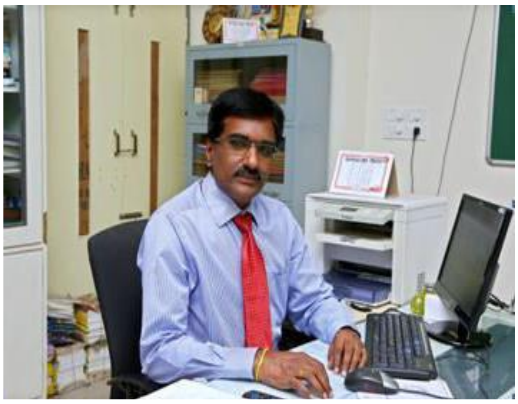
With firm faith in the saying, "Intelligence plus character –that is the goal of education" (Martin Luther King, Jr.), I strongly believe REVA University is marching ahead in the right direction, providing a holistic education to the future generation and playing a positive role in nation building. We 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. We will strive to provide all needed comfort and congenial environment for their studies. I wish all students pleasant stay in REVA and grand success in their career.

Dr. Y. Ramalinga Reddy
Director
School of Civil Engineering

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RUKMINI EDUCATIONAL CHARITABLE TRUST

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

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

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

ABOUT REVA UNIVERSITY

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

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

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

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

The programs being offered by the REVA University are well planned and designed after detailed study with emphasis with knowledge assimilation, applications, global job market and their social relevance. Highly qualified, experienced faculty and scholars from reputed universities / institutions, experts from industries and business sectors have contributed in preparing the scheme of instruction and detailed curricula for this program. Greater emphasis on practice in respective areas and skill development to suit to respective job environment has been given while designing the curricula. The Choice Based Credit System and Continuous

Assessment Graded Pattern (CBCS – CAGP) of education has been introduced in all programs to facilitate students to opt for subjects of their choice in addition to the core subjects of the study and prepare them with needed skills. The system also allows students to move forward under the fast track for those who have the capabilities to surpass others. These programs are taught by well experienced qualified faculty supported by the experts from industries, business sectors and such other organizations. REVA University has also initiated many supportive measures such as bridge courses, special coaching, remedial classes, etc., for slow learners so as to give them the needed input and build in them confidence and courage to move forward and accomplish success in their career. The University has also entered into MOUs with many industries, business firms and other institutions seeking their help in imparting quality education through practice, internship and also assisting students' placements.

REVA University recognizing the fact that research, development and innovation are the important functions of any university has established an independent Research and Innovation division headed by a senior professor as Dean of Research and Innovation. This division facilitates all faculty members and research scholars to undertake innovative research projects in engineering, science & technology and other areas of study. The interdisciplinary-multidisciplinary research is given the top most priority. The division continuously liaisons between various funding agencies, R&D Institutions, Industries and faculty members of REVA University to facilitate undertaking innovative projects. It encourages student research projects by forming different research groups under the guidance of senior faculty members. Some of the core areas of research wherein our young faculty members are working include Data Mining, Cloud Computing, Image Processing, Network Security, VLSI and Embedded Systems, Wireless Censor Networks, Computer Networks, IOT, MEMS, Nano- Electronics, Wireless Communications, Bio-fuels, Nano-technology for coatings, Composites, Vibration Energies, Electric Vehicles, Multilevel Inverter Application, Battery Management System, LED Lightings, Renewable Energy Sources and Active Filter, Innovative Concrete Reinforcement, Electro Chemical Synthesis, Energy Conversion Devices, Nano-structural Materials, Photo-electrochemical Hydrogen generation, Pesticide Residue Analysis, Nano materials, Photonics, Nana Tribology, Fuel Mechanics, Operation Research, Graph theory, Strategic Leadership and Innovative Entrepreneurship, Functional Development Management, Resource Management and Sustainable Development, Cyber Security, General Studies, Feminism, Computer Assisted Language Teaching, Culture Studies etc.

The REVA University has also given utmost importance to develop the much required skills through variety of training programs, industrial practice, case studies and such other activities that induce the said skills

among all students. A full-fledged Career Development and Placement (CDC) department with world class infrastructure, headed by a dynamic experienced Professor& Dean, and supported by well experienced Trainers, Counselors and Placement Officers.

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

The University has collaborations with Industries, universities abroad, research institutions, corporate training organizations, and Government agencies such as Florida International University, Okalahoma State University, Western Connecticut University, University of Alabama, Huntsville, Oracle India Ltd, Texas Instruments, Nokia University Relations, EMC^2, VMware, SAP, Apollo etc, to facilitate student exchange and teacher–scholar exchange programs and conduct training programs. These collaborations with foreign universities also facilitates students to study some of the programs partly in REVA University and partly in foreign university, viz, M.S in Computer Science one year in REVA University and the next year in the University of Alabama, Huntsville, USA.

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

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

Member of Planning Commission, Government of India, Dr. Balaram, Former Director IISc., and noted Scientist, Dr. V S Ramamurthy, Former Secretary, DST, Government of India, Dr. V K Aatre, noted Scientist and former head of the DRDO and Scientific Advisor to the Ministry of Defence Dr. Sathish Reddy, Scientific Advisor, Ministry of Defence, New Delhi and many others have accepted our invitation and blessed our students and faculty members by their inspiring addresses and interaction.

REVA organises various cultural programs to promote culture, tradition, ethical and moral values to our students. During such cultural events the students are given opportunities to unfold their hidden talents and motivate them to contribute innovative ideas for the progress of the society. One of such cultural events is REVAMP conducted every year. The event not only gives opportunities to students of REVA but also students of other Universities and Colleges. During three days of this mega event students participate in debates, Quizzes, Group discussion, Seminars, exhibitions and variety of cultural events. Another important event is ShubhaVidaaya, - 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'severyday 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	Member	School of Civil Engineering,

	Professor, REVA University	(Internal)	Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9448047250 Email:pshivananda@reva.edu.in
9	Dr.S.Harinath Professor, REVA University	Member (Internal)	School of Civil Engineering, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9449243525 Email: harinaths@reva.edu.in
10	Dr. S.P. Mahendra	Member (Internal)	School of Civil Engineering, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 9449260045 Email: mahendra.sp@reva.edu.in
11.	Dr. R.L. Ramesh	Member (Internal)	School of Civil Engineering, Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 91132 81345 Email: Ramesh.rl@reva.edu.in
12	Dr.N.NagaMaruthi Kumari Professor, REVA University	Member (Internal)	School of B18CE Science, 81345 Rukmini Knowledge park, REVA University, Yalahanka, Bengaluru-560064 (M): 876200582 Email: nagamaruthi.kumari@reva.edu.in
13	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.

REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Engineering Graduate Degree Programs, 2018

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

1. Title and Commencement:

1.1. These Regulations shall be called the **"REVA University Regulations for Choice Based Credit System (CBCS) and Continuous Assessment Grading Pattern (CAGP) for Engineering Graduate Degree Programs, 2018".**

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

2. The Programs:

The following programs and all Engineering Graduate Degree programs to be instituted and introduced in REVA University in coming years shall follow these regulations.

B Tech in:

Bioelectronics Engineering
Civil Engineering
Computer Science and Engineering
Computer Science and Information Technology
Computer Science and Systems Engineering
Computer Science and Engineering (AI and ML)
Electrical and Electronics Engineering
Electrical and Computer Engineering
Electronics and Communication Engineering
Electronics and Computer Engineering
Information Science and Engineering
Mechanical Engineering
Mechatronics Engineering

3. Definitions:

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

(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.

4. Courses of study and Credits

4.1. 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.

4.1.1. In terms of credits, every **one hour session of L amounts to 1 credit per Semester.**
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** over a period of one Semester of 16 weeks for teaching-learning process.

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

4.1.3. 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.

4.1.4. ***The concerned BoS will assign Credit Pattern for every course based on the requirement. However, generally, courses can be assigned with 1-4 Credits depending on the size of the course.***

4.1.5. 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. Open Elective Course:

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 denoted as "D" is a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. A Minor project normally will be assigned with 4-6 credits and a major project/dissertation will be assigned with 8-16 credits. **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.**

5. Eligibility for Admission:

5.1. The eligibility criteria for admission to B Tech Program of 4 years (8 Semesters) is given below:

Sl. No.	Program	Duration	Eligibility
1	Bachelor of Technology (B Tech)	4 Years	Passed 10+2 examination with Physics and Mathematics as compulsory subjects along with one of the Chemistry Biotechnology / Biology / Technical Vocational subject Obtained at least 45% marks (40% in case of candidate belonging to SC/ST category) in the above subjects taken together.
2	Bachelor of Technology(B Tech)	Lateral entry to second year	**(A)** Passed Diploma examination from an AICTE approved Institution with at least 45% marks (40% in case of candidates belonging to SC/ST category) in appropriate branch of Engineering / Technology. **(B)** Passed B. Sc Degree from a recognized University as defined by UGC, with at least 45% marks (40% in case of candidates belonging to SC/ST category) and passed XII standard with mathematics as a subject.

			(C) Provided that in case of students belonging to B. Sc. Stream, shall clear the subjects of Engineering Graphics / Engineering Drawing and Engineering Mechanics of the first year Engineering program along with the second year subjects. **(D)** Provided further that, the students belonging to B. Sc. Stream shall be considered only after filling the seats in this category with students belonging to the Diploma stream. **(E)** Provided further that students, who have passed Diploma in Engineering & Technology from an AICTE approved Institution or B. Sc Degree from a recognized University as defined by UGC, shall also be eligible for admission to the first year Engineering Degree courses subject to vacancies in the first year class in case the vacancies at lateral entry are exhausted. However the admissions shall be based strictly on the eligibility criteria as mentioned in A, B, D, and E above.
3	Bachelor of Technology (B Tech)	Lateral entry to fourth year (final year)	(F) Any candidate with genuine reason from any University / Institution in the country upon credit transfer could be considered for lateral admission to the respective semester in the concerned branch of study, provided he/she fulfils the university requirements.
4	B Sc (Honors) in Computer Science (with specialization in Cloud and Big Data)	4 Years (8Semesters)	Pass in PUC /10+2 examination with Physics, Mathematics as compulsory subject along with at least one of the Chemistry,/ Bio-Technology / Biology / Computer Science / Electronics / Technical Vocational subjects and obtained minimum 45% marks (40% in case of candidates belonging to SC / ST category) in the above subjects taken together of any board recognized by the respective State Government / Central Government / Union Territories or any other qualification recognized as equivalent there to.

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

6. Scheme, Duration and Medium of Instructions:

6.1. 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.

6.2. The medium of instruction shall be English.

7. Credits and Credit Distribution

7.1. A candidate has to earn 192 credits for successful completion of B Tech degree with the distribution of credits for different courses as given in **Table-1** below:

Course Type	**Credits**
	For B Tech Degree (8 Semesters)
Foundation Core Course	A minimum of 08
Hard Core Course	A minimum of 136, but not exceeding 156
Soft Core Course	A minimum of 24 but not exceeding 44
Open Elective	A minimum of 04
Total	**192**

7.2. Every course including project work, practical work, field work, self study elective should be entitled as **Foundation Course (FC), Hard Core (HC) or Soft Core (SC) or Open Elective (OE)** or **Core Course** (**CC**) by the BoS concerned. However, following shall be the **Foundation Courses** with credits mentioned against them, common to all branches of study.

Sl. No.	**Course Title**	**Number of Credits**
1	English for Technical Communication	4
2	Environmental Studies	2
3	Indian Constitution and Professional Ethics	2

7.3. A candidate can enrol 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.

7.4. 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.

8. Assessment

b) Each course is assessed for a total weight of 100%. Out of the total 100% weight; 40% weight is for Continuous Internal Assessment (CIA or IA) and the remaining 60% for the Semester End Examination (SEE). This applicable for theory, laboratory, workshop, studio and any such courses

c) Out of 40% weight earmarked for Internal Assessment (IA)- 30% is for internal tests & 10% for Assignments/ Seminars / Model making and this is applicable for theory based courses

d) The Internal tests and assignments are conducted as per the semester academic calendar provided by the University

The details as given in the table

Component	***Description***	***Conduction***	***Weight Percentage***
C1	***Test -1 IA 1***	***5th week from the starting date of semester***	***30*** ***1sr Test for 15 marks*** ***2nd Test for 15 marks*** ***3rd Test for 15 marks*** ***(Out of 3 tests, the sum of highest marks scored in two tests are considered)***
	Test-2: IA2	***10th week from the starting date of semester***	
	Test-3: IA3	***15th week from the starting date of semester***	
C2	***1 Assignment/ Seminar/ Model making***	***Portions covered within 50% of syllabus for Assignment1***	***05***
	2 Assignment/ Seminar/ Model making	***Portions covered remaining 50% of syllabus for Assignment2***	***05***
	SEE including practical	***between 18th Week-19th Week***	***60***
Results to be Announced			***By the end of 21st Week***

Note: IA or CIA includes C1,C2

Each test must be conducted for a duration of 60 minutes, setting the test question paper for a maximum of 30 marks. The final examination must be conducted for a duration of 3 hours and the question paper must be set for a maximum of 100 marks.

e)Students are required to complete courses like communication skills, technical English, Professional ethics and Indian Constitution, Environmental Sciences, technical skills, placement related courses, Open electives and any such value addition or specialized courses through online platforms like SWAYAM/NPTEL/Any other reputed online education aggregator. Students are required to choose the courses on the advice of their course coordinator/Director and required to submit the course completion certificate along with percentage of marks/grade scored in the assessment conducted by the online education aggregator. If the online education aggregator has issued a certificate along with the grade or marks scored to students, such courses will be considered for SGPA calculations, in case the aggregator has issued only a certificate and not marks scored, then such courses will be graded through an examination by concerned School, in case, if grading is not possible, students will be given a pass grade and award the credit and the credits will not be considered for SGPA calculations. The Online/MOOCs courses will not have continuous internal assessment component

f) Such of those students who would like to discontinue with the open elective course that they have already registered for earning required credits can do so, however, they need to complete the required credits by choosing an alternative open elective course.

9. Setting question paper and evaluation of answer scripts.

i. *For SEE, three sets of question papers shall be set for each theory course out of which two sets will be by the internal examiners and one set will be by an external examiner. In subsequent years by carrying forward the unused question papers, an overall three sets of question papers should be managed and depending on the consumption of question ppaers either internal or external examiner be called for setting the question paper to maintain an overall tally of 3 papers with the conditioned mentioned earlier. The internal examiner who sets the question paper should have been course tutor*

ii. *The Chairman of BoE shall get the question papers set by internal and external examiners.*

iii. *The Board of Examiners shall scrutinize and approve the question papers and scheme of valuation. It is the responsibility of the BoE to see that all questions contained in the question paper are within the prescribed syllabus of the concerned course.*

iv. *There shall be single valuation for all theory papers by internal examiners. However, there shall be moderation by the external examiner who has the subject background. In case no external examiner with subject background is available, a senior faculty member*

within the discipline shall be appointed as moderator.

v. ***The SEE examination for Practical work / Field work / Project work/Internship will be conducted jointly by internal and external examiners as detailed below: However, the BoE on its discretion can also permit two internal examiners.***

vi. ***If a course is fully of (L=0):T:(P=0) type or a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.***

[

10. Evaluation of Practical's and Minor Project / Major Project / Dissertation

10.3.1. A practical examination shall be assessed on the basis of:

a) Knowledge of relevant processes;

b) Skills and operations involved;

c) Results / products including calculation and reporting.

10.3.2. In case a course is fully of P type (L=0:T=0:P=4), the performance of a candidate shall be assessed for a maximum of 100 marks as explained below:

a) ***Continuous Internal assessment (CIA) =40 marks (20% weightage)***

b) ***Semester end practical examination (SEE) = 60 marks (30% Weightage)***

The 40 marks for continuous assessment shall further be allocated as under (IA or CIA):

i	***Conduction of regular practical throughout the semester***	***20marks***
ii	***Maintenance of lab records***	***10 marks***
iii	***Laboratory test and viva***	***10 marks***
	Total	***40 marks***

The 60 marks meant for Semester End Examination, 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***

10.3.3. The SEE for Practical work will be conducted jointly by internal and external examiners. However, if external examiner does not turn up, then both the examiners will be internal examiners.

10.3.4. In case a course is partly P type i.e, (L=3): (T=0) (P=1), then the examination for SEE component will be as decided by the BoS concerned.

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

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

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

1	***First project presentation describing the problem definition***	***Should be done a semester before the project semester***	***Weightage: 0%***
2	***Project Progress presentation-1***	***7th week from the start date of project semester***	***Weightage: 25%***
3	***Project progress presentation-2***	***14th Week from the start date of project semester***	***Weightage -25%***
4	***Final project Viva and Project Report Submission***	***17th -20th Week of project Semester***	***Weightage: 50% r (30% for Project Report & 20% for Final Viva Voce)***

11. Provision for Appeal

If a candidate is not satisfied with the evaluation of C1,C2 and C3 components, 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 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.

12. Eligibility to Appear for Semester End Examination

12.1. Only those students who fulfil a minimum of 75% attendance in aggregate of all the courses including practical courses / field visits etc, as part of the course(s), as provided in the succeeding sections, shall be eligible to appear for SEE examination.

12.2. Requirements to Pass a Course

Students are required to score a total minimum of 40% (Continuous Internal assessment and SEE) in each course offered by the University/ Department for a pass (other than online courses) with a minimum of 15 (25% of 60) marks in final examination

12.3. Requirements to Pass the Semester

To pass the semester, a candidate has to secure minimum of 40% marks in each subject / course of the study prescribed in that semester.

13. Provision to Carry Forward the Failed Subjects / Courses:

13.1. 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 C4 examination of failed courses of previous semesters concurrently with odd semester end examinations (C4) and / or even semester end examinations (C4) 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 C4 examination of 1 failed Course of First Semester concurrently with Third Semester C4 examination. Likewise, he / she is eligible to appear for C4 examination of 3 failed Courses of Second Semester concurrently with Fourth Semester C4 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 C4 examination of 2 failed Courses of Third Semester concurrently with Fifth Semester C4 examination. Likewise he / she is eligible to appear for C4 examination of 2 failed Courses of Fourth Semester concurrently with Sixth Semester C4 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 C4 examination of 4 failed Courses of Fifth Semester concurrently with Seventh Semester C4 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 C4 examination of 3 failed courses of 5th Semester concurrently with 7th Semester C4 examination and one failed course of 6th Semester concurrently with 8th Semester C4 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.

13.1. 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 (C4) 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.

14. Attendance Requirement:

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

14.2. 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.

14.3. 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 (C4) examination and such student shall seek re-admission as provided in 7.8.4.

14.4. 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 C4, and subsequently a notification pertaining to the above will be brought out by the Director of the School before the commencement of C4 examination. A copy of this notification shall also be sent to the office of the Registrar & Registrar (Evaluation).

15. Absence during Mid Semester Examination:

In case a student has been absent from a mid semester (C1,C2 and C3) examination 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 make-up examination. 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 test for such candidate(s) well in advance before the C4 examination of that respective semester. Under no circumstances C1,C2& C3 test shall be held after C4 examination.

16. Grade Card and Grade Point

16.1. **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).

16.2. **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).

16.3. **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	P
0-40	0	v*0	F
ABSENT			AB

O - Outstanding; A-Excellent; B-Very Good; C-Good; D-Fair; E-Satisfactory; F - Fail

Here, P is the percentage of marks (P=[C1+C2+C3+C4] 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.

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	P	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	P	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**

16.4. Cumulative Grade Point Average (CGPA):

16.4.1. Overall Cumulative Grade Point Average (CGPA) of a candidate after successful completion of the required number of credits (192) for B. Tech degree in Engineering & Technology is calculated taking into account all the courses undergone by a student over all the semesters of a program, i. e :**CGPA = ∑(Ci x Si) / ∑Ci**

Where Si is the SGPA of the ith semester and Ci is the total number of credits in that semester.

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

Illustration:
CGPA after Final Semester

Semester (ith)	No. of Credits (Ci)	SGPA (Si)	Credits x SGPA (Ci X Si)
1	24	6.83	24 x 6.83 = 163.92
2	24	7.29	24 x 7.29 = 174.96
3	24	8.11	24 x 8.11 = 192.64
4	26	7.40	26 x 7.40 = 192.4
5	26	8.29	26 x 8.29 = 215.54
6	24	8.58	24 x 8.58 = 205.92
7	24	9.12	24 x 9.12 = 218.88
8	24	9.25	24 x 9.25 =222
Cumulative	196		1588.26

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

16.4.2. *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

16.5. 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	P	Pass	Satisfactory

Overall percentage=10*CGPA

17. Challenge Valuation:

a. A student who desires to apply for challenge valuation shall obtain a photo copy of the answer script 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 C3 component.

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.

18. With regard to any specific case of ambiguity and unsolved problem, the decision of the Vice-Chancellorshall be final.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
B18CE 1010	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
B18CE 1020	CO1	3	3		1									3	3	3	3
	CO2	3	2	1										3	3	3	3
	CO3	3	2					1						3	3	3	3
B18CE 1030	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
B18CE 1040	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
B18CE 1050	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				
B18CE 1060	CO1	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO2	2	1	2		1	1			2	1	2	2	2	2	2	2

	CO3	2	1	2		1	1			2	1	1	2	2	2	2	2
	CO4	2	1	2		1	1			2	1	2	2	2	2	2	2
B18CE 1070	CO1	3	2	3	2											1	1
	CO2	2	2		2								1		1	1	
	CO3	3	3	2	3	1									1	2	
	CO4	2	2	3	3		2					1	2		2	2	
B18CE 1080	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
B18CE 2010	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
B18CE 2020	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			
B18CE 2030	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			
B18CE 2040	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
B18CE 2050	CO1	3	2	1		1								3	3	1	2
	CO2	2	3	2	1									3	3	1	2
	CO3	3	2			1								3	3	1	1
	CO4	2	2	1										2	3	1	2
B18CE 2060	CO1						3	3		3	3		3				
	CO2						3	3		3	3		3				
	CO3												3				
	CO4						3	3		3	3		3				
B18CE 2070	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			
B18CE 2080	CO1	3	3	2	2	1	1	1						2	3	1	2
	CO2	3	2	2	1									2	3	1	2
	CO3	3	2		1	1								3	3	1	2
	CO4	3	2	1		1								2	3	1	2
B18CE 2090	CO1	2	1			2					1			3	3	1	2
	CO2	2	1			1					1			3	3	1	2
	CO3	2	1			2	1				1			3	3	1	2
	CO4	2	1			3					1			3	3	1	2
B18CE 3010	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
B18CE 3020	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
B18CE 3030	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
B18CE 3040	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
B18CE 3050	CO1	3	2	2	3									3	1	1	2
	CO2	3	3	2										3	3	1	1
	CO3	3	3	2	1									3	3	1	1
	CO4	3	3	3	1									3	3	3	2
B18CE 3060	CO1						2		3				2				
	CO2								3		3		2				
	CO3	2					2		3		2		3				
	CO4	2					2		3				2				
B18CE 3070	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
B18CE 3080	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
B18CE 3090	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
B18CE 4010	CO1	3	2	1	2	1	1							3	1	1	1
	CO2	3	2	1	2	1	1							3	1	1	1
	CO3	3	3	2	1	2	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1
B18CE 4020	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
B18CE 4030	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
B18CE 4040	CO1	3	3	2	3	3							3	3	3	3	3
	CO2	3	3	2	3								3	3	3	3	3

	CO3	**3**	**3**	**2**	**1**								**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**								**3**	**3**	**3**	**3**	**3**
B18CE 4050	**CO1**	**3**	**3**			**2**		**2**	**3**	**2**	**3**		**1**	**3**	**3**	**2**	**3**
	CO2	**2**	**3**		**3**	**3**		**3**		**2**	**3**		**3**	**2**	**3**	**2**	**3**
	CO3	**2**	**2**		**3**		**2**	**2**		**2**	**2**		**2**	**2**	**2**	**3**	**3**
	CO4	**3**	**3**	**3**		**3**	**3**	**3**	**3**	**3**			**3**	**3**	**3**	**3**	**3**
B18CE 4061	**CO1**	**3**	**3**		**1**	**3**				**2**	**2**	**3**		**3**	**2**	**1**	**3**
	CO2	**3**	**3**		**1**	**2**				**3**	**2**	**3**		**3**	**2**	**1**	**3**
	CO3	**2**	**3**		**1**	**3**				**2**	**3**	**3**		**3**	**2**	**1**	**3**
	CO4	**3**	**3**		**1**	**1**				**3**	**3**	**3**		**3**	**2**	**1**	**3**
B18CE 4062	**CO1**	**3**											**3**	**3**	**3**		**3**
	CO2	**3**	**3**		**2**								**3**	**3**			**3**
	CO3	**3**	**3**	**3**	**3**								**3**	**3**			**3**
B18CE 4063	**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**
B18CE 4064	**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**
B18CE 4070	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**
B18CE 4080	**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**
B18CE 5010	**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**
B18CE 5020	**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**
B18CE 5030	**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
B18CE 5041	**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**
B18CE 5042	**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**
B18CE 5043	**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**
B18CE 5044	**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
B18CE 5051	**CO1**	**2**	**3**	**1**										**2**	**3**		
	CO2		**2**	**2**										**3**		**1**	**2**
	CO3	**1**	**2**					**1**						**2**		**1**	
	CO4	**1**	**2**	**1**										**2**			**1**
B18CE 5052	**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**
B18CE 5053	**CO1**	2	1	2	1								2	3	3	2	1
	CO2	3	1	1	2								2	3	3	2	1
	CO3	3	1	1	3								2	3	3	2	1
	CO4	3	1	2	3	2							2	3	3	2	1
B18CE 5054	**CO1**	3	3	3	2		1			2	2	3	2	3	2	2	3
	CO2	2	3	3	2		1			3	3		3	3	2	2	3
	CO3	3	2	3	2		1			3	3		2	3	2	2	3

	CO4	3	2	3			2			2	2		3	3	2	2	3
B18CE 5061	**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
B18CE 5062	**CO1**	**3**	**3**	**1**	**3**	**3**		**3**					**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**2**	**3**		**3**					**3**	**3**	**3**	**3**	**3**
	CO3	**2**	**3**	**2**	**2**	**3**		**3**					**3**	**3**	**3**	**3**	**3**
	CO4	**2**	**3**	**2**	**3**	**2**		**3**					**3**	**3**	**3**	**3**	**3**
B18CE 5063	**CO1**	**3**	**2**				**2**	**3**					**2**	**3**	**1**	**3**	**3**
	CO2	**3**	**2**				**2**	**3**	**1**				**2**	**3**	**1**	**3**	**3**
	CO3	**3**	**2**			**1**	**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**
	CO4	**3**	**2**				**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**
B18CE 5064	**CO1**	**3**	**3**	**2**	**3**	**1**	**1**	**1**		**1**			**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**	**3**	**1**	**1**		**1**			**2**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**	**3**	**1**	**1**		**1**			**2**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**1**	**1**	**2**	**1**		**1**			**3**	**3**	**3**	**3**	**3**
B18CE 5070	**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**
B18CE 5080	**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**

B18CE 5090	CO1	3	3			3								3	3	2	3
	CO2	3	2	3		3							2	3	3		2
	CO3	3	2	3		3							2	3	3		2
	CO4	3	2	3		3							2	3	3		2
B18CE 6010	CO1	3	3											3	3		
	CO2	3	3	3	1	2			2		2		1	3	3	3	1
	CO3	3	3	3	2	3	1	1	1		2		1	3	3	3	2
	CO4	3	3	3	2	3	1	1	1		2		1	3	3	3	2
B18CE 6020	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
B18CE 6030	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
B18CE 6040	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
B18CE 6051	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

B18CE 6052	**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**
B18CE 6053	**CO1**	**1**	**2**	**2**	**2**									**2**	**2**	**2**	**2**
	CO2	**2**	**2**	**3**	**2**									**2**	**2**	**3**	**2**
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	CO4	**2**	**2**	**3**	**2**									**2**	**2**	**3**	**2**
B18CE 6054	**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
B18CE 6061	**CO1**					3	2	3	2	2		2	2	3	1	1	3
	CO2	2				2	2	3	1	1		1	2	3	2	1	3
	CO3	2		2	1	1	1	3	1	1			2	3	2	1	3
	CO4	3	1		1	1		3	2	1	1		3	3	2	1	3
B18CE 6062	**CO1**	**3**	**1**				**3**		**2**		**2**		**2**	**3**			**1**
	CO2	**3**	**3**			**2**		**2**	**2**	**3**	**3**			**3**	**3**		**1**
	CO3	**3**	**3**		**2**	**2**	**3**			**3**	**1**	**2**		**3**	**3**	**1**	**2**
	CO4	**3**	**3**		**2**	**2**	**1**	**2**	**3**		**3**		**2**	**3**			**2**
B18CE 6063	**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**

B18CE 6064	**CO1**	2					3	3	1	1	1	2	2	3	2	1	2
	CO2	2	2	2	1		2	3	1	3		2	3	3	2	3	2
	CO3	2		3	2	3		3	1	3		1	3	3	2	2	2
	CO4	2	2	3	1	2			2	3	2		3	3	2	1	2
B18CE 6070	**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**
B18CE 6080	**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
B18CE 6090	**CO1**	**3**	**2**	**3**	**3**	**2**				**2**	**1**	**3**	**2**	**3**	**2**	**1**	**1**
	CO2	**3**	**2**	**2**	**2**	**2**				**1**	**1**	**3**	**1**	**3**	**2**	**1**	**1**
	CO3	**2**	**3**	**3**	**2**	**2**				**1**	**2**	**3**	**1**	**3**	**2**	**1**	**1**
	CO4	**3**	**2**	**2**	**2**	**3**				**2**	**1**	**3**	**1**	**3**	**2**	**1**	**1**
B18CE 7010	**CO1**	**3**	**2**		**1**	**1**	**1**		**2**	**3**	**2**	**2**		**3**	**3**		**3**
	CO2	**3**	**2**		**2**	**2**			**2**	**2**	**2**	**3**		**3**	**2**		**3**
	CO3	**3**	**2**		**3**	**3**	**2**		**2**	**2**	**3**	**2**		**3**	**2**		**2**
	CO4	**3**	**3**		**2**	**2**			**3**	**2**	**3**	**2**	**2**	**3**	**3**		**1**
B18CE 7020	**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**

B18CE 7030	**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**
B18CE 7041	**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
B18CE 7042	**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
B18CE 7043	**CO1**	**3**	**3**	**2**	**3**	**3**							**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**								**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**								**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**								**3**	**3**	**3**	**3**	**3**
B18CE 7051	**CO1**	**2**	**1**	**1**			**2**	**3**	**1**	**1**	**1**		**2**	**3**	**3**	**2**	**2**
	CO2	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**2**	**2**
	CO3	**3**	**3**	**3**	**2**	**2**	**2**	**3**	**1**	**1**	**1**	**1**	**2**	**3**	**3**	**2**	**2**
	CO4	**3**	**3**	**3**	**3**	**2**	**2**	**3**	**1**	**1**	**2**	**1**	**2**	**3**	**3**	**2**	**2**
B18CE 7052	**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**

B18CE 7053	**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**
B18CE 7054	**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**
B18CE 7061	**CO1**	**3**	**3**											**3**	**3**		
	CO2	**3**	**3**	**1**										**3**	**3**		
	CO3	**3**	**3**	**2**			**1**					**1**		**3**	**3**		**1**
	CO4	**2**	**2**	**1**	**2**	**3**	**2**	**1**	**2**	**1**	**1**		**2**	**3**	**3**	**3**	**2**
B18CE 7062	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**
B18CE 7063	**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**
B18CE 7064	**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**

B18CE 7070	CO1	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**
B18CE 7080	**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**
B18CE 7090	**CO**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
B18CE 8010	**CO**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**
B18CE 8020	**CO**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**	**3**

Mapping of PEOS with Respect to POs& PSOs

	PO1	P2	PO3	PO4	PO5	PO6	P7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3	
PEO1	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO2	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO3	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
PEO4	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

B. Tech in Civil Engineering
Scheme of Instructions

Sl. No.	Course Code	Course Title	Course Type	Credit Pattern and Value				Weekly Contact Hours	Teaching School/Dept.
				L	T	P	C		
First Semester: Physics Cycle									
1	B18CE1010	Differential Equations and Linear Algebra	HC	2	1	0	3	4	Mathematics
2	B18CE1020	Applied Physics	HC	2	1	0	3	4	Physics
3	B18CE1030	Object Oriented Programming with C $^{++}$	HC	2	1	0	3	4	C&IT .
4	B18CE1040	Building Materials	HC	2	1	0	3	4	Civil
5	B18CE1050	Technical English-1	HC	1	0	1	2	4	Arts and Humanities
6	B18CE1060	Civil Workshop Practice	HC	0	0	2	2	3	Civil
7	B18CE1070	Object Oriented Programming withC^{++}lab	HC	0	0	2	2	3	C&IT .
8	B18CE1080	Engineering Drawing (Manual)	HC	0	0	2	3	2+3	Mech.
			Total Credits for the First Semester:				21	31	
Second Semester: Chemistry Cycle									
1	B18CE2010	Vector Calculus and Partial Differential Equations	HC	2	1	0	3	4	Mathematics
2	B18CE2020	Applied Chemistry	HC	2	1	0	3	4	Chemistry
3	B18CE2030	Basics of Electrical and Electronics Engineering	HC	2	1	0	3	4	EEE
4	B18CE2040	Engineering Mechanics	HC	2	1	0	3	4	Civil
5	B18CE2050	Building Construction	FC	2	1	0	3	4	Civil
6	B18CE2060	Technical English-II	FC	1	0	1	2	4	Arts and Humanities
7	B18CE2070	Basic Electrical Lab	HC	0	0	2	2	3	EEE.
8	B18CE2080	Physics and Applied Mechanics Lab	HC	0	0	2	2	3	CIVIL
9	B18CE2090	Basic Auto CAD -Lab	HC	0	0	2	2	3	Civil
			Total Credits for the Second Semester:				**23**	**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	B18CE3010	Laplace Transform and Fourier series	HC	B18CE2010	2	1	-	3	4	Mathematics
2	B18CE3020	Strength of Materials	HC	B18CE2040	2	1	-	3	4	Civil
3	B18CE3030	Applied Surveying	HC	-	2	1	-	3	4	Civil
4	B18CE3040	Fluid Mechanics	HC	B18CE2040	2	1	-	3	4	Civil
5	B18CE3050	Concrete Technology	HC	B18CE1040	2	1	-	3	4	Civil
6	B18CE3060	Constitution of India and Professional Ethics	HC*	-	2	0	0	2	2	LAW
7	B18CE3070	Surveying Practice Lab	HC	B18CE3030	0	0	2	2	3	Civil
8	B18CE3080	Fluid Mechanics Lab	HC	B18CE3040	0	0	2	2	3	Civil
9	B18CE3090	Strength of Material Testing Lab	HC	B18CE3030	0	0	2	2	3	Civil
10	B18CE3100	**Placement &Training-I**	RULO		1	1	0	2	2	Placement
Total Credits for the Third Semester								**25**	**33**	

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	B18CE4010	Probability and Sampling Theory	HC	B18CE3010	2	1	-	3	4	Mathematics
2	B18CE4020	Structural Analysis	HC	B18CE3020	2	1	-	3	4	Civil
3	B18CE4030:Hydrology and Irrigation Engineering		HC	B18CE3040	2	1	-	3	4	Civil
4	B18CE4040:Water and Waste Water Engineering		HC	B18CE2020	2	1	-	3	4	Civil
5	B18CE4050:Highway Engineering		HC	B18CE3030	2	1	-	3	4	Civil
6	B18CE4061:Construction Project Management.		SC	B18CE2050	2	1	-	3	4	Civil
	B18CE4062:Rural Infrastructure development			-	2	1	-	3	4	Civil
	B18CE4063:Alternative Building materials			B18CE1040	2	1	-	3	4	Civil
	B18CE4064:Advanced Surveying			B18CE3030	2	1	-	3	4	Civil
7	B18CE4070:Environmental Engineering Lab		HC	B18CE2020	0	0	2	2	3	Civil
8	B18CE4080:Building Drawing With sketch book and Through CAAD		HC	B18CE2090	0	0	2	2	3	Civil
9	B18CE4090	**Placement Training-II**	RULO		1	1	0	2	2	Placement
10	B18CE4100:**DANCE / MUSIC/ SPORTS /YOGA**		RULO		0	0	2	2	2	Physical Education / Performing Arts
Total Credits for the Fourth Semester								**26**	**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	B18CE5010	Design of RC structural Elements	HC	B18CE4020	2	1	-	3	4	Civil
2	B18CE5020	Basic Geotechnical Engineering	HC	B18CE2050	2	1	-	3	4	Civil
3	B18CE5030	Railways, Airways, Waterways and Tunnels	HC	B18CE4050	2	1	-	3	4	Civil
4	B18CE5041	Advanced Structural Analysis	SC	B18CE4020	2	1	-	3	4	Civil
	B18CE5042	Traffic Analysis and Design		B18CE4050	2	1	-	3	4	Civil
	B18CE5043	Industrial Waste Water Treatment		B18CE4040	2	1	-	3	4	Civil
	B18CE5044	Fundamentals of Remote Sensing and GIS		B18CE4064	2	1	-	3	4	Civil
5	B18CE5051	Structural Dynamics and seismic Analysis	SC	B18CE4020	2	1	-	3	4	Civil
	B18CE5052	Rural Water supply and sanitation		B18CE4040	2	1	-	3	4	Civil
	B18CE5053	Water Resource systems and Management		B18CE4030	2	1	-	3	4	Civil
	B18CE5054	Construction Planning and Equipment.		B18CE4061	2	1	-	3	4	Civil
6	B18CE5061	Hydraulic Machines	SC	B18CE3040	2	1	-	3	4	Civil
	B18CE5062	Occupational Safety and Health Hazards			2	1	-	3	4	Civil
	B18CE5063	Renewable Energy			2	1	-	3	4	Civil
	B18CE5064	Non Destructive Testing Methods		B18CE3050	2	1	-	3	4	Civil
7	B18CE5070	Geotechnical Lab	HC	B18CE5020	0	0	2	2	3	Civil
8	B18CE5080	Concrete and Highway Materials Lab	HC	B18CE3050/ B18CE 4050	0	0	2	2	3	Civil
9	B18CE5090	Structural CADD Lab	HC	B18CE4080	0	0	2	2	3	Civil
10	B18CE5100	**Placement Training -III**	RULO		1	1	0	2	2	Placement
Total Credits for the Fifth Semester								**28**	**34**	

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	B18CE6010	Design of Steel Structures	HC	B18CE4020	2	1	-	3	4	Civil
2	B18CE6020	Applied Geotechnical Engineering	HC	B18CE5020	2	1	-	3	4	Civil
3	B18CE6030	Estimating, Costing and Valuation	HC	B18CE4080	2	1	-	3	4	Civil
4	B18CE6040	Design of Bridge Structures	HC	B18CE5010	2	1	-	3	4	Civil
5	B18CE6051	Repair and Rehabilitation of Structures.	SC	B18CE3050/ B18CE5010	2	1	-	3	4	Civil
	B18CE6052	Air and Noise Pollution		B18CE4040	2	1	-	3	4	Civil
	B18CE6053	Pavement Design and construction		B18CE4050	2	1	-	3	4	Civil
	B18CE6054	Design of Hydraulic Structures		B18CE4030	2	1	-	3	4	Civil
6	B18CE6061	Design of Masonry Structures	SC	B18CE2050	2	1	-	3	4	Civil
	B18CE6062	Intelligent Transport System		B18CE4050	2	1	-	3	4	Civil
	B18CE6063	Ground Improvement Techniques		B18CE5020	2	1	-	3	4	Civil
	B18CE6064	Disaster Management and Mitigation			2	1	-	3	4	Civil
7	B18CE6070	Structural Design and Detailing (RCC & Steel)	HC	B18CE5010/ B18CE6010	1	0	2	3	3	Civil
8	B18CE6080	NTP and OTP Projects with DPR	HC	B18CE3030 B18CE4030	1	0	2	3	3	Civil
9	B18CE6090	Project Management Lab	HC	B18CE4061/ B18CE5054	0	0	2	2	3	Civil
10	B18CE6100	**Placement Training-IV**	RULO		1	1	0	2	2	Placement
Total Credits for the Sixth Semester								**28**	**35**	

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	B18CE7010	Financial Management and Entrepreneurship	HC	B18CE4061	2	1	-	3	4	MBA
2	B18CE7020	Solid Waste Management	HC	B18CE4040	2	1	-	3	4	Civil
3	B18CE7030	Design of Prestressed and Prefabricated Structures	HC	B18CE5010	2	1	-	3	4	Civil
4	B18CE7041	Building Materials and Construction	OE*		2	1	-	3	4	Civil
	B18CE7042	Rainwater Harvesting and Ground Water Recharge.	OE*		2	1	-	3	4	Civil
	B18CE7043	Water Supply and Sanitation	OE*		2	1	-	3	4	Civil
5	B18CE7051	Earthquake Resistant Design of RC Structures	SC	B18CE5010	2	1	-	3	4	Civil
	B18CE7052	Green Building Technology		-	2	1	-	3	4	Civil
	B18CE7053	Geometric Design of Roads		B18CE4050	2	1	-	3	4	Civil
	B18CE7054	Open Channel Hydraulics		B18CE3040	2	1	-	3	4	Civil
6	B18CE7061	Numerical Methods in Civil Engineering	SC	B18CE4020	2	1	-	3	4	Civil
	B18CE7062	Earth and Earth Retaining Structures		B18CE6020	2	1	-	3	4	Civil
	B18CE7063	Urban transport and smart city.		B18CE6020	2	1	-	3	4	Civil
	B18CE7064	Environmental Assessment Methodologies		B18CE4040	2	1	-	3	4	Civil
7	B18CE7070	Design and drawing of Hydraulic structures	HC	B18CE4030/ B18CE6054	1	0	2	3	3	Civil
8	B18CE7080	Highway and Water Supply Project With DPR	HC	B18CE4050/ B18CE4040	1	0	2	3	3	Civil
9	B18CE7090	Field Visits	HC	-	0	0	3	3	3	Civil
Total Credits for the Sixth Semester								**27**	**49**	

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	B18CE8010	Internship (Practical)	SC	-	-	-	-	03	-	Civil
2	B18CE8020	Project Work with Seminar (Term Work)	HC	-	-	-	-	08	-	Civil
3	B18CE8030	MOOCS (Massive Open Online Courses) Certification Course	SC	-	-	-	-	3	-	Civil
Total Credits for Eigth Semester								**14**		
Total credits for all Eight semesters								**192**		

B. Tech in Civil Engineering

DETAILED SYLLABUS

(Effective from Academic Year 2020 - 21)

Semester – I

B18CE1010	Differential Equations and Linear Algebra	L	T	P	C
Duration:16Wks		2	1	0	3

Prerequisites:

Basics of Pre University Mathematics.

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1010	CO1	3	3	2	1	2	1							3	1	1	1
	CO2	3	3	2	2	2	2							3	1	1	1
	CO3	3	2	2	2	1	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1

Course Contents:

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

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

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

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

Unit-III: Linear Algebra [12 Hrs]

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

Unit-IV: Linear Algebra II [12 Hrs]

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

Reference Books:

1. B.V.Raman, Higher Engineering Mathematics by Higher Engineering Mathematics, Tata McGraw- Hill publishing company, New Delhi, 2008
2. Erwin Kreyszig , Advanced Engineering Mathematics, 8thEdition, Johnwilley&Sons, 1998
3. Peter V. O'Neil , Advanced Engineering Mathematics, 7th edition, Thomson publishers , 2011
4. Merle C. Potter & Jack Goldberg, Mathematical Methods, 2nd edition, Prentice- Hall, 1987

B18CE1020	**Applied Physics**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basics of Pre University Physics.

Course Objectives:

1. To make a bridge between the physics fundamentals which they studied in schools and

their applications which they are going to study in Civil Engineering.

2. To be acquainted with the basic concepts of properties of fluids, pressure and its measurements.
3. To get exposed to basic concepts of elastic properties of solids, vibrations & To Know about the different types of kinematic motions

Course Outcomes:

Understand the Concepts of Kinematics

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1020	CO1	**3**	**3**		**1**									**3**	**3**	**3**	**3**
	CO2	**3**	**2**	**1**										**3**	**3**	**3**	**3**
	CO3	**3**	**2**					**1**						**3**	**3**	**3**	**3**

Course Contents:

UNIT-I : Properties of Fluids [12 HOURS]

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

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

UNIT-II :Hydrostatics Forces [12 HOURS]

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

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

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

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

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

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

REFERENCE BOOKS:

1. Dr.P.N.Modi&Dr.S.M.Seth , Hydraulics and Fluid Mechanics, 21st Edition, Standard Book House, 2018
2. A.K. Mohanty, Fluid Mechanics, 2nd edition, Prentice Hall India, 1994
3. M.S.Vijaya, G.Rangarajan , Material Science, Tata McGraw Hill., 2006
4. S.Timoshenko, D.H.Young and J.V.RAo , Engineering Mechanics, Tata McGraw Hill, 2006
5. I.S.Gujral , Engineering Mechanics, Laxmi Publications, 2012
6. James F.Shackeford, Material Science for Engineers , Pearson Publishers, 2014.

B18CE1030	Object Oriented Programming with C++	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basics of Computers.

Course Objectives:

1. Introduce the basic concepts for defining classes with data members and member functions.
2. Familiarize with object creation and accessing members of a class.
3. Explain inheritance mechanisms for reusability of code.
4. Describe the concept of Virtual functions and Polymorphism

Course Outcomes:

Understand the Concepts of Kinematics

1. Identify the differences between Procedure oriented programming and Object oriented programming and demonstrate the use of Inline functions and Recursive functions.
2. Find a solution for a given problem using Object Oriented Methodology by creating Classes and their Objects to achieve better modularity of a solution.
3. Demonstrate the reusability of a created module by using Inheritance feature of OOP's.
4. Develop programs for making use of virtual functions and polymorphism

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1030	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: Introduction [12 HOURS]

Overview of OOP, Demonstrate how C++ is different from C Programming, Introduction to variables in C++, I/O operators, Introduction to Functions, Function overloading, Inline function, Recursive function.

UNIT-II: Classes & Objects [12 HOURS]

Introduction to Classes, Member Functions and Member data, Constructors and Destructors. Introduction to Objects, Accessing Data Members using Objects, Accessing Member Functions using Objects..

UNIT-III : Inheritance [12 HOURS]

Introduction to Inheritance, Base Class, Derived Class, Calling Derived class using derived class objects, Types of Inheritance, Hierarchy of Types of Inheritance. Inheriting multiple base classes, Constructors, Destructors and Inheritance.

UNIT-IV: Virtual functions and Polymorphism **[12 HOURS]**

Virtual functions, Pure virtual functions, Binding, Early and Late binding. Introduction to Polymorphism, Making call to different functions using Polymorphism..

REFERENCE BOOKS:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.
2. SanleyB.Lippmann, JoseeLajore: C++ Primer, 4th Edition, Pearson Education, 2005.
3. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
4. K R Venugopal, RajkumarBuyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.
5. ACM, Transactions on Programming Languages and Systems (TOPLAS)

B18CE1040	**Building Materials**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basics of Science

Course Objectives:

1. To understand the different types, and Properties of Bricks and Stones.
2. To understand the different types, and Properties of Cement and Steel
3. To understand the different types, composition and Properties of Timber and Glasses.
4. To understand the different types, ingredients, and Properties of Paints and Varnishes.

Course Outcomes:

1. Identify the types, origin, classification, manufacturing process, qualities, and uses of building elements, of bricks and stones.
2. Explain about Chemical composition, manufacturing process, various tests, types, Uses and storage of cement and steel.
3. Identify the types, classification, composition, qualities and properties of timber and glasses.
4. Know about ingredients and types of paints and varnishes and recognize its good qualities.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1040	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 **[12 HOURS]**

Bricks: Introduction, types of bricks, material suitable for manufacture of bricks, methods of brick manufacture, quality of good brick, testing of brick, uses of bricks.

Stones: Introduction, classification, composition and characteristics, different types of stones, method of quarrying and dressing.

UNIT-II **[12 HOURS]**

Cement: Chemical composition, physical properties of cement, manufacturing of cement, tests for cement, uses of cement, types of cement.

Steel: Manufacturing of steel, uses of steel, factors affecting physical properties of steel, defects in steels.

UNIT-III **[12 HOURS]**

Timber: Introduction, classification of timber, structure of a timber (microstructure and macrostructure), defects in timber, qualities of good timber, factors affecting strength of timber.

Glass: introduction, classification of glasses, composition of glasses, properties of glasses, types of glasses, uses of glasses.

UNIT-IV **[12 HOURS]**

Painting: Ingredients of paints, Types of Paints, Defects in Painting, Application of Paints to new

and old surface (wood and steel).

Varnishes: Introduction, characteristics of varnish, ingredients of varnishes, types of varnishes, process of varnishing.

REFERENCE BOOKS:

1. S.C. Rangwala, Engineering Materials, Charoter Publishing House, India, 1989
2. . Sushil Kumar , Engineering Materials, Standard Publishers distributors, Delhi, 2003
3. P.C. Rangawala Varghese, Text Book Building Materials, Prentice-Hall of India Pvt. Ltd., New Delhi, 2006.
4. Mohan Rai and M.P. Jain Singh, Advances in Building Materials and Construction, CBRI Publication, Roorkee, 2019
5. C B Kukreja and Ravi Chawla, Material Testing Laboratory Manual, Standard Publishers Distributors, New Delhi, 1996

B18CE1050	Technical English-I	L	T	P	C
Duration: 16weeks		1	0	1	2

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 1050	CO1						3	2		3	3		3				
	CO2						3	3		3	3		3				
	CO3						3	2		3	2		3				
	CO4						3	3		3	3		3				

Course Contents:

UNIT-I [12 HOURS]

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

Practice Session:Listening - Types of listening - Listening to audio (verbal & sounds);Speaking - Speaking about one's place, important festivals etc. – Introducing oneself, one's family /friend; Reading - Skimming a reading passage – Scanning for specific information Writing - Free writing on any given topic (My favourite place / Hobbies / School life,etc.) Grammar - Prepositions - Wh-questions - Tenses (Simple)Email communication

UNIT-II [12 HOURS]

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

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

UNIT-III [12 HOURS]

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

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

UNIT-IV [12 HOURS]

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

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

REFERENCE BOOKS:

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

WEBSITES:

1. http://www.usingenglish.com

2. http://www.uefap.com

B18CE1060	Civil Workshop Practice	L	T	P	C
Duration: 14weeks		0	0	2	2

Prerequisites:

None

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1060	CO1	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO2	2	1	2		1	1			2	1	2	2	2	2	2	2
	CO3	2	1	2		1	1			2	1	1	2	2	2	2	2
	CO4	2	1	2		1	1			2	1	2	2	2	2	2	2

Course Contents:

Carpentry:

1. Handling carpentry tools: Marking, sawing, plaining and chiselling to size

2. Making simple joints: (a) Half lap (b) Dovetail (c) T- joints

Plumbing:

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

Welding:

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

Construction Tools:

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

REFERENCE BOOKS:

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

B18CE1070	**Object Oriented Programming Using C++ Lab**	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Object Oriented Programming with C++

Course Objectives:

1. Practice basic and fundamental object oriented programming concepts.
2. Use Constructors and Destructors to solve any real world problems.
3. Write and practice C++ program that contains classes and objects.
4. Write and practice C++ program that contains inheritance and polymorphism

Course Outcomes:

1. Design and develop C++ programs for solving simple problems.
2. Compile and debug programs in C++ language.
3. Design and develop programs using all OOP concepts like Classes, Objects, Inheritance and Polymorphism.
4. Develop complex applications to address needs of society, industry and others.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1070	CO1	**3**	**2**	**3**	**2**											**1**	**1**
	CO2	**2**	**2**		**2**								**1**		**1**	**1**	
	CO3	**3**	**3**	**2**	**3**	**1**									**1**	**2**	
	CO4	**2**	**2**	**3**	**3**		**2**					**1**	**2**		**2**	**2**	

Course Contents:

List of Experiments

1. a. C++ Program to Print “Hello World” using output statement.

   b. Program to Print the Number entered by the User using Input statement and Output statement.

2. Consider there are 3 variables where the values are assigned by the user using input statement. Write a C++ program to check which is the largest number of the three variables and print the output using output statement. Note: Check for the condition when all three variables have same value.

3. Write a C++ program to create class to Read and Print details of a Student using objects. The Student details should consist of Student Name, SRN and Age.

4. Create a class for counting the number of objects created and destroyed within various block using constructor and destructors.

5. Create a class Student having members like Name, Age and Gender. Write a C++ program to read students information using two classes (one being the base class and other a derived class) and print the data using simple inheritance.

6. Create Base Class called Employee having members: Name, ID and Gender. Create a derived class Called Department having members: Dept. Name and Dept. ID. Write a C++ program to read and print employee information using Multilevel Inheritance.

7. Area can be computed for any polygon. Calculate and return the area of rectangle and triangle by defining a single virtual function Area. Write a C++ program to use Polymorphism.

8. Write a C++ program to perform different arithmetic operation such as addition, subtraction, division and multiplication using inline function.

9. Write a C++ program to print the given number in reverse order. Use functions with return type and without return type for reversing the number Ex: given number is 2345, output should be 5432.

10. Create two functions "add" for two different data types. Make two functions one for adding two integers and other for adding two floats, but having the same name. Write a C++ Program to show the use of Function Overloading.

REFERENCE BOOKS:

1. Herbert Schildt: The Complete Reference C++, 4th Edition, Tata McGraw Hill, 2003.
2. Sanley B. Lippmann, Josee Lajore: C++ Primer, 4th Edition, Pearson Education, 2005.
3. Paul J Deitel, Harvey M Deitel: C++ for Programmers, Pearson Education, 2009.
4. K R Venugopal, Rajkumar Buyya, T Ravi Shankar: Mastering C++, Tata McGraw Hill, 1999.
5. ACM, ACM Transactions on Programming Languages and Systems (TOPLAS).

B18CE1080	Engineering Drawing (Manual)	L	T	P	C
Duration: 16weeks		1	0	2	3

Prerequisites:

Basics of Geometry

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 1080	CO1	2	2	2		-	-	-	-	-	-	-	-	3	2	1	2
	CO2	2	3	1		1	-	-	-	-	-	-	-	3	2	1	2
	CO3	2	2	1		1	1	-	-	-	-	-	-	3	2	1	2
	CO4	2	2	1		1	-	-	-	-	-	-	-	3	2	1	2

Course Contents:

UNIT-I [12 HOURS]

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

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

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

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

UNIT-II [12 HOURS]

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

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

UNIT-III [12 HOURS]

Isometric Projection:Principles of Isometric projections - Lines and Planes – Isometric Scale – Isometric views – conventions – Isometric views of lines, plane figures, simple and compound

solids – Isometric projection of objects having non-isometric lines. Isometric projection of spherical parts.

UNIT-IV **[12 HOURS]**

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

REFRENCE BOOKS:

1. N.D.Bhatt and V.M. Panchal, Engineering Drawing , 48th Edition, Charotar Publishing House, Gujarat, 2005
2. K.L.Narayan&P.Kannaih, Engineering Drawing, Scitech publications, India, 2009
3. K.R. Gopalakrishna, Engineering Graphics, 32nd Edition, Subhas Publishers, Bangalore., , 2005
4. P. S. Gill , Engineering Drawing , 11th Edition, S. K. Kataria& Sons, Delhi, 2001

SEMESTER II

B18CE2010	Vector Calculus and Partial Differential Equations	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Differential Equations and Linear Algebra

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2010	CO1	3	2	2	1	1	1							3	1	1	1
	CO2	3	3	2	1	2	1							3	1	1	1
	CO3	3	3	2	2	1	1							3	1	1	1
	CO4	3	3	2	1	2	1							3	2	1	1

Course Contents:

UNIT-I **[12 HOURS]**

Partial Derivative and Multiple Integrals: Functions of several variables – Partial derivatives, Homogeneous Functions – Euler's theorem and Jacobians. Multiple Integrals – Double integrals – Change of order and change of variables. Triple integrals Illustrative examples for change of order and change of variables.

UNIT-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

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

REFERENCE BOOKS:

1) B.V.Raman ,Higher Engineering Mathematics , TMH publishers, 2003
2) E.Kreyszig Publisher ,Advanced Engineering Mathematics , 8thEdition ,Johnwilleyn&SonsInc-.
3) P.V.O'Neil , Advanced Engineering Mathematics , Publisher: Thomson
4) Potter &Goldberg , Mathematical Methods,Publisher:PHI

B18CE2020	**Applied Chemistry**	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Pre University Chemistry

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2020	CO1	**3**	**2**	**3**	**1**	**1**	**3**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO2	**3**	**3**	**2**	**2**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**2**	**3**			
	CO3	**3**	**3**	**-**	**-**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**3**			
	CO4	**3**	**2**	**1**	**1**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**3**			

Course Contents:

UNIT-I **[12 HOURS]**

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

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

UNIT-II **[12 HOURS]**

Phase Equilibrium: Phase, Components, Degree of freedom, Gibb's phase rule, Phase diagram of one component system: H20, Lever rule, Basic idea of (a) Isomorphism system, (b) Eutectic system

(Bi-Cd), (c) Peritectic system, (d) Eutectoid system and (e) Peritectoid system, Binary phase diagrams of Bi-Cd & Fe-C system.

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

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

UNIT-III [12 HOURS]

Ceramics: Types, Structure, Properties, Applications,

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

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

UNIT-IV [12 HOURS]

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

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

REFERNCE BOOKS:

1. G.M. Barrow ,Physical Chemistry, 6th edition, Tata McGraw Hill, New Delhi.
2. P.W. Atkins ,Physical Chemistry, 5thedition Oxford.
3. S.S.Dara, Text Book of Engineering Chemistry, S.Chand& C0.
4. Callister W.D., Materials Science and Engineering, John Wiley & Sons.
5. BalaramPani ,Text Book of Engineering Chemistry, Galgotia Publication.
6. R.Gopalan, D.\/enkappaya, S.Nagarajan, Engineering Chemistry , Vikas Publication.
7. S.S.Chawla, , Text Book of Engineering Chemistry,Dhanpat Rai Pub.Co.
8. Jain and Jain ,Text Book of Engineering Chemistry ,l5th edition, Dhanpat Rai Pub.
9. S.K.Tripathy, Arun K.Padhy&A.K.Panda , Materials Science, SCITECH publication
10. Vijaya.M.S., Rangarajan.G, Materials Science, TMH
11. Rajendra V., Marikani A., Materials Science, TMH
12. B.K.Sharma , Industrial Chemistry , Goel Publishing House.

B18CE2030	Basic Electrical and Electronics Engineering	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Pre University Physics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2030	CO1	3	2	2	2	-	1	-	-	-	-	-	1	3			
	CO2	3	3	1	2	1	1	-	-	-	-	-	-	3			
	CO3	3	2	2	1	1	1	-	-	-	-	-	-	3			
	CO4	3	2	2	2	1	1	-	-	-	-	-	1	3			

Course Contents:

UNIT-I **[12 HOURS]**

Electrical Circuits: Basic definitions, Types of elements, Ohm's Law, Kirchhoff's Laws, Resistive, Inductive, capacitive networks, Series, Parallel circuits and Star-delta and delta-star transformations, Network Theorems (Superposition, Thevenin's& Norton's) Generationof an alternating Emf–average and rms values of alternating quantity–representation of alternating quantities by phasors–single phase series and parallel circuits (simple problems), three phase systems and power calculations.

UNIT-II **[12 HOURS]**

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

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

UNIT-III **[12 HOURS]**

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

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

UNIT-IV **[12 HOURS]**

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

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

REFERNCE BOOKS:

1. V.N. Mittle “Basic Electrical Engineering”, Tata McGraw Hill Edition, New Delhi, 1990.
2. Surinder Pal Bali , Electrical Technology, Pearson Publications
3. R.S. Sedha, “Applied Electronics” S. Chand & Co., 2006.
4. R.L. Boylestad and Louis Nashelsky , Electronic Devices and Circuits, , 9th edition, PEI/PHI 2006.
5. Muthusubramanian R, Salivahanan S and Muraleedharan K A, Basic Electrical, Electronics, and Computer Engineering, Second Edition, Tata McGraw Hill, 2006.
6. Nagsarkar T K and Sukhija MS, Basics of Electrical Engineering, Oxford Press , 2005.

B18CE2040	Engineering Mechanics	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Pre University Physics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2040	CO1	3	3	2	1		2	1				1	3	3	2	2	3
	CO2	3	3	3	1		1					1	2	3	3	2	2
	CO3	3	3	2	1		1	1				1	2	3	3	2	2
	CO4	3	3	1	1		2	1				1	3	3	2	2	1

Course Contents:

UNIT-I **[12 HOURS]**

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

UNIT-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

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

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

REFERENCE BOOKS:

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

B18CE2050	Building Construction	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Building Materials

Course Objectives:

1. To understand the different types of foundations provided for civil engineering structures.
2. To understand the different types of materials and joints in brick and stone masonry.
3. To understand the technical terms and different types of doors, windows and stairs.
4. To understand the different types, materials, and uses of plastering and flooring

Course Outcomes:

1. Identify different types of foundations provided for civil engineering structures
2. Identify the materials, and explain the types of joints in brick and stone masonry.
3. Explain the technical terms and types of doors, windows and stairs of a building.
4. Know the various types and uses of plastering and flooring materials.

Mapping of Course Outcomes with programme Outcome

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3	PS O4
B18CE 2050	CO1	3	2	1	-	1	-	-	-	-	-	-	-	3	3	1	2
	CO2	2	3	2	1	-	-	-	-	-	-	-	-	3	3	1	2
	CO3	3	2	-	-	1	-	-	-	-	-	-	-	3	3	1	1
	CO4	2	2	1	-	-	-	-	-	-	-	-	-	2	3	1	2

Course Contents:

UNIT-I **[12 HOURS]**

Foundations: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, pier and pile foundations. (Basic Concepts and Sketches only) excavation of foundation. Simple Problems on design of foundations..

UNIT-II **[12 HOURS]**

Brick masonry: Introduction, Definition of terms used in Masonry, materials used, types of bonds, joints in brick work, joint between old and new masonry, maintenance of brick work.

Stone masonry: Introduction, Definition of terms used in Masonry, cutting and dressing of stones, types of stone masonry (rubber and ashlar), joints of stones, maintenance of stone works, cavity walls, purpose and method of construction of cavity walls.**UNIT-III**

[12 HOURS]

Doors and Windows: Definition of technical terms, Types of Doors, Types of windows, Varieties of materials for doors and windows & properties of wood. Location of doors and windows with a plan of typical residential building (line diagram only),

Stairs: Definition of technical terms related to stairs, Types of Stairs, Essential requirements of stairs and design of stairs.

UNIT-IV **[12 HOURS]**

Plastering: Definition, materials used for plastering, types of plastering, Purpose of plastering, Methods of plastering, Defects and remedial measures in plastering.

Flooring: Types of flooring and their construction- brick, stone, concrete, tile, mosaic, terrazzo and asphalt.

REFERENCE BOOKS:

1. RangawalaP.C. ,Engineering Materials, Charter Publishing House, Anand, India.
2. Sushil Kumar ,Engineering Materials, Standard Publication and Distributors, New Delhi.
3. M.S. Shetty ,Concrete technology – Theory and practice, S. Chand and Co, 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, CBRI, Roorkee.
6. Neville A.M and Brooks J.J ,Concrete Technology, ELBS Edition, London
7. Gambhir M.L ,Concrete Technology, Dhanpat Rai and Sons, New Delhi.

B18CE2060	Technical English-II	L	T	P	C
Duration: 16weeks		1	0	1	2

Prerequisites:

Technical English-I

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2060	CO1						3	3		3	3		3				
	CO2						3	3		3	3		3				
	CO3												3				
	CO4						3	3		3	3		3				

Course Contents:

UNIT-I **[12 HOURS]**

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

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

UNIT-II **[12 HOURS]**

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

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

UNIT-III **[12 HOURS]**

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

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

format and practice in the preparation of minutes. Note making skills – making notes from books Types of reports – Feasibility / Project report – report format – recommendations / suggestions – interpretation of data (using charts for effective presentation)

UNIT-IV **[12 HOURS]**

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

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

REFERENCE BOOKS:

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

B18CE2070	**Basic Electrical Engineering Lab**	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Basic Electrical and Electronics Engineering

Course Objectives:

1. To establish a broad concept of various types of electrical apparatus and instrumentation.

2. To provide hands on experience with electrical apparatus.
3. To train students to read and understand schematics so as to make connection.
4. To train students in collecting and interpreting experimental data.

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2070	CO1	3	2	2	2		1						1	3			
	CO2	3	3	1	2		1							3			
	CO3	3	2	2	1		1							3			
	CO4	3	2	2	2		1						1	3			

Course Contents:

List of Experiments

1. Electronic tools introduction: ammeter, voltmeter, CRO.(demo)
2. Home electrical wiring demonstration: energy meter, MCB, tube light wiring.
3. Study of mutual induction effect.
4. Home electrical wiring demonstration: short circuit, series and parallel operation of load.
5. Electrical safety training: electrical activities to avoid shocks and importance of earthing, role of fuse, working of MCB.
6. Single phase transformer: study of polarity, turns ratio, losses, open circuit and closed circuit test
7. Diode rectifier applications: half wave & full wave rectifier, ripple factor calculations.
8. Thyristor applications: half wave & full wave rectifier (demo)
9. Sensor experiments: ultrasonic sensor, pressure sensor, LDR, opto coupler.
10. Connection & Measurement of power consumption of a fluorescent lamp.

B18CE2080	Physics and Applied Mechanics Lab	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Applied Physics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 2080	CO1	3	3	2	2	1	1	1	-	-	-	-	-	2	3	1	2
	CO2	3	2	2	1	-	-	-	-	-	-	-	-	2	3	1	2
	CO3	3	2	-	1	1	-	-	-	-	-	-	-	3	3	1	2
	CO4	3	2	1	-	1	-	-	-	-	-	-	-	2	3	1	2

Course Contents:

List of Experiments:

1) Determination of Young's Modulus by single cantilever method/Uniform bending method
2) Determination of Rigidity Modulus by Static Torsion Method.
3) Determination of Tensile strength of mild steel materials
4) Determination of viscosity by Poiseuille method/ falling ball method
5) Determination of Metacentric height of a floating body.
6) Determination of pressure on a surface by using monometer.
7) Calibration of pressure gauges.
8) Determination of surface tension of water by capillary rise method.
9) Verification of laws of vibration of a stretched string using sonometer.(demonstration only)
10) Newton's Laws of motion. (demonstration only)

REFERENCE BOOKS:

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

B18CE2090	**Basic AUTO- CAD Lab**	L	T	P	C
Duration: 16weeks		**0**	**0**	**2**	**2**

Prerequisites:

Engineering Drawing

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 2090	CO1	**2**	**1**			**2**					**1**			**3**	**3**	**1**	**2**
	CO2	**2**	**1**			**1**					**1**			**3**	**3**	**1**	**2**
	CO3	**2**	**1**			**2**	**1**				**1**			**3**	**3**	**1**	**2**
	CO4	**2**	**1**			**3**					**1**			**3**	**3**	**1**	**2**

Course Contents:

List of Experiment

1. Introduction to Engineering Drawing:
2. Introduction to AUTO CAD. Setting of units and limits. Drawing tools, modify tools, special tools. 3D drawing tools.
3. Drawing of a Title Block with necessary text and projection symbol.
4. Drawing of front view and top view of simple solids like prism, pyramid, cylinder, cone, etc., and dimensioning
5. Drawing sectional views of prism, pyramid, cylinder, cone, etc., and dimensioning
6. Drawing isometric projection of simple objects. and dimensioning
7. Creation of 3-D models of simple objects and obtaining 2-D multi-views from 3-D model.

REFERENCE BOOKS:

1. T.Jeyapavan ,Engineering Drawing with AUTO CAD , Vikas publishing house, 2009
2. N.D.Bhatt and V.M. Panchal, Engineering Drawing , 48th Edition, Charotar
3. Publishing House, Gujarat, 2005
4. K.R. Gopalakrishna ,Engineering Graphics, 32nd Edition, 2005 ,Subhas Publishers, Bangalore.
5. P. S. Gill ,Engineering Drawing, 11th Edition, S. K. Kataria& Sons, Delhi, 2001

SEMESTER III

B18CE3010	Laplace Transform and Fourier Series	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Partial Differential Equations.

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3010	CO1	3	3	2	2	1	1							3	1	1	1
	CO2	3	3	2	2	1	1							3	1	1	1
	CO3	3	2	1	3	2	1							3	1	1	1
	CO4	3	2	2	2	2	1							3	2	1	1

Course Contents:

UNIT-I **[12 HOURS]**

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

UNIT-II **[12 HOURS]**

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

Applications: Applications of Laplace transforms to civil engineering problems.

UNIT-III **[12 HOURS]**

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

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

UNIT-IV **[12 HOURS]**

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

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

REFERENCE BOOKS :

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

B18CE3020	Strength of Materials	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Physics, and Engineering Mechanics.

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3020	CO1	3	3	1	1	1	2	1		1	2		3	3	3	3	2
	CO2	3	3	1	2		2	1		1	2		3	3	3	3	2
	CO3	3	3	2	2	2	2	1		1	2		3	3	3	3	2
	CO4	3	3	2	2	2	2	1		1	2		3	3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Simple Stresses and Strains: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Principle of superposition (Bars of uniform and varying sections), Total elongation of tapering bars of circular and rectangular cross sections, Volumetric strain, Expression for volumetric strain, Elastic constants, Relationships among elastic constants, Saint Venant's principle, Composite bars-Thermal stresses in simple and compound bars. With numerical examples.

UNIT-II **[12 HOURS]**

Shear Force and Bending Moment: Definition of beam, Types of beams, Concept of shear force and bending moment, Relation between S.F, B.M and rate of loading at a section of a beam. S.F and B.M diagrams for cantilever simply supported and overhanging beams subjected to point loads, UDL, moment, Couple and combination of these loads, Point of contra flexure. With numerical examples.

UNIT-III **[12 HOURS]**

BENDING AND SHEAR STRESSES IN BEAMS, AND DEFLECTION OF BEAMS.

Bending Stresses: Theory of simple bending, Assumptions, Definition of Flexural rigidity and Modulus of rupture. Derivation of bending equation, Moment of resistance, Design of Simple beam sections, (rectangular, I and T) Section modulus of rectangular and circular sections (Solid and Hollow). **Shear stresses:** Expression for horizontal shear stress in beam, Design of Simple (rectangular, symmetrical & unsymmetrical I and T) beam sections. With numerical examples.

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 (simply supported and overhanging beams with point loads, UDL and external moment) by the method of singularity functions (Macaulay's method). With numerical examples.

UNIT-IV **[12 HOURS]**

Torsion of Circular Shafts:

Introduction – Pure torsion - torsion equation of circular shafts, Strength and stiffness, Torsional rigidity and polar modulus, Power transmitted by shaft of solid and hollow circular sections. With numerical examples.

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. With numerical examples.

REFERENCE BOOKS:

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

B18CE3030	**Applied Surveying**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Basic Mathematics, and Basic science

Course Objectives:

1. To provide basic knowledge about 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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3030	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Chain Surveying: importance of surveying- classification of surveying- principles of surveying- units of measurements, concepts of plane and geodetic surveying-plans and maps-surveying equipment's, obstacles in Chain Surveying with numerical examples.

UNIT-II **[12 HOURS]**

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 and Fall and H.I methods.

Contours and their characteristics – Methods of contour plotting- Interpolation- Grade contour- application of contours, Numerical examples on levelling and calculation of reservoir capacity

UNIT-III **[12 HOURS]**

Theodolite Survey, Trigonometric Levelling and Tacheometry:

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

Calculation of Area and Volumes- calculation of area using cross staff surveying- coordinates method- Simpson's and Trapezoidal rules and use of Digital Planimeter- Measurements of volume by Trapezoidal and Prismoidal formula.

UNIT-IV **[12 HOURS]**

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

REFERENCES BOOKS:

1. B. C Punmia, Surveying Vol. 1, Laxmi publications pvt ltd, New Delhi
2. S. K Duggal, Surveying Vol. Tata McGraw Hill Publishing Co. Ltd. New Delhi-2009
3. K. R Arora, Surveying Vol. 1 Standard Book House, New Delhi-2010
4. Kanetkar T P and S V Kulkarni, Surveying and Levelling Part I, Pune VidyarthiGrihaPrakashan, 1988.
5. R Subramanian, Surveying and Levelling, Second edition, Oxford University Press, New Delhi.
6. A. Bannister, S. Raymond , R. Baker, "Surveying", Pearson, 7th ed., NewDelhi

B18CE3040	**Fluid Mechanics**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Applied Physics

Course Objectives:

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

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3040	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**2**	**-**	**3**					**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**2**	**2**	**2**	**-**	**2**					**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

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

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

UNIT-II **[12 HOURS]**

Pipe Flow: Introduction, losses in pipe flow, Darcy-Weisbach equation for head loss due to friction in a pipe. Equation for head loss due to sudden expansion- problems. Momentum equation and its application to problems on pipe bends. Pipes in series, pipes in parallel, equivalent pipe, concept of pipe networks-problems.

UNIT-III **[12 HOURS]**

Flow Through Notches and Weirs: Introduction, Triangular notch, Rectangular notch, Cipolletti notch, Ogee weir and broad crested weir. Problems.

UNIT-IV **[12 HOURS]**

Uniform Flow in Open Channels: Introduction, Geometric properties of Rectangular, Triangular, Trapezoidal channels. Chezy's equation, Manning's equation-problems. Most economical open channels-Rectangular, Triangular, Trapezoidal channel - problems.

REFERENCE BOOKS :

1. 'Text Book of Fluid Mechanics& Hydraulic Machines'-R.K.Bansal, Laxmi Publications, New Delhi, 2008 Edition.
2. 'A Textbook of Fluid mechanics & Hydraulic Machines'- R.K.Rajput, S.Chand&Co, New Delhi,2006 Edition.
3. 'Principles of Fluid Mechanics and Fluid Machines'-N.NarayanaPillai, Universities Press (India), Hyderabad, 2009 Edition.
4. 'Fluid Mechanics and Turbo machines'- Madan Mohan Das, PHI Learning Pvt. Limited, New Delhi. 2009 Edition.

B18CE3050	**Concrete Technology**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Building Materials

Course Objectives:

1. To learn about properties of aggregates , manufacture and tests on concrete To understand about properties of hardened concrete
2. To know the durability of concrete and various admixtures used in concrete.
3. To understand the principles of Concrete mix design.

Course Outcomes:

1. To identify the properties of aggregates and conduct the suitable tests on concrete
2. To assess the properties and Strength of hardened concrete

3. To assess the durability of concrete and suitable admixture to be used in concrete.
4. To carry out economical mix design for required grade of concrete

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3050	CO1	**3**	**2**	**2**	**3**									**3**	**1**	**1**	**2**
	CO2	**3**	**3**	**2**										**3**	**3**	**1**	**1**
	CO3	**3**	**3**	**2**	**1**									**3**	**3**	**1**	**1**
	CO4	**3**	**3**	**3**	**1**									**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Aggregates :Fine Aggregates- Grading, Sieve analysis, Specific gravity, bulking, moisture content,

Coarse Aggregates- Importance of size, shape and texture grading, sieve analysis, specific gravity, flakiness and elongation index, crushing, impact and abrasion test.

Concrete-Introduction and different materials used in concrete, definition of workability of concrete, factors affecting workability, measurements of workability, various tests on fresh concrete, Segregation and Bleeding, Process and manufacture of concrete, curing of concrete.

UNIT-II **[12 HOURS]**

Hardened Concrete: Factors affecting strength, W/C ratio, gel/space ratio, maturity concept, testing of hardened concrete, factors influencing strength test results. Accelerated curing,

Elasticity - Relation between modulus of elasticity and Strength, factors affecting modulus of elasticity, Poisson's Ratio, Shrinkage-types and factors affecting Shrinkage, Creep-Measurement, factors and effect of creep.

UNIT-III **[12 HOURS]**

Durabilityof concrete- 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.

Chemical Admixture- Plasticizers, accelerators, retarders and air entraining agents.

Mineral Admixtures- Flyash, silicafumes, GGBS, and Rice husk ash.

UNIT-IV **[12 HOURS]**

Mix Design of Concrete: Concept of Concrete Mix design, variables in proportioning, exposure conditions, Factors affecting mix design. Selection of Zones of fine aggregates, grading of coarse aggregates, Procedure of mix design as per ACI method, British Code method and IS 10262-2009, Numerical examples of Mix Design based on Indian standards only

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 ,Concrete technology – Theory and practice, S. Chand and Co, New Delhi, 2002.
4. P.G. Varghese ,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. C B Kukreja and Ravi Chawla ,Material Testing Laboratory Manual by, Standard Publishers Distributors, New Delhi.

B18CE3060	Constitution of India and Professional Ethics	L	T	P	C
Duration:16weeks		2	0	0	2

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3060	CO1						2		3				2	-	-	-	-
	CO2								3		3		2	-	-	-	-
	CO3	2					2		3		2		3	-	-	-	-
	CO4	2					2		3				2	-	-	-	-

Course Contents:

UNIT-I **[12 HOURS]**

Constitution of India: 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 Characteristics. Elements of National Significance; National Flag, National Anthem, National Emblem.

UNIT-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

Engineering Ethics: 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, Constitution of India

B18CE3070	**Surveying Practice Lab**	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Applied Surveying

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE	CO1	3	3	2	-	-	-	-	-	2	-	-	3	3	3	3	3

3070	CO2	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**3**	**2**	**-**	**-**	**-**	**-**	**2**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

List of Practical

1. List of Practical

1. Measurements of distances using tape along with horizontal planes and slopes, direct ranging.
2. Setting out perpendiculars. Use of cross staff, optical square. Obstacles in Chaining and Ranging
3. Measurements of bearings / directions using prismatic compass, setting of geometrical figures using prismatic compass.
4. Determination of distance between two inaccessible points using compass and accessories
5. Determination of reduced levels of points using Dumpy level/ Auto level (simple levelling)
6. Determination of reduced levels of points using dumpy level/ auto level (differential levelling and inverted levelling)
7. To determine the difference in elevation between two points using reciprocal levelling and to determine the collimation error.
8. To conduct profile levelling, cross sectioning and block levelling.
9. To determine the tachometric constants and to determine distance and elevation of an object using tachometric methods.
10. To determine distance and elevation using tachometric surveying with horizontal and inclined line of sight.
11. Measurement of horizontal angle by repetition and reiteration methods and measurement of vertical angles using theodolite.
12. Determination of horizontal distance and vertical height to a base inaccessible object using theodolite by single and double plane method.
13. Setting out a simple curve by Rankine's deflection method, offset from chord produced method and long chord method.
14. Setting out a compound curve by Rankine's deflection method.

REFERENCE BOOKS:

1 B. C Punmia, Surveying Vol. 1, Laxmi publications pvt ltd, New Delhi

2 S. K Duggal, Surveying Vol. Tata McGraw Hill Publishing Co. Ltd. New Delhi-2009

3 K. R Arora, Surveying Vol. 1 Standard Book House, New Delhi-2010

B18CE3080	Fluid Mechanics Lab	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Applied physics& Fluid mechanics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3080	CO1	3	3	2	3	3	-	3	-	-	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	3	-	-	-	-	3	3	3	3	3
	CO3	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3
	CO4	3	3	2	2	2	-	2	-	-	-	-	3	3	3	3	3

Course Contents:

List of experiments:

1 1 Calibration of Notches: Triangular (V-Notch), Rectangular and Cipolletti Notch.

2 Calibration of Venturi-meter and Orifice-meter.
3 Calibration of Venturi Flume.
4 Calibration of weirs: Broad crested weir and Ogee weir.
5 Determination of Darcy's friction factor for a straight pipe.
6 Determination of Hydraulic coefficients of a vertical orifice.
7 Determination of vane coefficients for a flat vane, inclined and semi-circular vane.
8 Verification of Bernoulli's equation.
9 Reynolds experiment (Laminar and Turbulent flow)

Performance characteristics of a Centrifugal pump(Demo only)

REFERENCE BOOKS:

1. Fluid Mechanics & Machinery Laboratory Manual Prepared by School of Civil Engineering, REVA University, Bengaluru.
2. R.K.Bansal, Fluid Mechanics & Hydraulic Machines, Laxmi Publication (P) Ltd, New Delhi.
3. R.V.RaikarHydraulics and Hydraulic Machines Laboratory Manual –, PHI Learning Pvt.Ltd.

B18CE3090	**Strength of Materials Testing Lab**	L	T	P	C
Duration: 16weeks		**0**	**0**	**2**	**2**

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 3090	CO1	**3**	**3**	**2**	**1**	**1**	**1**			**1**	**2**	**2**	**2**	**3**	**2**	**2**	**2**
	CO2	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO3	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**
	CO4	**3**	**2**	**1**	**2**	**1**	**2**			**1**	**2**	**3**	**2**	**2**	**3**	**2**	**2**

Course Contents:

List of Experiments:

1. Tests on bricks- Compressive strength and water absorption test
2. Tests on fine aggregates- Sieve analysis, Specific gravity, Bulk density and Bulking test
3. Tests on coarse aggregates-Sieve analysis,Specificgravity,Bulk density and Water absorption test
4. Impact test on mild steel- Izod and Charpy test
5. Hardness test- Brinells Hardness, Rockwells Hardness and Vicker's hardness test
6. Torsion test on mild steel
7. Tension test on mild steel
8. Compression test on mild steel and wood
9. Bending test on wood under one and two point loading
10. Shear test on mild steel- single and double shear

REFERENCE BOOKS:

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

SEMESTER IV

B18CE4010	**Probability and Sampling Theory**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Basics of probability and statistics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Contents:

e Code	COs	1	2	3	4	5	6	7	8	9	10	11	12	O 1	O2	O3	PS O4
B18CE 4010	CO1	3	2	1	2	1	1							3	1	1	1
	CO2	3	2	1	2	1	1							3	1	1	1
	CO3	3	3	2	1	2	1							3	1	1	1
	CO4	3	3	2	2	1	1							3	2	1	1

UNIT-I **[12 HOURS]**

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

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

UNIT-II **[12 HOURS]**

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

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

UNIT-III **[12 HOURS]**

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

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

UNIT-IV **[12 HOURS]**

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

REFERENCE BOOKS:

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

B18CE4020	**Structural Analysis**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Strength of Materials

Course Objectives:

1. To learn the basics of structures and present the concept of moment area method,

conjugate beam method and unit load method to compute slopes and deflections.

2. Present systematic approach for analysing three hinged and two hinged arches.
3. Compute the moments of statically indeterminate structures by consistent deformation method, Clapeyron's theorem of three moments and slope deflection method.
4. Explain and demonstrate the concept involved in the analysis of indeterminate structures by moment distribution method and Kani's method**.**

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4020	CO1	**2**	**3**	**2**	**1**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO2	**3**	**3**	**3**	**2**		**1**	**2**	**1**	**2**	**1**	**1**	**2**	**3**	**3**	**2**	**1**
	CO3	**3**	**3**	**3**	**3**		**1**	**2**	**1**	**2**		**1**	**2**	**3**	**3**	**2**	**1**
	CO4	**3**	**3**	**3**	**3**	**2**	**1**	**3**	**1**	**2**	**2**	**2**	**2**	**3**	**3**	**2**	**1**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Statically determinate and indeterminate structures, determination of degree of static and kinematic indeterminacies of structures.

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

UNIT-II **[12 HOURS]**

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

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

UNIT-III **[12 HOURS]**

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

Slope Deflection Method: Analysis of statically indeterminate beams and rigid-jointed plane frames without side sway. Numerical problems.

UNIT-IV **[12 HOURS]**

Moment Distribution Method:Introduction, Definition of terms, Analysis of beams and rigid jointed plane frames without side sway. Numerical problems.

Kani's Method: Introduction, Analysis of Continuous beams and rigid jointed plane frames without side sway. Numerical problems.

REFERENCE BOOKS

1. DevdasMenon , Structural Analysis,Narosa Book Distributors Pvt Ltd., 2009
2. Reddy C. S , Basic Structural Analysis, Tata McGraw Hill, New Delhi.
3. Pandit and Gupta ,Theory of Structures, Vol. I, Tata McGraw Hill, New Delhi.
4. S. S. Bhavikatti , Structural Analysis-II, Vikas Publishers, New Delhi
6. Norris and Wilbur ,Elementary Structural Analysis, International Student Edition, McGraw Hill Book Co., New York.
7. R C Hibbeler , Structural Analysis , Prentice Hall, New Jersey.
8. B.C. Pumia, R.K. Jain, Strength of Materials and theory of structures Vol I & II, Laxmi Publication New Delhi.

B18CE4030	**Hydrology and Irrigation Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Fluid mechanics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4030	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-I **[12 HOURS]**

Introduction, Precipitation & Abstraction: Hydrologic cycle, Water budget equation, Applications - Precipitation: Forms & Types, Measurement of precipitation(Rain gauges), Rain gauge density, Adequacy of rain gauges, Computations of mean rainfall, Estimation of missing data, Presentation of rainfall data(hyetograph and mass curve).-Evaporation, Transpiration and Infiltration –Process

& influencing factors, Field Measurement (IS Class A Pan, Double ring infiltrometer) – Horton's infiltration equations, Infiltration Indices-Numerical problems

UNIT-II [12 HOURS]

Runoff: Definition, Components, influencing factors, concept of catchment, Rainfall-Runoff relationship –Simple regression analysis-numerical problems

Hydrograph: Definition, Components, Hydrograph separation, Unit hydrograph theory & its Derivation from simple storm hydrograph, Prepositions of unit hydrograph- Numerical problems

UNIT-III [12 HOURS]

Introduction To Irrigation: Necessity, Benefits & ill effects of Irrigation, Systems of Irrigation: Flow & Lift irrigation, Infiltration galleries, Sewage & Supplemental Irrigation, - Methods of irrigation: Surface methods, Sprinkler & Drip Irrigation, Soil-water-plant relationship, soil moisture, Irrigation relationship, frequency of irrigation-Numerical problems.

UNIT-IV [12 HOURS]

Crop Water Requirement & Canal Irrigation: Crop seasons of India, Crop rotation, Duty, Delta, Base period (relationship & numerical problems on reservoir capacity),-Irrigation efficiencies. Assessment of irrigation water.

Types of Irrigation Canals, Alignment of canal, Design of canal: Kennedy's & Lacey's theory-Numerical problems.**REFERENCE BOOKS:**

1. Subramanya.K , Engineering Hydrology ,4th Edition , Tata McgrawHillNewDelhi.
2. Madan Mohan Das, Mim Mohan Das , Hydrology, PHI Learning private Ltd. New Delhi, 2009
3. JayaramiReddy , A Text Book Of Hydrology,Laksmi Publications, New Delhi,2007
4. P.N.Modi , Irrigation, water Resources and water power Engineering, standard book house, New Delhi.
5. Punmia B C ,Irrigation and Water Power Engineering, 16th Edition , Laxmi Publication
6. PatraK.C ,HydrologEy& Water Resources Engineering, Narosa Book Distributors Pvt. Ltd. New Delhi, 2008
7. R.K.Sharma& Sharma, Hydrology & Water Resources Engineering, Oxford and IBH, New Delhi
8. S. K.Garg , Irrigation Engineering and Hydraulic structures, Khanna Publication, New Delhi.

B18CE4040	**Water and Waste Water Engineering**	L	T	P	C
Duration :16 Weeks		2	1	0	3

Prerequisites:

Applied Chemistry, Fluid Mechanics

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4040	CO1	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Water Supply: Need for protected water supply, water demands, design period, population forecasting, Numerical on population forecast, variations in demand of water, Source of water,

Intake structures and types, Sampling, Water quality parameters – Physical, chemical and Microbiological.

Conveyance of Water: Pipe materials (No Design examples), Pipe appurtenances, various valves, systems of water supply.

UNIT-II **[12 HOURS]**

Water Treatment: Objectives of treatment, Sedimentation- types (design example), Coagulation and Flocculation, clariflocculator; Filtration-theory, types, construction, operation and maintenance of filters, Numericals on Design, Disinfection- methods, Miscellaneous treatments - Softening- lime soda process, zeolite process, RO and membrane techniques, Fluoridation and Defluoridation. Methods of layout of distribution systems.

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

Waste Water Treatment: Screening, grit chambers, skimming tanks, primary sedimentation tanks, secondary treatment- Trickling filter – theory and operation, types, Activated sludge process- Principle and flow diagram, Modifications of ASP, Sludge digestion, Septic tank, Oxidation Pond, Disposal of effluents: methods, Sewage farming, Recreational Reuse, Use of Sewage Effluents for Groundwater recharge.

REFERENCE BOOKS:

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

B18CE4050	**Highway Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Surveying

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 make students familiar with design elements: sight distance, horizontal curvature, super elevation, grades, visibility on vertical curves, cross section elements.
4. To make students appreciate the effects of natural phenomena on the components of harbours and ports and the basic aspects of tunnelling.

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: Requirements of drainage systems and design procedures for drains, road arboriculture , Road side development

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE4050	CO1	3	3			2		2	3	2	3		1	3	3	2	3
	CO2	2	3		3	3		3		2	3		3	2	3	2	3
	CO3	2	2		3		2	2		2	2		2	2	2	3	3
	CO4	3	3	3		3	3	3	3	3			3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: 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-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

Highway Materials:-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-IV **[12 HOURS]**

Highway Drainage: Requirements, Surface and Sub-surface drainage system, road construction in water-logged areas. **Road-Side Development:** Environmental and Social issues in Highway development, Road-side development and Arboriculture, Control of soil Erosion

REFERENCE BOOKS

1. Khanna S K, Justo C E G and Veereragavan A, “Highway Engineering”, Nemchand and Bros, Roorkee.
2. Saxena S C and Arora S P, “A Text Book of Railway Engineering”, DhanpatRai Publications Pvt. Ltd. New Delhi.
3. Khanna S K, Arora M G and Jain S S, “Airport Planning and Design”, Nemchand and Bros. Roorkee.
4. Srinivasan R, “Harbour Dock and Tunnel Engineering”, Charotar Publishing House, Anand.
5. William W. Hay, “An Introduction to Transportation Engineering”, Toppan Company Ltd., Tokyo.
6. Relevant IRC codes

B18CE4061	Construction Project Management	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Building Construction

Course Objectives:

1. To study how the owner view a project in consideration with project life cycle, construction agencies legal requirements etc.
2. To study the various types of organization and their impact on and suitability to construction projects.
3. Understand the effect of management for project organization and Control
4. To study the design and construction procedures along with labour material and equipment utilization

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4061	CO1	**3**	**3**		**1**	**3**				**2**	**2**	**3**		**3**	**2**	**1**	**3**
	CO2	**3**	**3**		**1**	**2**				**3**	**2**	**3**		**3**	**2**	**1**	**3**
	CO3	**2**	**3**		**1**	**3**				**2**	**3**	**3**		**3**	**2**	**1**	**3**
	CO4	**3**	**3**		**1**	**1**				**3**	**3**	**3**		**3**	**2**	**1**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Project-Concept of a Project - Characteristic features - Project Life cycle - Phases - Project

Management - tools and techniques for project management - role of project managers. Development of Project Plan and Objectives - Programming - Scheduling - Project Organization - Organization And Project Team - Role Of Communication In Project Management - Controlling Systems

UNIT-II **[12 HOURS]**

Working Systems - Characteristics - Class Of Systems - Design Of Systems - Work Break Down System (WBS) - Project Execution Plan - Project Procedure Manual -Sub Systems Of Project Management- Monitoring Of Projects- Networks - Monitoring Contracts

UNIT-III **[12 HOURS]**

Stages of Project- Project direction - Direction During Production Stage - Value Engineering Review - Stages -Directives - Project Coordination - Procedure - Interface Management – Project Control - Scope For Progress Control - Overall Project Progress Control - Stages - Methods.

UNIT-IV **[12 HOURS]**

Labour and Equipment Utilization-Labour Productivity-Factors Affecting Job-Site Productivity - Labour Relations in construction-Problems in collective bargaining-Construction Equipment – Choice of Equipment and Standard production Rates-Construction Processes Queues and Resource Bottlenecks

REFERENCE BOOKS

1. Prasanna Chandra " Project Planning, Analysis, Selection, Implementation and review"
2. Tata Mcgraw Hill ,1999
3. Chitkara, K.K, “Construction Project Management: Planning Scheduling and control” Tata McGraw-Hill Publishing Company, New Delhi- 1998

4 Frederick E. Gould, “Construction Project Management” Went worth Institute ofTechnology,Vary E. Joyce, Massachusetts Institute of Technology, 2000

5. Choudhury, S. “Project Management” Tata McGraw-Hill Publishing company New Delhi1988
6. Sengutha, B., Guha,H., " Construction Management and Planning ", Tata Mc GrawHill, 2001

B18CE4062	**Rural Infrastructure Development**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

High Way Engineering

Course Objectives:

1.To enable the students to understand nature of Rural Infrastructure

2.To make familiar the students about development process & Rural Infrastructure

3. To enable the students to understand Rural Communication

Course Outcomes:

1.To understand nature of Rural Infrastructure

2.To get the knowledge about development process & Rural Infrastructure

3. To learn and understand Rural Communication.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4062	CO1	**3**											**3**	**3**	3		**3**
	CO2	**3**	3		**2**								**3**	**3**			**3**
	CO3	**3**	**3**	**3**	**3**								**3**	**3**			**3**

Course Contents:

UNIT-I **[12 HOURS]**

Rural Infrastructure: Definition, Components -Importance of Rural infrastructure, Growth of Rural Infrastructure – Infrastructure Policy- Rural Infrastructure Development Fund (RIDF).

UNIT-II **[12 HOURS]**

Rural Transportation: Types and Structure - Road and Rail Co- ordination - Rural transportation problems - Various Schemes for Rural Roads Development of India/PMGSY.

UNIT-III **[12 HOURS]**

Social Infrastructure: Concept -Components of Social Infrastructure, Education, Health, Drinking Water - Sanitations -Issues, problems and Remedies, smart villages.

UNIT-IV **[12 HOURS]**

Rural Communication and Information Communication Technology: Need, Sources, technology and Rural Communication, Issues and problems - Government policies for rural Communication.

Rural Energy: Meaning and types - Sources of rural energy, Rural electrification Problems, Remedies and Programmes - Non-Renewable Energy.

REFERENCE BOOKS

1. Dutta and Sundaram- Indian Economy, S.Chand Publications, New Delhi, 2013-07-02 2. VasantDesai: Rural Development in India, Himalaya Publishing House, Mumbai, 2012.
2. Mishra S.K. and Puri V.K. - Economics of Development and Planning, Himalaya Publishing House, Mumbai, 2012
3. SukhadeoThorat, SamitaSirohi- Rural Infrastracture, volume 4.
4. A.N Agarwal-Indian economy, Vikas pub. House, Delhi.
5. P Adinarayana Reddy-Rural infrastructure and development.

B18CE4063	**Alternative Building materials**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4063	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:

UNIT-I [12 HOURS]

Introduction: Energy building materials, environmental issues concerned to building materials, environmental friendly and cost effective building technologies, requirements for building of different climatic regions.

Alternative Building Materials: Characteristics of building blocks for walls, stones and laterite blocks, bricks and hollow clay blocks, concrete blocks.

UNIT-II [12 HOURS]

Lime- Pozzolana Cements:

Raw materials, manufacturing process, properties and uses. Fiber reinforced concrete- materials, properties and application, Fiber reinforced plastic- material, properties and uses. Building materials from agro and industrial waste and its types, with properties and application.

UNIT-III [12 HOURS]

Structural Masonry:Factors affecting compressive strength, effect of Brick work bond on strength, bond strength of masonry (flexure and shear), elastic properties of masonry materials and masonry.

Equipment's: Machines for manufacture of concrete. Equipment for production of stabilized blocks. Moulds and methods of production of precast elements.

UNIT-IV [12 HOURS]

Alternative Building Technology And Cost Effective Building Design:

Building Technology:Alternative for wall construction, its types and construction method, Masonry mortars, its types, preparations and properties. Ferro cement components, materials, properties and construction method, Alternative roofing systems, filler slabs.

Building Design:Cost concept in buildings, cost saving techniques in planning, design and construction. Cost analysis with Case studies using alternatives

REFERENCE BOOKS

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

B18CE4064	Advanced Surveying	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Applied Surveying

Course Objectives:

1. Have an overview of the advanced surveying techniques and modern surveying equipment.
2. Use the concepts of advanced data capturing methods.
3. Analyse spatial data using appropriate computational and analytical techniques.

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4064	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**

Course Contents:

UNIT-I [12 HOURS]

Introduction: General requirements and specifications for engineering project surveys, reconnaissance, preliminary and location surveys, advanced surveying instruments – digital levels, digital theodolites, electronic distance measurements, total stations – principles, features and applications.

UNIT-II [12 HOURS]

Hydrographic Survey: Tides, tide gauges, shoreline survey, soundings, sounding equipment, locating soundings, plotting of soundings, stream measurements.

Aerial Photogrammetry: Introduction and principle, aerial camera, aerial photographs, terms and definitions used, scale of vertical and tilted aerial photographs, ground control techniques.

UNIT-III [12 HOURS]

Remote Sensing: Definition and concept, ideal remote sensing system, stages involved in remote sensing, classifications, electromagnetic energy and electromagnetic radiation spectrum, concept of signatures, remote sensing sensors and platforms, data acquisition and interpretation, concept of resolution, applications of remote sensing.

GPS: Definition and concept, components of GPS, satellite constellations, operational control segment and user equipment segment, relative and differential GPS, factors affecting GPS, applications of GPS.

UNIT-IV [12 HOURS]

Geographical Information System (GIS): Definition and concept, components of GIS, data for GIS, data structures in GIS, concept of layers, capabilities and functionalities of GIS, applications of GIS.

Field Astronomy: Conceptual overview, purpose and instruments used, astronomical terms and definitions.

REFERENCE BOOKS

1. B C Punmia, “Surveying Vol.2”, Laxmi Publications Pvt. Ltd., New Delhi.
2. S K Duggal, “Surveying Vol.2”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. B Bhatia, “Remote Sensing and GIS”, Oxford University Press, New Delhi.
4. SateeshGopi, “Global Positioning System”, Tata McGraw Hill Publishing Co. Ltd., New Delhi.
5. T M Lillesand, R W Kiefer and J W Chipman, “Remote Sensing and Image Interpretation”, 5th Edition, John Wiley and Sons, India.

B18CE4070	Environmental Engineering Lab	L	T	P	C
Duration16 Weeks		0	0	2	2

Prerequisites:

Theoretical Concept of Environmental Engineering

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4070	CO1	3	3	3	3	3							3	3	3	3	3
	Co2	3	3	3	3	3							3	3	3	3	3
	Co3	3	3	3	3	3		3					3	3	3	3	3
	CO4	3	3	3	3	3		3					3	3	3	3	3

Course Contents:

Laboratory Experiments

1. Determination of Alkalinity, Acidity, pH
2. Determination of Electrical Conductivity and Turbidity
3. Jar test for Optimum Dosage of Alum
4. Determination of Fluoride
5. Determination of Chlorides
6. Determination of Hardness
7. Determination of Residual Chlorine
8. Determination of percentage of available Chlorine in Bleaching Powder
9. Determination of DO and Biochemical Oxygen Demand (BOD) of Wastewater
10. Determination of Total Solids, Suspended Solids, Dissolved Solids, and Settleable Solids.
11. Determination of Sulphates
12. Determination of iron by Phenanthroline method.
13. MPN determination
14. Determination of nitrates
15. Determination of heavy metals-Lead, Cadmium and Zinc.

REFERENCE BOOKS:

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

B18CE4080	**Building Drawing With sketch book and Through CAAD**	L	T	P	C
Duration: 16weeks		0	0	2	2

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 4080	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-I **[12 HOURS]**

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

UNIT-II **[12 HOURS]**

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-III **[12 HOURS]**

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-IV **[12 HOURS]**

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.

REFERENCE BOOKS:

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

SEMESTER V

B18CE5010	Design of RC Structural Elements	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Concrete Technology and Alternative Building Materials basic Structural Analysis

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5010	CO1	3	2		3		2	2					2	3	1		
	CO2	3	3	3	2	3	2	2	2	1	2	1	2	3	3	3	3
	CO3	3	3	3	2	3	2	2	2	1	2	1	2	3	3	3	3
	CO4	3	3	3	2	3	2	2	2	1	2	1	2	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

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

UNIT-II [12 HOURS]

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

UNIT-III [12 HOURS]

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

UNIT-IV [12 HOURS]

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

REFERENCE BOOKS:

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

B18CE5020	Basic Geotechnical Engineering	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5020	CO1	3	3	1	3	2	2	1			2			3	3	3	2
	CO2	3	2	1	3		2	1			2			3	3	3	2
	CO3	3	2	3	3		2	1			2			3	3	3	1
	CO4	3	2	3	3		2	1			2			3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

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

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

UNIT-II **[12 HOURS]**

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

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

UNIT-III **[12 HOURS]**

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

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

UNIT-IV **[12 HOURS]**

Effective Stress: Introduction – stresses in soil – concept of effective and neutral stresses

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.

REFERENCES BOOKS:

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

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

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

4. Braja, M. Das (2002), ,Geotechnical Engineering; , Fifth Edition, Thomson Business Information India (P) Ltd., India

5. Bowles J.E ,Foundation Analysis and Design, 5th Edition,McGraw Hill Pub. Co. New York, 1996

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

7. GopalRanjan and Rao A.S.R. ,Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi., 2000 8. Geotechnical Engineering- Donold P Coduto Phi Learning Private Limited, New Delhi
9. Shashi K. Gulathi& Manoj Datta ,Geotechnical Engineering,TataMcGraw Hill. 2009
10. Iqbal H. Khan ,Text Book of Geotechnical Engineering, 2nd Edition, PHI, India, 2005
11. NarasimhaRao A. V. &VenkatrahmaiahC. ,Numerical Problems, Examples and objective questions in Geotechnical Engineering- (2000), Universities Press., Hyderabad.
12. 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.
13. Lambe T.W., Soil Testing for Engineers, Wiley Eastern Ltd., New Delhi.
14.Head K.H ,Manual of Soil Laboratory Testing, Vol. I, II, III, Princeton Press, London, 1986
15. Bowles J.E Engineering Properties of Soil and Their Measurements, McGraw Hill Book Co. New York, 1988

B18CE5030	Railways, Airways, Waterways & Tunnel	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

AppliedSurveying.

Course Objectives:

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

Course Outcomes:

1. Outline the importance of transportation, Describe the characteristics of rail transportation and the requirements of the components, compute the geometric features of railway tracks

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5030	**CO1**	3	3	1	3	2	2	1			2			3	3	3	2
	CO2	3	2	1	3		2	1			2			3	3	3	2
	CO3	3	2	3	3		2	1			2			3	3	3	1
	CO4	3	2	3	3		2	1			2			3	3	3	2

Course Contents:

UNIT-I [12 HOURS]

Railway: Comparison of various modes of transportation, permanent way-functions, requirements, gauges and types, comparison of gauges, typical cross sections of railway track, Coning of wheels and tilting of rails, hauling capacity of locomotives. Rails-Types-Requirements-Functions-Rail Length-Rail Joints-Creep Of Rails.Sleepers-Functions-Requirements.Ballast-Requirements-Functions-Types.

Geometric Design of Railways-gradients-types and grade compensation on curves, speed of trains, super elevation, points and crossings, quantity of material/km length.

UNIT-II [12 HOURS]

Airways: Airport classification, Layout of an airport and components, aircraft characteristics affecting planning and design of airports, site selection, Runway-orientation of runway, wind rose diagram, basic runway length and corrected runway length, Taxiways-taxiways and exit taxiways, runway and taxiway markings, lighting, air traffic control, ILS - numerical examples.

UNIT-III **[12 HOURS]**

Waterways: Classification of harbours, layout of harbours, component parts, effects of natural phenomena on harbour structures, breakwaters-types, wharf and jetties and piers, dry dock and wet dock, warehouse, navigational aids.

UNIT-IV **[12 HOURS]**

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

REFERENCE BOOKS:

1. Khanna S.K and Justo C.E.G, "Highway Engineering", Nemchand and Bros, Roorkee.
2. Saxena S C and Arora S P, "A Text Book of Railway Engineering", DhanpatRai Publications Pvt. Ltd. New Delhi.
3. Khanna S K, Arora M G and Jain S S, "Airport Planning and Design", Nemchand and Bros. Roorkee.
4. Srinivasan R, "Harbour Dock and Tunnel Engineering", Charotar Publishing House, Anand.
5. SatishChandra and Agarwal M M, "Railway Engineering", Oxford University Press, New Delhi.
6. Horonjeff, "Planning and Design of Airports", McGraw Hill Publications, New Delhi.
7. William W. Hay, "An Introduction to Transportation Engineering", Toppan Company Ltd., Tokyo.
8. BC Punmia"surveying"Laxmi publications.
9. Railway engineering-Mundrey, McGraw Hill Publications

B18CE5041	**Advanced Structural Analysis**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Strength of Materials, Structural Analysis.

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5041	CO1	3	3	1		2	2	1					2	3	3		2
	CO2	3	3	1										3	3		
	CO3	3	3	1		3	2						2	3	3		3
	CO4	3	3	1		3	2						2	3	3		3

Course Contents:

UNIT-I [12 HOURS]

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

UNIT-II [12 HOURS]

Plastic Analysis of Structures: Beams in pure bending, Plastic moment of resistance, Plastic modulus, Shape factor, Load factor, Plastic hinge and mechanism, Plastic analysis of indeterminate beams and frames, Aspects. Inspection, Assessment procedure for evaluating a damaged structure

UNIT-III [12 HOURS]

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

UNIT-IV [12 HOURS]

Flexibility Matrix Method of Analysis:

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

REFERENCE BOOKS:

1. RangawalaP.C. ,Engineering Materials, Charter Publishing House, Anand, India.
2. Sushil Kumar, Engineering Materials, Standard Publication and Distributors, New Delhi.
3. M.S. Shetty ,Concrete technology – Theory and practice, S. Chand and Co, 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. Neville A.M and Brooks J.J ,Concrete Technology , ELBS Edition, London
7. Gambhir M.L , Concrete Technology, DhanpatRai and Sons, New Delhi.

B18CE5042	**Traffic Analysis and Design**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Highway Engineering

Course Objectives:

1. Provide an insight on various elements of traffic engineering
2. To explain the various traffic studies
3. Illustrate the application and functions traffic control devices
4. Various grade separated intersections

Course Outcomes:

1. Describe various elements of traffic engineering
2. Explain the various traffic studies
3. Illustrate the application and functions traffic control devices
4. Classify the different grade separated intersections

Mapping of Course Outcomes with programme Outcomes

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

Code														1			
B18CE 5042	CO1	3					3		2		2		2	3			1
	CO2	3	3			2		2	2	3	3	1		3	3		1
	CO3	3	3		2	2	3	1		3	1	2		3	3	1	2
	CO4	3	3		2	2	1	2	3		3		2	3			2

Course Contents:

UNIT-I **[12 HOURS]**

Elements of Traffic Engineering: Road user, vehicle and road way. Vehicle characteristics - IRC standards - Design speed, volume. Highway capacity and levels of service - PCU concept and its limitations - Road user facilities - Parking facilities - Cycle tracks and cycle ways - Pedestrian facilities.

UNIT-II **[12 HOURS]**

Traffic Studies:Traffic volume studies, origin destination studies, speed studies. Elements of design - Alignment - Cross sectional elements - Sight distance. Horizontal curves - Vertical curves. Design problems

UNIT-III **[12 HOURS]**

Traffic Regulation and Control: Signs and markings - Traffic System Management – Channelization - Traffic signals - pre-timed and traffic actuated. Design of signal setting - phase diagrams, timing diagram – Signal co-ordination.

UNIT-IV **[12 HOURS]**

Grade Separated Intersections: Geometric elements for divided and access controlled highways and expressways – Road furniture - Street lighting. Traffic Safety – Principles and Practices – Road Safety Audit.

REFERENCE BOOKS:

1. ITS Hand book 1998, safety and comfort for society in the 21stcentury, Japan
2. AASHTO A Policy on Geometric Design of Highway and Streets
3. R. J. Salter and N. B. Hounsel, Highway Traffic Analysis and Design, Macmillan Press Ltd, 1996.

B18CE5043	Industrial Waste Water Treatment	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

water supply and Sanitation Engineering, Hydraulic machines

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5043	CO1	3	3	2	3	3							3	3	3	3	3
	CO2	3	3	2	3	2							3	3	3	3	3
	CO3	3	3	2	1	2		2					3	3	3	3	3
	CO4	3	3	1	2	2		2					3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Difference between Domestic and Industrial Wastewater, Effect on Streams and on Municipal Sewage Treatment Plants. Stream Sampling, Effluent and Stream Standards and Legislation to Control Water Pollution. Stream Quality, Dissolved oxygen Sag Curve in Stream, Streeter– Phelps formulation, Numerical Problems on DO prediction

UNIT-II [12 HOURS]

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

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

UNIT-III [12 HOURS]

Combined Treatment: Feasibility of combined Treatment of Industrial Raw Waste with Domestic Waste, Discharge of Raw, Partially Treated and completely treated Wastes to Streams. Treatment Of Selected Industrial Waste-I: Process flow sheet showing origin / sources of waste water, characteristics of waste, alternative treatment methods, disposal, reuse and recovery along with flow sheet. Effect of wastewater disposal on water bodies.

The Industries to be Covered are:

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

UNIT-IV [12 HOURS]

Treatment Of Selected Industrial Waste-II:

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. Patwardhan A.D., “Industrial Wastewater Treatment”, PHI Learning Private Ltd., New Delhi, 2009
4. Mahajan S.P., “Pollution Control Processes in industries”, Tata McGraw Hill Publications, 2004

B18CE5044	Remote Sensing and GIS	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

water supply and Sanitation Engineering, Hydraulic machines

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5044	CO1	3	1	1	2	3				2			3	3	3	3	3
	CO2	3	3	2	3	2				2			3	3	3	3	3
	CO3	3	3	2	1					1			3	3	3	3	3
	CO4	3	3	1	2	3	2	3		2			3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

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

UNIT-II **[12 HOURS]**

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

UNIT-III **[12 HOURS]**

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

UNIT-IV **[12 HOURS]**

Applications In Civil Engineering: Applications of Aerial Photography and Satellite Imageries in Highway and Railway Alignment- terminals and roadside facilities – Accident analysis –. GIS as an integration technology – Integration of GIS, GPS and Remote Sensing Techniques –ATIS –AVLS – applications in other streams of civil engineering.

REFERENCE BOOKS:

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

B18CE5051	**Structural Dynamics and Seismic Analysis**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Structural Analysis

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 5051	CO1	2	3	1										2	3		
	CO2		2	2										3		1	2
	CO3	1	2					1						2		1	
	CO4	1	2	1										2			1

Course Contents:

UNIT-I [12 HOURS]

Introduction To Structural Dynamics: Introduction to dynamic problems in Civil Engineering, concept of degrees of freedom, D'Alembert's principle, principle of virtual displacement and energy principles, dynamics of single degree of freedom systems: Mathematical models of single degree of freedom systems, free vibration response of damped and undamped systems, methods of evaluation of damping.

UNIT-II [12 HOURS]

Single Degree Of Freedom Systems: Response of single degree of freedom systems to harmonic loading (rotation unbalance, reciprocating unbalance) including support motion, vibration isolation, transmissibility, numerical methods applied to single degree of freedom systems – Duhamel integral, principle of vibration-measuring instruments – seismometer and accelerometer.

UNIT-III **[12 HOURS]**

Engineering Seismology: Introduction to engineering seismology, geological and tectonic features of India, origin and propagation of seismic waves, characteristics of earthquake and its quantification – Magnitude and Intensity scales, seismic instruments, earthquake risk evaluation and mitigation, structural behaviour under gravity and seismic loads, lateral load resisting structural systems, requirements of efficient earthquake resistant structural system, damping devises, base isolation systems.

UNIT-IV **[12 HOURS]**

Seismic Resistant Design: Structural configuration for seismic resistant design, Concept of plan irregularities and vertical irregularities, soft storey, torsion in buildings, design provisions for these in IS-1893:2016, effect of infill masonry walls on frames, modelling concepts of infill masonry walls, behaviour of masonry buildings during earthquakes, failure patterns, strength of masonry in shear and flexure, slenderness concept of masonry walls, concepts for earthquake resistant masonry buildings – codal provisions.

REFERENCE BOOKS:

1. Anil K. Chopra, ,Dynamics of Structures – Theory and Application to Earthquake Engineering, 3rd Edition, Pearson Education.
2. M. Mukhopadhaya ,Vibrations, Structural Dynamics , Oxford IBH.
3. Mario Paz , Structural Dynamics , CBS publishers.
4. PankajAgarwal, Manish Shrikande ,Earthquake Resistant Design of Structures , PHI India.
5. Earthquake Resistant Design of Structures - Duggal, Oxford University Press.

B18CE5052	**Rural Water Supply and Sanitation**	L	T	P	C
Duration :16 Weeks		2	1	0	3

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. Categorize the different types of water borne diseases and Water treatment methods to control contamination of water.
2. Explain the overall management of rural sanitation and apply the principles of rain water harvesting.
3. Recognize the communicable diseases and Examine the management of solid waste collection, disposal.
4. Explain the Milk Sanitation principal and insects control measures.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O	PS O2	PS O3	PS O4
B18CE 5052	CO1	3	3	2	3	3				2			3	3	3	3	3
	CO2	3	3	2	3	2				2			3	3	3	3	3
	CO3	3	3	2	1	2		2		2			3	3	3	3	3
	CO4	3	3	1	2	2		2		2			3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Need for a protected water supply, Investigation and selection of water sources, water borne diseases, Protection of well waters, drinking water quality standards.

Types Of Pumps, Supply systems viz., BWS,MWS,PWS, water treatment methods-disinfection, deflouridation, hardness and iron removal, ground water contamination and removal.

UNIT-II **[12 HOURS]**

Rural Sanitation:

Conservancy, public latrine, concept of eco-sanitation, trenching and composing methods, two pit latrines, aqua privy, W.C, septic tank, soak pit,

Drainage Systems: Storm water and sullage disposal, rain water harvesting and uses.

UNIT-III **[12 HOURS]**

Communicable Diseases: Terminology, Classifications, Methods of communication, general methods of control.

Refuse Collection And Disposal: Garbage, ash, rubbish, collection methods, transportation and disposal-salvaging, dumping, controlled tipping, incineration and composting, dung disposal-digester, biogas plant.

UNIT-IV **[12 HOURS]**

Milk Sanitation: Essentials, test for milk quality, pasteurization, quality control, cattle borne diseases, planning for a cow shed.

Insect Control: House fly and mosquito-life cycle, diseases, transmission and control measures

REFERENCE BOOKS:

1. S.K.Garg , Water supply Engineering, Khanna Publishers
2. B C Punima and Ashok Jain, Environmental Engineering I
3. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G ,Environmental Engineering , McGraw Hill Book Co., 1986
4. B C Punima and Ashok Jain ,Wastewater Engineering, Lakshmi Publishers
5. Tchobanoglous: Integrated Solid Waste Management: M/c Graw Hill.
6. Manual on Water supply and treatment –CPHEEO, Ministry of Urban Development, New Delhi
7. Hammer, M.J., (1986), Water and Wastewater Technology –SI Version, 2nd Edition, John Wiley and Sons.
8. Karia, G.L., and Christian, R.A., (2006), Wastewater Treatment – Concepts and Design Approach, Prentice Hall of India Pvt. Ltd., New Delhi.
9. Sincero, A.P., and Sincero, G.A., (1999), Environmental Engineering – A Design Approach– Prentice Hall of India Pvt. Ltd., New Delhi.
10. E.W.Steel,Mc Ghee, Terence -'Water Supply Engineering and Sewerage; Mc.Graw Hill
11. E.W.Steel,Mc Ghee, Terence -'Water Supply Engineering and Sewerage; Mc.Graw Hill
12. Fair, Geyer and Okun-'Water and Wastewater Engineering: Water Supply and Wastewater Removal, 3rd Edition, John Wiley and Sons.
13. Metcalf and Eddy: 'Waste Water Treatment, Disposal and Reuse'; Tata McGraw Hill Publications.

B18CE5053	**Water Resource Systems and Management**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Hydrology & Irrigation Engineering

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	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
B18CE 5053	CO1	2	1	2	1								2	3	3	2	1
	CO2	3	1	1	2								2	3	3	2	1
	CO3	3	1	1	3								2	3	3	2	1
	CO4	3	1	2	3	2							2	3	3	2	1

Course Contents:

UNIT-I **[12 HOURS]**

Hydrologic Process & Surface Runoff : Hydrological cycle (Horton's Cycle), World Water Balance, Surface water resources of India, Rainfall-Runoff estimation – Empirical equations (Inglis &Desouza formula, Khosla's Formula)- SCS-CN method of estimation,(Numerical problems), Droughts & its management

UNIT-II **[12 HOURS]**

Watershed Management: Concept of watershed, Watershed Management - objectives and priorities, Soil and Water – Issues related to plant life, Soil erosion – problem, types; Soil

conservation, control measures in agricultural and non- agricultural land. Water-conservation and rain water-Harvesting, Use of Remote sensing and GIS in water shed management.

UNIT-III **[12 HOURS]**

Flood & Flood Routing: Definition of flood, factors affecting flood, methods of estimation (envelope curves, empirical formulae, rational method).Flood plain management,

Flood routing: Introduction to hydrological routing, Muskingum routing method-Numerical problems.

UNIT-IV **[12 HOURS]**

Storm Water Management: Storm water management objectives and limitations, Storm systems (theory only) Storm detention: effects of urbanisation, types of surface detention, subsurface disposal of storm water, artificial recharge techniques.

REFERENCE BOOKS:

1. Subramanya.K ,Engineering Hydrology , 4th Edition., McgrawHillNewDelhi
2. SathyaNarayana Murthy Challa , Water resources engineering, New Age International Publishers, New Delhi, 2002
3. Ralph A Wurbs, Wesley P. James ,Water resources engineering,PHILearningpvt. Ltd., New Delhi ,2009
4. J V S Murty , Watershed Management, New Age International Publishers, New Delhi,1998
5. PatraK.C., Hydrology & Water Resources Engineering- Narosa Book Distributors Pvt. Ltd. New Delhi, 2008
6. Chin D.A , Water resources engineering, Prentice Hall ,2009
7. Larry W. Mays , Water resources engineering, John Wiley & sons ,2005
8. Overtens D.E. and Meadows M.E., Storm Water Modelling, Academic Press, New York, 1976.

B18CE5054	**Construction Planning and Equipment**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Building Materials and Building Construction

Course Objectives:

1. The elements of construction planning and implication

2. The making of construction schedule and calculate the time schedule and cost of equipment's
3. The Capacity of construction equipment can be used for construction and the production capacity of the plants producing aggregates
4. The type of the equipment for different works and determine the performance of the equipment's

Course Outcomes:

1. Prepare a suitable construction planning for particular project
2. Estimate and find the cost of hiring equipment for construction activity
3. Identify the suitable equipment's required for the work
4. To know the power requirements and output of the equipment's.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5054	CO1	3	3	3	2		1			2	2	3	2	3	2	2	3
	CO2	2	3	3	2		1			3	3		3	3	2	2	3
	CO3	3	2	3	2		1			3	3		2	3	2	2	3
	CO4	3	2	3			2			2	2		3	3	2	2	3

Course Contents:

UNIT-I [12 HOURS]

Construction Planning: Basic Concepts in the Development of Construction Plans-Choice of Technology and Construction Method- Defining Work Tasks-Definition-Defining Precedence relationships among activities-Estimating Activity Durations-Estimating Resource Requirements for work activities-coding systems.

UNIT-II [12 HOURS]

Relevance Of Construction Schedules-The Critical Path Method-Activity Float And Schedules-Critical Path Scheduling For Activity-On-Node and With Leads, Lags and Windows-Numerical Problems

Fundamental Concepts of Equipment Economics-Evaluation, ownership cost, operation cost, Rent and lease considerations, Equipment records, cost for bidding, replacement, Equipment planning.

UNIT-III [12 HOURS]

Equipment for Excavation and Compaction of Soils-Types of Excavation, Compaction and stabilization equipment, Selection of equipment, Cost consideration, Finishing Equipment's.

Equipment for Pavement Material Production– Aggregate production unit, Crushers, Crushing equipment selection, Safety. Asphalt mix production plant and process. Concrete mix production plant.

UNIT-IV **[12 HOURS]**

Equipment for Placing and Hauling-Trucks and Hauling Equipment's, production calculation, Production issues and safety.

Special Construction Operations and Equipment's- Drilling Equipment's, Dozers, Graders, Scrapers, Blasting operation.

REFERENCE BOOKS:

1. Peurifoy, R.L., Ledbetter, W.B.andSchexnayder, C "Construction Planning, Equipment and Methods"- McGraw - Hill Higher Education
2. Sharma S.C. "Construction Equipment and its Management"- Khanna Publishers, New Delhi
3. K.K. Chitkara, "Construction Project Management,-Planning, Scheduling and Controlling"- Tata McGraw –Hill Publications
4. Mahesh Varma ,"Construction Equipment and its Planning and Applications", , Metropolitan Book Co.(P) Ltd., New Delhi. India.
5. Srinath L.S, "PERT and CPM", East West Press Pvt Ltd New Delhi.
6. Construction Machinery and Equipment in India". A compilation of articles Published in Civil Engineering and Construction Review, New Delhi,
7. Operation Manuals of relevant equipment.

B18CE5061	**Hydraulic Machines**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Fluid Mechanics

Course Objectives:

1. Impulse momentum equation and its applications related to Impact of jet on vanes-Flat and Curved – Stationary and moving, Concept of velocity triangles, Work done and efficiency related problems.
2. Introduction to turbines, Classifications, theory, equation for work done and efficiency, design parameters related Pelton, Francis and Kaplan.
3. To learn about performance evaluation of turbines, water hammer in pipes and its estimation.
4. Centrifugal pump, definition, description and general principal of working and related problems.

Course Outcomes:

1. Impulse momentum equation and its applications and learn how to find the magnitude and direction of force excreted by a jet of water on fixed and moving vane and also on a series of flat and curved vanes
2. Determination of work done and efficiency of various types of turbines.
3. How to evaluate the performance of various types of turbines (Impulse and Reaction turbines).
4. Designing and performance evaluation of Centrifugal pumps.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5061	CO1	3	3	2	3	3		3					3	3	3	3	3
	CO2	3	3	2	3	2		3					3	3	3	3	3
	CO3	3	3	2	2	2		2					3	3	3	3	3
	CO4	3	3	2	2	2		2					3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

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-II **[12 HOURS]**

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

Kaplan Turbine-Theory, equation for the work done and efficiency, design parameters, problems. Components, Working and Velocity triangles, Properties of the Turbine, Discharge of the Turbines, Number of Blades-numerical examples.

UNIT-III **[12 HOURS]**

Performance of Turbines: Draft tubes types, equation for efficiency. Cavitations in turbines, governing of turbines. Specific speed of a turbine, Equation for the specific speed (No numerical 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 (No numerical examples).

UNIT-IV **[12 HOURS]**

Centrifugal Pumps

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

REFERENCE BOOKS:

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

4. Robert w. Fox: Philip j. Pritchard: Alan t. McDonald, ,'Introduction to Fluid Mechanics' –Wiley India, New Delhi, 2009 Edition.

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

6. Dr. P.N. Modi&Dr S.M. Seth, ,'Hydraulics and Fluid Mrchanics' –Standard Book House-New Delhi. 2009 Edition

B18CE5062	Occupational Safety and Health Hazards	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Knowledge of Civil Engineering in Building Construction.

Course Objectives:

1. Gain an historical, economic, and organizational perspective of occupational safety and health;
2. Investigate current occupational safety and health problems and solutions.
3. Identify the forces that influence occupational safety and health.
4. Demonstrate the knowledge and skills needed to identify workplace problems and safe work practice

Course Outcomes:

1. Identify hazards in the workplace that pose a danger or threat to their safety or health, or that of others.
2. Control unsafe or unhealthy hazards and propose methods to eliminate the hazard.
3. Discuss the role of health and safety in the workplace pertaining to the responsibilities of workers, managers, supervisors.
4. Identify the decisions required to maintain protection of the environment, workplace as well as personal health and safety.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5062	CO1	3	3	1	3	3		3					3	3	3	3	3
	CO2	3	3	2	2	3		3					3	3	3	3	3
	CO3	2	3	2	2	3		3					3	3	3	3	3
	CO4	2	3	2	3	2		3					3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Occupational Hazard and Control Principles: Safety, History and development, National Safety Policy. Occupational safety and Health Act (OSHA), Occupational Health and Safety administration - Laws governing OSHA and right to know. Accident – causation, investigation, investigation plan, Methods of acquiring accident facts, Supervisory role in accident investigation

UNIT-II **[12 HOURS]**

Fire Prevention and Protection: Fire Triangle, Fire Development and its severity, Effect of Enclosures, early detection of Fire, Classification of fire and Fire Extinguishers.

Electrical Safety, Product Safety: Technical Requirements of Product safety

UNIT-III **[12 HOURS]**

Health Considerations at Work Place: types of diseases and their spread, Health Emergency. Personal Protective Equipment (PPE) – types and advantages, effects of exposure and treatment for engineering industries, municipal solid waste. Environment management plans (EMP) for safety and sustainability

UNIT-IV **[12 HOURS]**

Occupational Health and Safety Considerations: Water and wastewater treatment plants, Handling of chemical and safety measures in water and wastewater treatment plants and labs, Construction material manufacturing industries like cement plants, RMC Plants, precast plants and construction sites. Policies, roles and responsibilities of workers, managers and supervisors

REFERENCE BOOKS

1. Goetsch D.L., “Occupational Safety and Health for Technologists”, Engineers and Managers”, Prentice Hall.
2. Heinrich H.W., “Industrial Accident Prevention”, McGraw Hill Publication ,Newyork.
3. Colling D.A., “Industrial Safety Management and Technology”, Prentice Hall, New Jersey.
4. Della D.E., and Giustina, “Safety and Environmental Management”, Van Nostrand Reinhold International Thomson Publishing Inc.
5. CPHEEO, Manual on Sewerage and Sewage Treatment, M/s.Jain Book Agency, c-9, Connaught place, New Delhi.
6. National Safety Council and Associate (Data) Publishers Pvt. Ltd., “Industrial Safety and Pollution Control Handbook”

B18CE5063	Renewable Energy	L	T	P	C
Duration: 16weeks		2	1	0	4

Prerequisites:

Basics of Physics

Course Objectives:

1. Provide an insight on various renewable energy in use.
2. To explain the solar energy application
3. Illustrate the functions of wind energy
4. Discuss bio energy and various other renewable energy.

Course Outcomes:

1. Identify the new methodologies / technologies for effective utilization of renewable energy sources.
2. Explain the solar energy application
3. Illustrate the functions of wind energy
4. Classify the different renewable energy.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5063	**CO1**	**3**	**2**				**2**	**3**					**2**	**3**	**1**	**3**	**3**
	CO2	**3**	**2**				**2**	**3**	**1**				**2**	**3**	**1**	**3**	**3**
	CO3	**3**	**2**			**1**	**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**
	CO4	**3**	**2**				**2**	**3**	**1**	**2**		**2**	**2**	**3**	**1**	**3**	**3**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: World Energy Use – Reserves of Energy Resources – Environmental Aspects of Energy Utilisation – Renewable Energy Scenario India and around the World – Potentials –

Achievements / Applications – Economics of renewable energy systems. Comparison of these energy sources.

UNIT-II [12 HOURS]

Solar Energy: Definition, Energy available from Sun, Solar radiation data solar energy conversion into heat, Radiation – Measurements of Solar Radiation – Flat Plate and Concentrating Collectors – Solar direct Thermal Applications – Solar thermal Power Generation – Fundamentals of Solar Photo Voltaic Conversion – Solar Cells – Solar PV Power Generation – Solar PV Applications.

UNIT-III [12 HOURS]

Wind Energy: Energy available from wind, General formula, Wind Data and Energy Estimation – Types of Wind Energy Systems – Performance – Site Selection, characteristics and measurement, Wind energy conversion principles, Working principle of wind power plant. Details of Wind Turbine Generator – Safety and Environmental Aspects

UNIT-IV [12 HOURS]

Bio – Energy: Biomass direct combustion – Biomass gasifiers – Biogas plants – Digesters – Ethanol production – Bio diesel – Cogeneration – Biomass Applications Other renewable energy :Tidal energy – Wave Energy – Open and Closed OTEC Cycles – Small Hydro-Geothermal Energy – Hydrogen and Storage – Fuel Cell Systems – Hybrid Systems.

REFERENCE BOOKS:

1. Rai. G.D., “Non-Conventional Energy Sources”, Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., “Renewable Energy Sources”, EFN Spon Ltd., UK, 2006.
3. Sukhatme. S.P., “Solar Energy”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Godfrey Boyle, “Renewable Energy, Power for a Sustainable Future”, Oxford University Press, U.K., 1996.
5. Tiwari. G.N., Solar Energy – “Fundamentals Design, Modelling & Applications”, Narosa Publishing House, New Delhi, 2002.
6. Freris. L.L., “Wind Energy Conversion Systems”, Prentice Hall, UK, 1990.
7. Johnson Gary, L. “Wind Energy Systems”, Prentice Hall, New York, 1985
8. David M. Mousdale – “Introduction to Biofuels”, CRC Press, Taylor & Francis Group, USA 2010
9. Chetan Singh Solanki, Solar Photovoltaics, “Fundamentals, Technologies and Applications”, PHI Learning Private Limited, New Delhi, 2009.

B18CE5064	Non Destructive Testing Methods	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

knowledge of basics science in secondary education

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5064	CO1	3	3	2	3	1	1	1		1			3	3	3	3	3
	CO2	3	3	3	3	3	1	1		1			2	3	3	3	3
	CO3	3	3	3	3	3	1	1		1			2	3	3	3	3
	CO4	3	3	2	1	1	2	1		1			3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

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

Types of concrete structures, Composition of concrete, Process of concrete manufacture, Properties of concrete and their control, Discontinuities and defects in concrete structures, General procedure for visual inspection of distressed structures. Situations where NDT is an option to consider for investigation of in situ concrete, Testing of concrete, Quality control tests, Properties of fresh and hardened concrete, Partial destructive tests, Other tests, Comparison of NDT methods with partial destructive and destructive testing methods.

UNIT-II [12 HOURS]

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

UNIT-III [12 HOURS]

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

UNIT-IV [12 HOURS]

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

REFERENCES BOOKS:

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

B18CE5070	GEOTECHNICAL ENGINEERING LABORATORY	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Geotechnical Engineering

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5070	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

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Course Contents:

List of Experiments:

1. Water content determination (Oven drying method), Determination of Specific gravity by Pycnometer and density bottle method.
2. Grain size distribution (Sieve analysis Only)

3. Determination of Liquid (Casagrande method) and Plastic limit.
4. Determination of Shrinkage limit of soil.
5. Determination of moisture-density relationship (Standard Proctor's)
6. Determination of Permeability by Constant and Variable head method.
7. Determination of in-situ density by sand replacement and core cutter method.
8. Unconfined compression test for fine grained soils.
9. Triaxial Compression Test.
10. Direct shear test.
11. Determination of CBR value.
12. Only Demonstration - Determination of Relative density – Sand, Vane shear test. Odometer test(Consolidation)

REFERENCE BOOKS:

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

B18CE5080	**Concrete and Highway Materials Lab**	L	T	P	C
Duration:16Weeks		0	0	2	2

Prerequisites:

Construction materials, Concrete technology theory**.**

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5080	CO1	1	2	3				2	1	1				3	3	2	3
	CO2	1	2	3					1					3	3	3	2
	CO3	3	2	3										3	3	3	1
	CO4	3	2	-	2			1						3	3	3	2

Course Contents:

Experiments : Part- A- Concrete

1.Tests on Cement:

a. Normal Consistency
b. Setting time
c. compressive strength
d. Fineness of Cement
e. Specific gravity

2. Tests on Concrete:

a. Design of concrete mix as per IS-10262

b. Tests on fresh concrete:

i. Slump,
ii. Compaction factor and
iii. Vee Bee test

c. Tests on hardened concrete:

i. Compressive strength test,

ii. Split tensile strength test,
iii. Flexural strength test

Part B: Highway Materials

1.Tests on Aggregates
a. Aggregate Crushing value
b. Los Angeles abrasion test
c. Aggregate impact test
d. Aggregate shape tests

2. Tests on Bituminous Materials.
a. Penetration test
b. Ductility test
c. Softening point test
d. Specific gravity test
e. Viscosity test by tar viscometer

REFERENCES BOOKS:

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

B18CE5090	Structural CADD Lab	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Structural Analysis – II, Design of RCC Structural Elements and Design of Steel Structures

Course Objectives:

1. Draw SFD and BMD, analyse and design singly reinforced and doubly reinforced beams using MS EXCEL software.
2. Analyse 2D trusses, rigid frames using STAAD Pro software
3. Analyse 3D moment resistant frames using STAAD Pro software
4. Analyse 3D Truss using STAAD Pro software

Course Outcomes:

1. Draw SFD and BMD, analyse and design singly reinforced and doubly reinforced beams using MS EXCEL software.
2. Analyse 2D trusses, rigid frames using STAAD Pro software
3. Analyse 3D moment resistant frames using STAAD Pro software
4. Analyse 3D Truss using STAAD Pro software.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 5090	**CO1**	**3**	**3**			**3**								**3**	**3**	**2**	**3**
	CO2	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
	CO3	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**
	CO4	**3**	**2**	**3**		**3**							**2**	**3**	**3**		**2**

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Course Contents:

UNIT-I **[9 HOURS]**

Structural Analysis and Design of Beams: Analysis and design of singly reinforced and doubly reinforced beams using MS EXCEL software.

UNIT-II **[9 HOURS]**

Structural Analysis and Design of Rigid Frames: Analysis and design of 2 D rigid jointed frame and Truss using STADD Pro software.

UNIT-III **[9 HOURS]**

Structural Analysis and Design 3D Moment Resistant RC Frames:

Analysis and design of 3 D moment resistant RC frames using STADD Pro software for Dead load and Live load.

UNIT-IV **[9 HOURS]**

Structural Analysis and Design 3D Truss: Analysis and design of 3 D truss for Dead load and Live load using STADD-Pro software.

REFERENCE BOOKS

1. Ramesh Bangia , Learning Excel 2002, Khanna Book Publishing Co (P) Ltd.
2. Mathieson SA, Microsoft Excel- Starfire publishers
3. https://www.bentley.com/en/products/product-line/structural-analysis-software/staadpro
4. https://www.csiamerica.com/products/etabs

Semester VI

B18CE6010	Design of Steel Structures	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Knowledge of Basic Structural Analysis.

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6010	**CO1**	**3**	**3**											**3**	**3**		
	CO2	**3**	**3**	**3**	**1**	**2**			**2**		**2**		**1**	**3**	**3**	**3**	**1**
	CO3	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**		**2**		**1**	**3**	**3**	**3**	**2**
	CO4	**3**	**3**	**3**	**2**	**3**	**1**	**1**	**1**		**2**		**1**	**3**	**3**	**3**	**2**

Course Contents:

UNIT-I [12 HOURS]

Introduction to Steel Structures: 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.

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.

UNIT-II [12 HOURS]

Bolted Connections: Introduction, Behaviour of Bolted joints, Design strength of ordinary Black Bolts, Design strength of High Strength Friction Grip bolts (HSFG), Pin Connections(theory), Simple Connections – Lap joint ,Butt joint, Beam to Beam connections, Moment-resistant connections – Beam to column flange connections ,Eccentric connections - Bracket type 1 and 2 connections, Semi rigid connections(Theory).

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 - Lap joint ,Butt joint, Beam to Beam connections, Moment resistant connections-Beam to column flange connections ,Eccentric connections - Bracket type 1 and 2 (concept-No problems) connections.

UNIT-III [12 HOURS]

Design of Tension Members: Introduction, Types of tension members, Slenderness ratio, Behaviour of tension members, Modes of failure, Factors affecting the strength of tension members, Angles under tension, Design of tension member, Splices and Gussets (theory).

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 and Column splices (theory).

UNIT-IV [12 HOURS]

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

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 and unsupported beams.

REFERENCE BOOKS

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. PasalaDayaratnam ,Design of Steel Structures, S. Chand, 1999
5. Bureau of Indian Standards, IS800-2007, IS 875-1987
6. Relevant Steel Tables

B18CE6020	**Applied Geotechnical Engineering**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

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

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 6020	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

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Course Contents:

UNIT-I [12 HOURS]

Subsurface Exploration: Importance of exploration program, Methods of exploration: Boring, Seismic refraction method of geophysical exploration, Types of samples - undisturbed, disturbed and representative samples, Samplers, sample disturbance, area ratio, Recovery ratio, clearance, 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.

UNIT-II [12 HOURS]

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 (cohesion less soil only) – Culmann's and Rebhann's methods, Lateral earth pressure in cohesive and cohesion less 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 Method of slices and Friction Circle method, Taylor's stability number, Fellineous method.

UNIT-III [12 HOURS]

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

UNIT-IV **[12 HOURS]**

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

REFERENCE BOOKS:

1. Alam Singh and Chowdhary G.R. ,Soil Engineering in Theory and Practice, CBS Publishers and Distributors Ltd., New Delhi, 1994
2. PunmiaB.C. ,Soil Mechanics and Foundation Engg., 16th Edition Laxmi Publications Co., New Delhi, 2005
3. Bowles .J.E, "Foundation analysis and design", McGraw Hill, 2001.
4. Murthy .V.N.S, "Textbook of Soil Mechanics and Foundation Engineering", CBS Publishers and Distributors, New Delhi, 2009.
5. Gopal Ranjan and Rao A.S.R. ,Basic and Applied Soil Mechanics, New Age International (P) Ltd., New Delhi, 2000
6. VenkatrahmaiahC. , Geotechnical Engineering, 3rd Edition New Age International (P) Ltd., New Delhi, 2006
7. Craig R.F , Soil Mechanics, Van Nostrand Reinhold Co. Ltd., 1987
8. Braja M. Das ,Principles of Geotechnical Engineering, 5th Edition, Thomson Business Information India (P) Ltd., India., 2002
9. Iqbal H. Khan ,Text Book of Geotechnical Engineering, Edition, PHI, India, 2005

B18CE6030	Estimation, Costing and Valuation	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Building planning and drawing.

Course Objectives:

1. To learn study various drawing with estimates, methods of taking out quantities and preparation of detailed and abstract estimates for different civil engineering works.
2. To learn about writing specifications for various civil engineering works
3. To carry out rate analysis for various civil engineering works and to learn about the measurement of earth work for roads and other civil engineering works.
4. To understand the concept of valuation of a property.

Course Outcomes:

1. Students will learn how to study the various drawings and taking out quantities, and work out the cost and preparation of abstract for the estimated cost for the various civil engineering works.
2. To write specifications for various items of works.
3. To carry out rate analysis for various items of works and Obtain measurement of earth work for roads by various standard methods.
4. Preparation of contract document related to a project..

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6030	**CO1**	**1**	**2**	**3**		**1**		**2**	**1**	**2**				**3**	**3**	**2**	**3**
	CO2	**1**	**2**	**3**		**1**			**1**	**2**				**3**	**3**	**3**	**2**
	CO3	**3**	**1**	**3**		**1**				**1**				**3**	**3**	**3**	**1**
	CO4	**3**	**1**	**3**		**1**		**1**		**1**				**3**	**3**	**3**	**2**

Course Contents:

UNIT-I **[12 HOURS]**

Estimation: Study of various drawings with estimates, important terms, units of measurement, abstract Methods of taking out quantities and cost –centre 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, RCC roofs with all Building components

UNIT-II **[12 HOURS]**

Estimate: Different type of estimates, approximate methods of estimating buildings, cost of materials. Estimation of wooden joineries such as doors, windows & ventilators.

Estimates: Trusses, manhole and septic tanks, RCC Culverts, Waste weir.

Specifications: Definition of specifications, objective of writing specifications, essentials in specifications, general and detail specifications of common item of works in buildings.

UNIT-III **[12 HOURS]**

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, centring 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 slope.

UNIT-IV **[12 HOURS]**

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.

REFERENCE BOOKS:

1. B. N. Dutta ,Estimating & Costing, Chand Publisher
2. P.L. Basin S , Quantity Surveying, Chand: New Delhi.
3. S.C. Rangawala , Estimating & Specification,Charotar publishing house, Anand.
4. G.S. Birde ,Text book of Estimating & Costing, Dhanpath Rai and sons, New Delhi.

5. D.D. Kohli and R.C. Kohli S. Chand ,A text book on Estimating, Costing and Accounts-: New Delhi.
6. B. S. Patil ,Contracts and Estimates, University Press, 2006.
7. chakraborthi., Estimation and costing

B18CE6040	Design of Bridges	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of RCC, PSC Structures

Course Objectives:

1. To understand the concept of codal provisions for the design of bridges.
2. To study the loading patterns on the bridges.
3. To design the different types of bridges for railway and highway standards.
4. To understand the design principles of PSC bridges.

Course Outcomes:

1. To develop an understanding of an appreciation of basic concepts and terms involve in design of bridges.
2. To carry out a design of bridge starting from conceptual design
3. Shall be able to design the composite bridges and culverts
4. Shall be able to design PSC bridges

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 6040	CO1	1	1	1		1		2	1	2				3	3	2	3
	CO2	1	2	3		1			1	2				3	3	3	2
	CO3	3	3	3	1	1		1		1				3	3	3	1
	CO4	3	2	3	1	1		1		1				3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: History of bridges, Railway bridges and highway bridges, components of bridges and their definitions, classification of bridges and loads on bridges, selection of site for bridge design, types of abutments, piers, and wing walls, IRC codes for the design

Methods to calculate design discharge, natural, artificial and linear water ways, afflux, economic span, load combinations for different working state and limit state designs

UNIT-II [12 HOURS]

Design of slab culvert& design of pipe culvert for class AA and class A loading

UNIT-III [12 HOURS]

Design of T beam: with cross beams by Pie gaud's and Courbon's method for class AA loading, empirical design of substructures and foundations.

Choices of superstructure, longitudinal analysis of bridge, transverse analysis of bridge

UNIT-IV [12 HOURS]

Design of PSC bridges: Introduction to pre and post tensioning, analysis of main girder using Courbon's method for IRC class AA tracked vehicle, Design of end block

REFERENCE BOOKS:

1. D Johnson victor ,Essential of bridge engineering, Oxford and IBH publishing Co New Delhi.
2. N Krishnaraju ,"Design of bridges" , Oxford and IBH publishing New Delhi.
3. Jagadeesh T R and Jayaram M A ,"Design of bridge structures", Prentice hall of India pvt ltd.
4. IRC 6 – 1966 "Standard specification and code of practice for road bridges" section II
5. IRC 21 – 1966 "Standard specification and code of practice for road bridges" section II

B18CE6051	**Repair & Rehabilitation of Structures**	L	T	P	C
Duration:16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6051	CO1	3	2	3	2		2	1	2		3	2		3	3		3
	CO2	3	2	2	3	3	2	3	1	2	3	1	2	3	3	1	3
	CO3	3	3	3	1	3	1	1		1	2	3	2	3	3	1	3
	CO4	2	3	3	2	3	2	3	2	1	1	1	2	3	3	3	3

.

Course Contents:

UNIT-I [12 HOURS]

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 properties- Strength, Permeability, Thermal properties and Cracking.

UNIT-II [12 HOURS]

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, and Cathodic protection.

Maintenance and Repair Strategies: Definitions, Maintenance, Repair and rehabilitation, Facets of maintenance, Importance of maintenance, Protective measures on various aspects. Inspection, Assessment procedure for evaluating a damaged structure

UNIT-III [12 HOURS]

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-IV [12 HOURS]

Techniques for Repair: Rust eliminators and polymer coating for rebar's during repair, foamed concrete, dry pack technique, vacuum concrete, Gunite and Shot Crete, 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, engineered demolition 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. "Repair of Concrete Structures", ,Blakie and Sons, Hampshire.
4. R.T.Allen and S.C. Edwards , "Rehabilitation of concrete structures", Standard Publishers & Distributors, New Delhi.
5. B.L Gupta &Amit Gupta ,"Maintenance Repair of Civil Structures", Standard Publishers & Distributors, New Delhi.
6. P.S Gahlot& Sanjay Sharma, "Building Repair and Maintenance Management", CBS Publishers & Distributors Pvt. Ltd., New Delhi.
7. P Dayaratnam, N.V Ramana Rao, ,"Maintenance and Durability of concrete structures" Universities Press (India), 1997.
8. M.S.Shetty, , "Concrete Technology - Theory and Practice", S.Chand and Company, New Delhi

B18CE6052	Air and Noise Pollution	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Environmental Studies, Engineering Chemistry

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	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
B18CE 6052	CO1	3	3	2	3	3		3					3	3	3	3	3
	CO2	3	3	2	3	2		3					3	3	3	3	3
	CO3	3	3	2	2	2		2					3	3	3	3	3
	CO4	3	3	2	2	2		2					3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Definition – Classification and Characterization of Air Pollutants, Concentration of pollutants, Numerical Problems. Emission Sources, Behaviour 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.

UNIT-II **[12 HOURS]**

Meteorology: Introduction – Meteorological Variables, Primary and Secondary Lapse Rate, Inversions, Stability Conditions, Wind rose, pollution roses. General Characteristics of Stack

Plumes, Meteorological Models. Plume rise, stack height, Numerical problems, Factors to be considered in Industrial Plant Location and Planning.

UNIT-III **[12 HOURS]**

Sampling, Analysis And Control: Sampling and Measurement of Gaseous and Particulate matter, Stack Sampling, Analysis of Air Pollutants, Smoke and Smoke Measurement, Air Pollution Control Methods – Particulate, Emission Control, Gravitational Settling Chambers, Cyclone Separators, Fabric Filters, Electrostatic

Precipitators, Wet Scrubbers – numerical problems. Selection of a Particulate Collecting Equipment, Control of Gaseous Emissions, Adsorption by Liquids, Adsorption by Solids, Combustion Odours and their control.

UNIT-IV **[12 HOURS]**

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

Major Environmental Air Pollution Episodes – London Smog, Los Angeles Smog & Bhopal Gas Tragedy. Noise pollution – sources, measurement units, effects and control.

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

REFERENCE BOOKS

1. Rao M N. and Rao H V N., “Air Pollution” Tata McGraw Hill Publishing Co. Ltd., New Delhi. 2004.
2. Boubel, R W., Donald, L.F., Turner, D.B., and Stern, A.C., “Fundamentals of Air Pollution” – Academic Press, 1994.
3. Crawford, M., “Air Pollution Control Theory” – Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1980.
4. Henry C Perkins, “Air Pollution” – Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1980.
5. Murali Krishna K V S G., “Air Pollution & Control” Kaushal & Co., 1995.
6. Peavy, H.S., Rowe, D.R., and Tchobanoglous, G., “Environmental Engineering” – Tata McGraw Hill Publishing Co. Ltd., New Delhi. 1986.
7. Sincero, A.P and Sincero, G.A., “Environmental Engineering – A Design Approach”, Prentice Hall of India. 1999.
8. Wark, K., Warner, C.F. and Davies, W.T., “Air Pollution- Its Origin and Control”, Harper & Row Publishers, New York. 1998.
9. Rao C S., “Environmental Pollution Control Engineering”, New Age International, New Delhi. 2007.

B18CE6053	Pavement Design and Construction	L	T	P	C
Duration:16Weeks		2	1	0	3

Prerequisites:

Highway Engineering

Course Objectives:

1. To understand the fundamentals of conducting analysis of pavements, types and functions of pavement layers.
2. Understand design concepts of flexible pavement and rigid pavement by various methods.
3. Understand the components of highway construction, material mixes and soil stabilization methods.
4. Understand pavement and its components, pavement construction activities and its requirements, Specifications and quality checks for flexible and rigid pavement.

Course Outcomes:

1. To analyse the factors affecting pavement design for flexible and rigid pavements.
2. To design flexible and rigid pavement by different methods.
3. Capable to acquire understanding on construction mixes and stabilization methods for pavements.
4. Capable to understand specifications, quality checks in pavement construction.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6053	CO1	1	2	2	2									2	2	2	2
	CO2	2	2	3	2									2	2	3	2
	CO3	2	3	3	2									2	2	3	2
	CO4	2	2	3	2									2	2	3	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Requirements of pavement, Types and comparison of flexible and rigid pavement, components of pavement, Functions of component layers. Factors affecting design, Design wheel load and contact pressure, loads – axle load distribution, ESWL, EWL, Stresses and deflections, Boussinesq's theory – principle, Assumptions – Limitations - Busmister theory – Two layered analysis – Assumptions. Numericals on above

UNIT-II **[12 HOURS]**

Pavement Design: Flexible pavement design approach: Empirical, semi- empirical and theoretical design approaches, Principle, advantages and application, Design by CBR method as per IRC 37-2012.

Components and functions of rigid pavement, factors affecting design, Stresses in rigid pavements – Assumptions – Westergaard's Critical stresses, Wheel load stresses, Warping stress – Frictional stress – combined stresses. Reinforcement in slabs – Requirements of joints – Construction and design of joints. Design of C.C. Pavement by IRC: 58 – 2015. Numericals on above

UNIT-III **[12 HOURS]**

Design of gradation by Rothfuch's method. Uses and properties of bituminous mixes and cement concrete in pavement construction. Components of highway in embankment and cutting, steps for highway construction in embankment and cutting, Preparation of sub grade. Low volume roads. Soil stabilization- applications, factors affecting and methods-cement soil based stabilization. Numericals on gradation.

UNIT-IV [**12 HOURS]**

Construction of Flexible and Rigid Pavement:Construction method, specifications and field control checks for various types of flexible pavement layers like GSB,WBM, WMM, bituminous macadam, dense bituminous macadam, binder course and bitumen surface course.

Specifications and method of cement concrete pavement construction, PQC, DLC, Quality control tests, Construction of various types of joints.

REFERENCE BOOKS:

1. Khanna, S.K., C.E.G. Justo and A. Veeraragavan , Highway Engineering, Revised 10th Edition, NemChand and Bros. Roorkee
2. Sharma, S.C.: ,Construction Equipment and its Management, Khanna Publishers.
3. Yang H. Huang ,Pavement Analysis & Design , II edition
4. Yoder and Witzack , Principles of Pavement Design, 2nd edition, John Wileys and Sons

B18CE6054	**Design of Hydraulic Structures**	L	T	P	C
Duration: 16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE6054	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

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Course Contents:

UNIT-I [12 HOURS]

Reservoir Planning: Introduction, types, selection of sites, storage zones of a reservoir, reservoir yield, mass curve& demand curve, fixing capacity of a reservoir, safe yield(problems only), density currents, trap efficiency, reservoir sedimentation, life of a reservoir, economic height of a dam-numerical problems, environmental effects of reservoir. Diversion Head works: types & components. Types of Cross drainage works.

UNIT-II [12 HOURS]

Gravity Dam: Introduction, forces on a gravity dam, stress analysis in gravity dams-numerical problems, combination of forces for design, modes of failure. Elementary and practical profiles of a gravity dam, stability analysis (without earthquake forces) Numerical problems, galleries in gravity dams.

UNIT-III [12 HOURS]

Earth & Rock Fill Dams: Introduction, types, causes of failure, design criteria for earth dams, seepage line, - Numerical problems, control of seepage through earth dams, safety measures. Rock fill dam: Salient features.

UNIT-IV [12 HOURS]

Spillways: Introduction, spillway components, types of spillways, ogee spillway (simple design problems), and energy dissipation below spillways (theory only).

REFERENCE BOOKS:

1. Challa Satya Murthy , Water Resources Engineering, Principles and Practice-, New Age International Publishers, New Delhi
2. Modi P.N., ,Irrigation, Water Resources and Water Power Engineering –Standard Book House, New Delhi.
3. R.K. Sharma ,Text book of irrigation Engineering & Hydraulic Structures, Oxford & IBH Publishing Company, New Delhi , 2002.
4. G.L. Asawa ,Irrigation and Water Resources Engineering, New Age International Publishers, New Delhi, 2005.
5. N.Balasubramanya ,Hydraulic Structures and Irrigation Design and Drawing, Sapna Book House, 2017
6. Garg, S.K ,Irrigation Engineering & Hydraulic Structures, Khanna Publishers, New Delhi.
7. Madan Mohan Das & Mimi Das Saikia ,Irrigation and Water Power Engineering, PHI Learning Pvt. Ltd., New Delhi ,2009.

B18CE6061	Design of Masonry Structures	L	T	P	C
Duration: 16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
BCE20 6061	CO 1					3	2	3	2	2		2	2	3	1	1	3
	CO 2	2				2	2	3	1	1		1	2	3	2	1	3
	CO 3	2		2	1	1	1	3	1	1			2	3	2	1	3
	CO 4	3	1		1	1		3	2	1	1		3	3	2	1	3

Course Contents:

UNIT-I [12 HOURS]

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

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

UNIT-II [12 HOURS]

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

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

UNIT-III [12 HOURS]

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

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

UNIT-IV [12 HOURS]

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

Masonry Arches, Domes and Vaults: Components and classification of masonry arches, domes and vaults, historical buildings, construction procedure

REFERENCE BOOKS:

1. Hendry A.W., “Structural masonry”- Macmillan Education Ltd., 2nd edition
2. Sinha B.P & Davis S.R., “Design of Masonry structures”- E & FN Spon
3. Dayaratnam P, “Brick and Reinforced Brick Structures”- Oxford & IBH
4. Curtin, “Design of Reinforced and Prestressed Masonry”- Thomas Telford
5. Sven Sahlin, “Structural Masonry”-Prentice Hall
6. Jagadish K S, Venkatarama Reddy B V and Nanjunda Rao K S, “Alternative Building Materials and Technologies”-New Age International, New Delhi & Bangalore
7. IS 1905, BIS, New Delhi
8. SP20(S&T), New Delhi

B18CE6062	Intelligent Transportation Systems	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Highway Engineering

Course Objectives:

1. To develop an understanding of various sensor technology of ITS.
2. To describe the ITS architecture and user needs in functional areas of ITS.
3. To understand the various applications of ITS.
4. To understand how to evaluate technologies, applications and service of ITS.

Course Outcomes:

1. Use different techniques of ITS.
2. Identify different ITS user services.
3. Select appropriate ITS technology depending upon site specific conditions.
4. Design and implement suitable ITS components in transportation system.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6062	**CO1**	**3**	**1**				**3**		**2**		**2**		**2**	**3**			**1**
	CO2	**3**	**3**			**2**		**2**	**2**	**3**	**3**			**3**	**3**		**1**
	CO3	**3**	**3**		**2**	**2**	**3**			**3**	**1**	**2**		**3**	**3**	**1**	**2**
	CO4	**3**	**3**		**2**	**2**	**1**	**2**	**3**		**3**		**2**	**3**			**2**

Course Contents:

UNIT-I **[12 HOURS]**

Fundamentals Of ITS: Definition, objectives, the historical context from both public policy and market economic perspectives, Applications of ITS, Types of ITS, Benefits of ITS, data collection

techniques- Detectors, Automatic vehicle location, automatic vehicle identification, geographic Information system, video data collection, ITS case studies.

UNIT-II [12 HOURS]

Sensor Technologies and Data Requirements of ITS:Importance of telecommunications in the ITS. Information Management, Traffic Management Centres (TMC), Application of sensors to Traffic management; Traffic flow sensor technologies; Transponders and Communication systems; Data fusion at traffic management centres; Sensor plan and specification requirements; Elements of Vehicle Location and Route Navigation and Guidance concepts.

UNIT-III [12 HOURS]

ITS User Needs and Services: Introduction, Advanced Traffic Management systems (ATMS), Advanced Traveller Information systems (ATIS), Commercial Vehicle Operations (CVO), Advanced Vehicle Control systems (AVCS), Advanced Public Transportation systems (APTS), Advanced Rural Transportation systems (ARTS), travel and traffic management, public transportation management, Electronic payment, commercial vehicle operations, emergency management, advanced vehicle safety systems, information management, road pricing.

UNIT-IV [12 HOURS]

ITS Applications: Traffic and incident management systems; ITS and sustainable mobility, travel demand management, electronic toll collection, ITS and road-pricing.; Transportation network operations; commercial vehicle operations and intermodal freight; public transportation applications; ITS and regional strategic transportation planning, including regional architectures: ITS and changing transportation institutions Automated Highway Systems- Vehicles in Platoons – Integration of Automated Highway Systems. ITS Programs in the World – Overview of ITS implementations in developed countries, ITS in developing countries.

REFERENCE BOOKS

1. Mashrur A. Chowdhury, Adel WadidSadek,Fundamentals of intelligent transportation systems planning
2. Lawrence A. Klein, Sensor technologies and Data requirements of ITS.
3. ITS Hand Book 2000: Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.
4. Sussman, J. M., Perspective on ITS, Artech House Publishers, 2005.
5. National ITS Architecture Documentation, US Department of Transportation, 2007.

B18CE6063	Ground Improvement Techniques	L	T	P	C
Duration: 16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6063	CO1	2				2		3				2		3	2	1	2
	CO2	2	2	1		2		2						3	2	1	2
	CO3	2				3		2						3	3	3	1
	CO4	2				3		1						3	3	3	2

Course Contents:

UNIT-I **[12 HOURS]**

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 and Preloading: Importance, Vertical drains, Sand drains, Drainage of slopes, Electro kinetic dewatering, Preloading.

UNIT-II **[12 HOURS]**

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.

UNIT-III **[12 HOURS]**

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.

UNIT-IV **[12 HOURS]**

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, Micro piles.

REFERENCE BOOKS:

1. Purushothama Raj P. ,Ground Improvement Techniques,Laxmi Publications, New Delhi, 1999

2. Koerner R.M. ,Construction and Geotechnical Method in Foundation Engineering, McGraw Hill Pub. Co., New York.

3. Manfred Hausmann, Engineering principles of ground modification- (1990) - McGraw Hill Pub. Co., New York, 1985
4. Bell, F.G. ,Methods of treatment of unstable ground, Butterworths, London, 1975
5. Nelson J.D. and Miller D.J., Expansive soils, John Wiley and Sons., 1992
6. Ingles. C.G. and Metcalf J.B., Soil Stabilization; Principles and Practice, Butterworths, London, 1972

B18CE6064	**Disaster Management and Mitigation**	L	T	P	C
Duration:16weeks		2	1	0	3

Prerequisites:

Environmental Engineering

Course Objectives:

1. To create awareness on various natural and man-made disasters occur.
2. To learn about the concept of the chronological phases of natural disaster response, refugee relief operation, vulnerability assessment and preparedness for various disasters.
3. To learn about the various measures of disaster mitigation and disaster management.
4. To learn the importance of public awareness and rehabilitation.

Course Outcomes:

1. Demonstrate the usefulness of integrating management principles in disaster mitigation work.
2. Distinguish between the different approaches needed to manage pre, during& post disaster periods and examine the vulnerability, preparedness of disasters.
3. Describe the strategies of disaster management and explain the various mitigation measures.
4. Explain the various safety programmes, rehabilitation programmes and general awareness on disasters.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6064	CO 1	2					3	3	1	1	1	2	2	3	2	1	2
	CO 2	2	2	2	1		2	3	1	3		2	3	3	2	3	2
	CO 3	2		3	2	3		3	1	3		1	3	3	2	2	2
	CO 4	2	2	3	1	2			2	3	2		3	3	2	1	2

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Principles of Disaster Management, Natural Disasters- floods, Landslides, earthquakes, Tsunamis, and volcanoes, Significance of earth processes in natural disasters, Hazards, Risks and Vulnerabilities, Human induced disasters, Case studies of important natural and human induced disasters.

UNIT-II **[12 HOURS]**

Vulnerability Assessment and Preparedness: Assessment of Disaster Vulnerability of a location and vulnerable groups, Vulnerability assessment for floods, earthquakes, tsunamis, landslides and volcanoes, Preparedness for various Disasters- floods, earthquakes, tsunamis, landslides and volcanoes with special reference to construction of residential buildings and public utility buildings, Preparation of Disaster Management Plans.

UNIT-III **[12 HOURS]**

Mitigation Measures and Disaster Management: Disaster mitigation planning of human settlements and townships for earthquakes, floods, Fire, tsunamis, Landslides and volcanoes, Issues in Environmental Health, Water & Sanitation, Post disaster Relief & Logistics Management. Basic principles of disaster Management, Emergency Support Functions, Resource & Material Management, Management of Relief Camp, Information systems &decision making tools, Voluntary Agencies & Community Participation at various stages of disaster management.

UNIT-IV **[12 HOURS]**

Rehabilitation and Awareness: School Awareness & Safety Programme, Integration of Rural Development Programmes with disaster reduction and mitigation activities, Role of Remote

Sensing, Science & Technology Information systems and decision making tools in disaster management, Rehabilitation Programmes, New initiatives, Disaster management in India.

REFERENCE BOOKS:

1. R.B.Singh, Environmental Geography, Heritage Publishers New Delhi,1990
2. Savinder Singh Environmental Geography, PrayagPustakBhawan, 1997
3. Kates,B.I& White, G.F The Environment as Hazards, oxford, New York, 1978
4. R.B. Singh,Disaster Management, Rawat Publication, New Delhi, 2000
5. H.K. Gupta, Disaster Management, Universiters Press, India, 2003
6. R.B. Singh, Space Technology for Disaster Mitigation in India (INCED) University of Tokyo, 1994
7. Dr.Satender , Disaster Management in Hills, Concept Publishing Co., New Delhi, 2003
8. A.S. Arya Action Plan For Earthquake, Disaster, Mitigation in V.K. Sharma (Ed) Disaster Management IIPA Publication New Delhi, 1994
9. R.K. BhandaniAn overview on Natural & Manmade Disaster & their Reduction, CSIR, New Delhi
10. M.C. Gupta Manuals on Natural Disaster management in India, National Centre for Disaster
11. Abbott, P.L, Natural Disasters. 3rd Ed., McGraw Hill Company, 2001.

B18CE6070	**Structural Design and Detailing (RCC & STEEL)**	L	T	P	C
Duration: 16weeks		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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6070	CO1	2	1	1			2	3	1	1	1		2	3	3	2	1
	CO2	3	3	3			2	3	1	1	1		2	3	3	2	1
	CO3	3	3	3	1		2	3	1	1	1		2	3	3	3	1
	CO4	2	3	3	1		2	3	1	1	1		2	3	3	3	1

Course Contents:

UNIT-I [12 HOURS]

Layout Drawing:General layout of building showing position of columns, footings, beams and slabs with standard notations, Detailing of Beam and Slab floor system, continuous beams.

Design and Detailing of Staircase and Column Footings:Detailing of Staircases: Dog legged and Open well, Column and footing (Square and Rectangle), Design and detailing of Rectangular Combined footing slab and beam type.

UNIT-II [12 HOURS]

Retaining Wall: Design and detailing of Cantilever type retaining walls.

Water Tanks: Design and detailing of Circular and Rectangular water tanks resting on ground (Flexible base and Rigid base) using IS: 3370 (Part IV) only.

UNIT-III [12 HOURS]

Detailing of Steel Connections: Bolted and welded, beam-beam, Beam-column, seated, stiffened and un-stiffened (Design and detailing).

UNIT-IV [12 HOURS]

Design and Detailing of Column Splices: Column-column connection of same and different sections Columns- Lacing and battens

Detailing of Column Bases: Slab base and gusseted base, grillage foundation.

REFERENCE BOOKS

1. N. Krishna Raju,Structural Design & Drawing-Reinforced Concrete & Steel, University Press, Delhi
2. Krishnamurthy ,Structural Design and Drawing (Concrete Structures), CBS publishers, New Delhi. Tata Mc-Graw publishers.
3. B.C. Punmia , Reinforced Concrete Structures, Laxmi Publishing Co.
4. S.N.Sinha , Reinforced Concrete Design, Mc-GrawHill Education,
5. S.K. Duggal , Design of steel structures, Tata Mcgraw Hill, New Delhi
6. N. Subramanian , Design of Steel Structures, Oxford University, Press.
7. Negi , Design of Steel Structures, Tata McGraw Hill Publishers.
8. Arya and Ajaman , Design of Steel Structures, Nem Chand &Bros. Roorkee.
9. S UnnikrishnaPillai&DevadasMenon , Reinforced Concrete Design, Tata McGraw-Hill, New Delhi
10. IS: 456-2000, IS: 800 – 2007, SP(16)-1980, SP 6 (1) – 1984

B18CE6080	**New Tank & Old Tank Project With DPR**	L	T	P	C
Duration: 16weeks		1	0	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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6080	CO1	1	2	3				2	1					3	3	2	3
	CO2	1	2	3					1					3	3	3	2
	CO3	3	2											3	3	3	1
	CO4	3	2					1						3	3	3	2

Course Contents:

New Tank Project:

Field Work:i) Reservoir site selection, Reconnaissance of the sites and fly levelling to establish bench marks. ii) Alignment of centre line of the proposed bund, Longitudinal and cross sections of the centre line. iii) Reservoir capacity surveys. iv) Sluice & Surplus weir surveys. v) Canal alignment surveys.

Data Collection:i) Rainfall and runoff. ii) Irrigation water/crop pattern. iii) Topography.

iv) Demography v) Land-use & Land cover.

Old Tank Project

Field work: i) Alignment of centre line of the existing bund, Longitudinal and cross sections of the centre line. ii) Old & improved Reservoir capacity surveys. iii) Details of existing Sluice & Surplus weir.

Data Collection: i) Rainfall and runoff. ii) Irrigation water/crop pattern. iii) Topography.

iv) Demography v) Land-use & Land cover.

Note:

1. At least one of the above should be done by using TOTAL STATION

The survey camp Report should be attached with field book, calculation sheets, all Plans/drawings, estimates of earth work and structure in spread sheet and should be submitted in the form of Hardcopy and softcopy (CD)

REFERENCE :

1. Punmia B C, Ashok K Jain, Arun K Jain ,Surveying Vol 1, 2,3, 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. Challa Satya Murthy , Water Resources Engineering, Principles and Practice,2nd edition, New Age International Publishers, New Delhi

B18CE6090	**Project Management Lab**	L	T	P	C
Duration: 16weeks		0	0	2	2

Prerequisites:

Construction Planning and Management

Course Objectives:

1. Use industry standard software in a professional set up.
   Understand the elements of finite element modelling, specification of loads and boundary condition, performing analysis and interpretation of results for final design
   Develop customized automation tools

Course Outcomes:

1. Use software skills in a professional set up to automate the work and thereby reduce cycle time for completion of the work

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 6090	**CO1**	**3**	**2**	**3**	**3**	**2**				**2**	**1**	**3**	**2**	**3**	**2**	**1**	**1**
	CO2	**3**	**2**	**2**	**2**	**2**				**1**	**1**	**3**	**1**	**3**	**2**	**1**	**1**
	CO3	**2**	**3**	**3**	**2**	**2**				**1**	**2**	**3**	**1**	**3**	**2**	**1**	**1**
	CO4	**3**	**2**	**2**	**2**	**3**				**2**	**1**	**3**	**1**	**3**	**2**	**1**	**1**

Course Contents:

List of experiments:

Project Management- Exercise on Project planning and scheduling of a building project using any project management software: (PRIMAVERA,MS-OFFICE)

1. Understanding basic features of Project management software
2. Constructing Project: create WBS, Activities, and tasks and Computation Time using Excel spread sheet and transferring the same to Project management software.
3. Identification of Predecessor and Successor activities with constrain
4. Constructing Network diagram (AON Diagram) and analysing for Critical path, Critical activities and other on Critical paths, Project duration, Floats.
5. Study on various View options available
6. Basic understanding about Resource Creation and allocation
7. Understanding about Splitting the activity, Linking multiple activity, assigning Constrains, Merging Multiple projects, Creating Baseline Project

GIS applications using open source software:

1. To create shape files for point, line and polygon features with a map as reference.
2. To create decision maps for specific purpose.

REFERENCE BOOKS:

1. Training manuals and User manuals and Relevant course reference books

SEMESTER VII

B18CE7010	Financial Management and Entrepreneurship	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Construction Planning and Management

Course Objectives:

1. Understand the Financial Management.
2. Understand the Economic analysis of the projects.
3. Understand the Financial Planning of the projects.
4. Understand the concept and functions of Entrepreneurship

Course Outcomes:

1. Explain the objectives of the financial management
2. Analyse the cost involved in the projects
3. Explain the Financial implications of the project and Economizing the projects
4. Explain the concept and functions of an entrepreneur.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CV 7010	**CO1**	**3**	**2**		**1**	**1**	**1**		**2**	**3**	**2**	**2**		**3**	**3**		**3**
	CO2	**3**	**2**		**2**	**2**			**2**	**2**	**2**	**3**		**3**	**2**		**3**
	CO3	**3**	**2**		**3**	**3**	**2**		**2**	**2**	**3**	**2**		**3**	**2**		**2**
	CO4	**3**	**3**		**2**	**2**			**3**	**2**	**3**	**2**	**2**	**3**	**3**		**1**

Course Contents:

UNIT-I [12 HOURS]

Financial Management: – Introduction to financial management, objectives of financial management – profit maximization and wealth maximization. Changing role of finance managers. Interface of Financial Management with other functional areas. Indian financial system – Primary market, Secondary market – stocks & commodities market, Money market, Forex markets. (Theory Only)Sources of Financing: Shares, Debentures, Term loans, Lease financing, Hybrid financing, Venture Capital, Angel investing and private equity, Warrants and convertibles (Theory Only)

UNIT-II [12 HOURS]

Economic Analysis: Cost implication to different forms of construction and maintenance and maintenance and replacement lives of material, Installation and running cost of services, Capital investment in project, Cost analysis by traders and by functional element, Cost planning techniques, Cost control during design and Construction, Depreciation, Various Appraisal Criteria Methods. Break-even analysis, Cash flow analysis, Risk Analysis and Management Practice, Role of Lender's Engineer.

UNIT-III [12 HOURS]

Financial Planning: Long term finance planning, Stock, Borrowings, Debentures, Loan Capital, Public Deposit, Dividend Policies, Bonus Shares, Market value of shares, Reserves. Over and under capitalization, Introduction to Micro financing. Working capital management – factors influencing working capital requirements. Current asset policy and current asset finance policy. Determination of operating cycle and cash cycle. Estimation of working capital requirements of a firm (Does not include Cash, Inventory &Receivables Management)

UNIT-IV [12 HOURS]

Entrepreneurship:Evolution of the concept, functions of an entrepreneur, concepts of entrepreneurship, stages in entrepreneurial process, different sources of finance for entrepreneur, central and state level financial institutions. Micro, Small & Medium Enterprises (MSME): definition, characteristics, objectives, scope, role of MSME in economic development, advantages of MSME, Introduction to different schemes: TECKSOK, KIADB, KSSIDC, DIC,

Window Agency:SISI, NSIC, SIDBI, KSFC Business Planning Process: Business planning process, marketing plan, financial plan, project report and feasibility study, guidelines for preparation of model project report for starting a new venture. Introduction to international entrepreneurship opportunities, entry into international business, exporting, direct foreign investment, venture capital.

REFERENCE BOOKS

1. Mubarak, Construction project scheduling and control, Wiley India.
2. D Lal, S. K., Construction Management & PWD Accounts, Kataria& Sons, 2012
3. Singh H. ,Construction Management and Accounts , Tata McGraw Hill, New Delhi, 1988
4. CormicanD , Construction Management, Planning and finance, Construction press, London,
5. "Financial Management" – Indian Institute of Banking and Finance – Macmillan Publications.
6. Prasanna Chandra ,Projects planning, Analysis Selection, Implementation and Review, Tata McGraw Hill, New Delhi, 2005
7. Pravin Kumar ,Fundamentals of Engineering Economics, Wiley, India.

B18CE7020	Solid Waste Management	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Industrial Waste Management and Environmental Engineering.

Course Objectives:

1. To develop insight into the collection, transfer, and transport of municipal solid waste.
2. Different methods of municipal solid waste disposal are studied.
3. Examine the operation of a resource recovery facility and understanding the different methods of waste to energy facility.
4. To understand the different types of biological and hazardous waste disposal.

Course Outcomes:

1. Explain the different methods of collection, transfer, and transport of municipal solid waste.
2. Explain the Different methods of municipal solid waste disposal.
3. Exposure to different method of waste to energy facility.
4. Evaluate landfill site and to study the sanitary landfill reactions.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7020	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

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Course Contents:

UNIT-I **[12 HOURS]**

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. Solid waste management 2000 rules with 2016 amendments.

UNIT-II **[12 HOURS]**

Collection, Transportation, Treatment/Processing:Systems of collection, collection equipment, garbage chutes, transfer stations bailing and compacting, route optimization techniques and problems. Components separation, volume reduction, size reduction, chemical reduction, plastic waste- environmental significance and reuse, reuse of materials in other industries.

UNIT-III **[12 HOURS]**

Disposal Methods-I: Open dumping, ocean disposal, feeding to hogs, incineration- Process–3T's,factors affecting incineration process, incinerators–types, 3T's,preventionofairpollution,Pyrolysis, energy recovery operations, composting- Aerobic and anaerobic composting, factors affecting composting, Indore and Bangalore processes, mechanical and semi mechanical composting processes. Vermi-composting.

UNIT-IV **[12 HOURS]**

Disposal Methods –II: Sanitary land fill-Different types, trench area, Ramp and pit method, site selection, basic steps involved, cell design, prevention of site pollution, leachate & gas collection and control methods, geo-synthetic fabrics in sanitary landfills. Energy recovery technique from solid waste management.

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. BhideandSunderashan 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

B18CE7030	**Design of Prestressed and Prefabricated Structures**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7030	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

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Course Contents:

UNIT-I [12 HOURS]

Materials: Stress-Strain characteristics and properties, non-cementitious materials. High strength concrete and steel, necessity of High strength concrete and steel,

Basic principles of pre-stressing: Pre-tensioning and post-tensioning systems, Tensioning methods and end anchorages. Fundamentals, Load balancing concept, Pressure Line, Stress concept, centre of thrust with examples.

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

UNIT-II [12 HOURS]

Loss of pre-stress: Difference between pre-tensioning and post- tensioning losses, various losses encountered in pre-tensioning and post-tensioning methods with numerical.

Limit state of serviceability: Deflection of pre-stressed members, Short term and long term deflections, deflections at transfer and working load conditions with different cable profiles. Deflection limits as per IS 1343-2012. Effect of creep on deflection, load versus deflection curve, methods of reducing deflections and methods for control of cracking

UNIT-III [12 HOURS]

Limit state of collapse: Types of Failures in beams due to Flexure and Shear, Codal provisions for Flexure and Shear. Design of beams for Ultimate flexural strength, Shear resistance and shear reinforcement using IS-1343-2012.

Design of PSC Beams: Design of pre-tensioned and post-tensioned symmetrical and asymmetrical sections by limit state method. Permissible stresses, design of pre-stressing force and eccentricity and design of end block as per IS 1343-2012 with numerical.

UNIT-IV **[12 HOURS]**

Prefabricated Structures: General Civil Engineering requirements, specific requirements for planning and layout of prefabrication plant. IS Codal specifications. Modular co-ordination, standardization, Disuniting of Prefabricates, production, transportation, erection, stages of loading and code provisions, safety factors, material properties, Deflection control parameters. Location, types and Lateral load resistance of shear walls. . Long wall and cross-wall large panel buildings, one way and two way prefabricated slabs, -Connections – Beam to column and column to column

REFERENCE BOOKS

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

B18CE7041	**Building Materials and Construction**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Building Materials and Building Construction

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 bricks, stones, cement and Concrete
2. To assess the properties of cement and mortar.
3. To Provide Suitable lintels ,stairs, roofs, doors and windows
4. To carry out the Suitable type of flooring and plastering.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7041	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 [12 HOURS]

Bricks:Introduction, types of bricks, material for manufacture of bricks, methods of brick manufacture, quality of good brick, testing of brick, uses of bricks.

Stones: Introduction, classification, composition and characteristics, different types of stones, method of quarrying and dressing.

Cement:Chemical composition, physical properties of cement, manufacturing of cement, tests for cement, uses of cement, types of cement ,

Concrete: Its ingredients, Grades of Concrete, Tests on Fresh and hardened concrete

UNIT-II [12 HOURS]

Foundation: Function and requirement of a good foundation, types of foundation-spread foundations combined foundation, strap, mat and pile foundations.

Brick masonry: Terminology used, material used, types of bonds-stretcher bond, Header bond, English bond, Flemish Bond, Comparison of English Bond and Flemish Bond

Stone masonry: Terminology used types of stone masonry, joints of stones, maintenance of stone work.

UNIT-III **[12 HOURS]**

Lintels:Definition, function and classification of lintels, Balconies, chejja and canopy.

Stairs:Technical Terms, Requirements of good stair, Classification of stairs.

Roofs: Types of Roofs, Uses of roofs

Doors and windows:Common types of doors and windows of timber and metal.

UNIT-IV **[12 HOURS]**

Flooring:Components of a floor, selection of flooring materials, Brick flooring, Cement concrete flooring, mosaic, marble, Terrazzo flooring, Tiled roofing.

Plastering: Definition, material used for plastering, types of plastering, and methods of plastering, defects of remedial measures in plastering.

REFERENCE BOOKS:

1. RangawalaP.C. ,Engineering Materials by Charter Publishing House, Anand, India.
2. Sushil Kumar ,Engineering Materials, by, Standard Publication and Distributors, New Delhi.
3. M.S. Shetty ,Concrete technology – Theory and practice, S. Chand and Co, New Delhi, 2002.
4. P.G. Varghese ,Text Book Building Materials, Prentice-Hall of India Pvt. Ltd., Publication.
5. C B Kukreja and Ravi Chawla ,Material Testing Laboratory Manual , Standard Publishers Distributors, New Delhi.
6. SushilKumar , Building Construction, Standard Publication and Distributors, New Delhi.
7. Punmia.B.C , Building Construction , Lakshmi Publications New Delhi.

B18CE7042	**Rainwater Harvesting and Groundwater Recharge**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Basic knowledge about Hydrology and elementary fluid mechanics.

Course Objectives:

1. Basics terms, definition and concepts of Hydrology.
2. Relevance of Rainwater Harvesting its need and advantages, Various methods/techniques

of Rainwater harvesting and a case study

3. Basics terms and concepts of Groundwater, history, background and its potential in India.
4. Water Quality standards of Groundwater and its Pollution, Different methods of artificial recharge and investigation.

Course Outcomes:

1. Understand the basics of Hydrological terms and watershed management.
2. Understand the Importance and need for rain water harvesting, various methods commonly adopted for rain water harvesting.
3. Understand the historic background and its potential in India. Basic terms related to Groundwater.
4. Understand the Importance and need for groundwater recharge, various methods commonly adopted for groundwater recharge.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18C E704 2	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**

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Course Contents:

UNIT-I [**12HOURS]**

Introduction: Rainwater harvesting, advantages of rainwater harvesting, natural water resources, agricultural practices, integrated farming, Soil erosion and conservation techniques, concept of Arid and Semiarid Regions, Drought Management- introduction, Drought assessment and classification, drought mitigation planning, Concept of watershed, introduction to watershed management.

UNIT-II [**12HOURS]**

Rainwater harvesting: Components of domestic rain water harvesting system, design of roof top rainwater harvesting system,

Water Conservation and Recycling:Perspective on recycle and reuse, Waste water reclamation, Rain Water Harvesting Techniques- in Urban areas and Rural areas, a case study of both techniques, maintenance and monitoring of rainwater harvesting structures.

UNIT-III [**12HOURS]**

Ground water Recharge: introduction, Ground water utilization & historical background, ground water in hydrologic cycle, Groundwater development and Potential in India,concept of Porosity and Permeability, Aquifers-Type of aquifers, aquifer properties, Objectives of Groundwater Recharge, Water quality standards of Groundwater, Groundwater Pollution-Municipal/industrial /agricultural /miscellaneous sources & causes of pollution,

UNIT-IV [**12HOURS]**

Artificial recharge techniques:Methods of artificial recharge to ground water through open well and bore wells, recharge mounds & induced recharge, wastewater recharge for reuse, water spreading. Ground water flow rates & flow directions, ground water basin management concept, investigation of ground water-remote sensing / electric resistivity/seismic refraction based methods.

REFERENCE BOOKS :

1. P.N.Modi , Irrigation, water Resources and water power Engineering, standard book house, New Delhi.
2. Madan Mohan Das & Mimi Das Saikia ,Irrigation and Water Power Engineering,PHILearningpvy. Ltd. New Delhi, 2009
3. S. K.Garg , Irrigation Engineering and Hydraulic structures, Khanna Publication, New Delhi.

B18CE7043	**Water Supply and Sanitation**	L	T	P	C
Duration: 16weeks		**2**	**1**	**0**	**3**

Prerequisites:

Environmental Engineering

Course Objectives:

1. To introduce the understanding of the fundamental scientific concepts of water supply, sources of water, and characteristics of water and health issues.
2. To get the knowledge about intakes, pipe materials and joints, understand the various sewer materials.
3. To introduce to the types of sewerage system and sewer appurtenances.
4. To provide clear concept on the disposal of waste and other sewer appurtenances.

Course Outcomes:

1. Recall the concepts of protected water supply, water demand and forecast the population, List the various sources of water.
2. To assess the concept of intakes with their types and also different joints in pipes.
3. Explain the necessity of sanitation, types of sewerage system, Analyse the various sewer materials, and Sewer appurtenances.
4. To understand clearly about the disposal of the waste and appurtenances of it.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7043	**CO1**	**3**	**3**	**2**	**3**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**2**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**2**	**1**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**
	CO4	**3**	**3**	**1**	**2**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**3**	**3**	**3**	**3**	**3**

Course Contents:

UNIT-I **[12HOURS]**

Water Requirement: Necessity of water supply, Methods ofpopulation forecasting (Arithmetical, Geometrical and Incremental Increase method)- Water Requirements for a) Domestic Purpose b) Industrial Use c) Fire Fighting d) Public Purpose e) Losses. Per Capita Demand and Factors affecting it.

Sources Of Water: Surface Sources - Lakes, Streams, Rivers.Impounded Reservoirs. Underground Sources.

UNIT-II **[12HOURS]**

Intake And Conveyance Of Water: Types of intakes i)Reservoir intake ii) River intake iii) Canal intake, Conveyance of Water - Open Channels and Pipes. Pipe Materials - Cast Iron Pipes, Steel Pipes, Concrete Pipes, Pre-Stressed Concrete Pipes, Merits and Demerits. Pipe Joints - Spigot and Socket Joint, Flange Joint, Universal Pipe Joint, Expansion Joint, Flexible Joint, Various stages of pipe laying and its testing.

UNIT-III **[12HOURS]**

Sanitation: Introduction, importance and purpose of sanitation, definitions – bacteria, invert, sewer, sewerage, types of refuse, collection and disposal of refuse, systems of drainage – separate, combined and partially separate system, advantages and disadvantages of each system. Sanitary requirements for various types of buildings, types of pipes. Man holes – drop manholes, manhole with intercepting trap, inspection chambers, self-cleansing velocity, drains on sloping sites, sub soil drainage, storm water disposal – catch basins, inlets, storm water regulators.

UNIT-IV **[12HOURS]**

Sewer appurtenances: Importance of pumps and sewage pumping stations, septic tanks – soak pit, soak well, disposal of effluent. House drainage – principles, traps-floor trap, multi-trap, gully trap, grease and oil trap, urinals, Indian, European, Anglo Indian type of water closet, squatting urinal, bidet. Definitions – Siphonage, anti-siphonage pipe, cowl, fresh air inlet, soil and waste pipes, vent pipe.Garbage, ash, rubbish, collection methods, transportation, disposal – salvaging, dumping, controlled tipping, incineration, composting, dung disposal – digester, biogas plant.

REFERENCE BOOKS:

1. Rangwala ,Water Supply & Sanitary Engineering
2. S.K.Garg , Water supply Engineering , Khanna Publishers
3. Birde ,Water Supply & Sanitary Engineering
4. S.K.Garg , Sewage Disposal and Air Pollution Engineering , Khanna Publishers.
5. Dr B.C.Punmia , Water Supply Engineering , Jain publishers

B18CE7051	**Earthquake Resistant Design of RC Structures**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Design of RCC, Engineering Mechanics

Course Objectives:

1. To understand elements of earthquake engineering
2. To understand the principles of seismic design
3. To understand the seismic forces in buildings
4. To understand seismic design of masonry buildings

Course Outcomes:

1. Recall the concepts of protected water supply, water demand and forecast the population, List the various sources of water.
2. To assess the concept of intakes with their types and also different joints in pipes.
3. Explain the necessity of sanitation, types of sewerage system, Analyse the various sewer materials, and Sewer appurtenances.
4. To understand clearly about the disposal of the waste and appurtenances of it.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7051	CO1	2	1	1			2	3	1	1	1		2	3	3	2	2
	CO2	3	3	3	2	2	2	3	1	1	1	1	2	3	3	2	2
	CO3	3	3	3	2	2	2	3	1	1	1	1	2	3	3	2	2
	CO4	3	3	3	3	2	2	3	1	1	2	1	2	3	3	2	2

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Course Contents:

UNIT-I [12 HOURS]

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

UNIT-II [12 HOURS]

Principles of Seismic Design: Response of structure to earthquake motion- Codal provision for design – IS 1893-2002 - aspects in planning and layout - Principles of design – choice of materials – ductility based design –Effect of Structural Irregularities on seismic performance of RC buildings-

Vertical irregularity and plan configuration problems, Seismic resistant building architecture – lateral load resistant systems, building characteristics.

UNIT-III [12 HOURS]

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

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

UNIT-IV [12 HOURS]

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

REFERENCE BOOKS:

1. PankajAgrawal, Manish Shrikhande ,Earthquake Resistant Design of Structures, PHI Learning
2. AK Chopra, Dynamics of Structures: Theory and Applications to Earthquake Engineering, Prentice Hall
3. R.W. Clough and Joseph Penzien, Dynamics of Structures, McGraw-Hill Education
4. Mario &Paz ,Structural Dynamics by, Springer.
5. David J. Dowrick , Earthquake Resistant Design, Wiley India Pvt Ltd
6. Elements of Earthquake Engg by Jai Krishna, A.R. Chandrasekaran, Brijesh Chandra, South Asian Publishers.
7. IS 1893-2002 Indian Standard Criteria for Earthquake Resistant Design of Structures.
8. IS 4326-1993 2002 Indian Standard for Earthquake Resistant Design and Construction of Buildings.
9. IS 13920-1993 2002 Ductile detailing of Reinforced Concrete Structures subjected to Seismic Forces.

B18CE7052	Green Building Technology	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Building Materials and Construction, Architectural Planning and Design of Buildings (Manual Drawing)

Course Objectives:

1. Understand the basic concepts of green buildings and its design.
2. To promote the technology to develop solutions to address non-renewable energy challenges.
3. Understand the cleaner production and life cycle assessment
4. Know the impacts of green technology.

Course Outcomes:

1. Recollect the basic concepts of green buildings and its design.
2. Expose to design criteria of green buildings.
3. Explain cleaner production and life cycle assessment
4. Describe the principles of green manufacturing and use of alternative energy resources

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 7052	3	3	2	3	3	-	-	-	-	-	-	3	3	3	3	3	3
	3	3	2	3	2	-	-	-	-	-	-	3	3	3	3	3	3
	3	3	2	1	2	-	2	-	-	-	-	3	3	3	3	3	3
	3	3	1	2	2	-	2	-	-	-	-	3	3	3	3	3	3

Course Contents:

UNIT-I **[12 HOURS]**

Introduction to Green Building: Green Buildings: Definition of green building, benefits and challenges, public policies and market-driven initiatives, effective green specifications, LEED ratings, green materials.

Overview to Site Design:Site planning and analysis: biophysical, social, economic factors, Basic steps of site analysis, Site assessment, strategies for optimizing land use; transportation fundamentals.

UNIT-II **[12 HOURS]**

Energy Efficient Buildings: Energy Efficient Design, Overview of the Building Energy System Design Process, Assessing human functional and physiological needs, local climate and free energy resources. Design scenarios, Passive solar design, Building Envelope, Plug Loads, Domestic Hot Water, HVAC, Day lighting, Electric Lighting, Green Power, Water and Site Design: problems and issues with water and site practices, Nature as a model approach, Overview of site and landscape solutions.

UNIT-III **[12 HOURS]**

Cleaner Production Technology: Cleaner Production and Life Cycle Assessment: Definition, Importance, Source Reduction Techniques, Process and equipment optimization, reuse, recovery, recycle, raw material substitution, Elements of LCA, Life Cycle Costing, Eco-labelling, Designs for the Environment, International Environmental Standards, ISO 14001, Environmental Audit.

UNIT-IV **[12 HOURS]**

Green Technology: Introduction, sustainable green manufacturing, Alternative energy resources-wind turbines, hydroelectric, bio-fuels, solar power, fuel cells, and green technology systems. Case studies on cleaner production, Life Cycle assessment and Green buildings.

REFERENCE BOOKS

1. Prasad Modak, C.Visvanathan and Mandarparasnis, "Cleaner Production Audit", Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok, 1995.
2. Environmental System Reviews, No.38, Asian Institute of Technology, Bangkok.
3. Paul L Bishop, " Pollution Prevention: Fundamentals and Practice ", McGraw-Hill International, 2000
4. Green Building Rating System for New Construction and Major Renovations (LEED-NC), Version 2.2, October 2005.

B18CE7053	Geometric Design of Roads	L	T	P	C
Duration: 16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7053	**CO1**	**3**	**3**	**3**	**2**						**1**		**1**	**3**	**2**	**3**	**2**
	CO2	**3**	**3**	**3**	**2**			**2**		**3**	**3**			**3**	**3**	**3**	**2**
	CO3	**3**	**3**	**2**	**2**		**1**			**2**	**1**			**3**	**3**	**3**	**2**
	CO4	**3**	**3**			**2**					**2**	**3**	**2**	**3**	**3**		**1**

Course Contents:

UNIT-I **[12 HOURS]**

Introduction: Importance of Geometric Design, Geometric Controls and Criteria as per IRC and AASHTO standards and specifications, PCU Concepts, factors controlling PCU for different design purpose. Pavement surface characteristics – friction – skid resistance–Problems – pavement unevenness - light reflecting characteristics, Camber – objectives – types of camber – methods of providing cambers in the field – problems, Carriage way, Krebs, Medians, Road margins, Roadway, Right of way, Design of Road speed breaker as per latest IRC provisions.

UNIT-II **[12 HOURS]**

Sight Distance: Importance-Types, Stopping Sight Distance, Overtaking Sight Distance, Criteria for Sight Distance requirements, Sight distance at uncontrolled intersection, derivation, factors affecting sight distance, IRC standards and problems on above.

UNIT-III **[12 HOURS]**

Horizontal Alignment: Definition, Design Speed, Horizontal Curves, Super elevation, Radius of Horizontal Curve, Assumptions ,problems, method of providing super elevation for different curves, Widening of Pavement on Horizontal Curves, objectives – Mechanical widening – psychological widening, Horizontal Transition Curve, objectives, ideal requirements, Method of evaluating length of transition curve, Set-back distance on horizontal curve, Curve Resistance and problems on above.

UNIT-IV **[12 HOURS]**

Vertical Alignment: Gradient – Types of gradient – Design criteria of summit and valley curve – Design of vertical curves based on SSD – OSD – Night visibility considerations – Design standards for hilly roads – problems on the above. Principle – At-grade and Grade separated junctions – Types – Un-channelized Intersections, Channelized Intersections, and Rotary Intersection – Problems, Signalized Intersections.

REFERENCE BOOKS

1. S. K. Khanna, C. E. G. Justo and A. Veeraragavan, —Highway Engineering‖, Revised 10th Edition, Nem Chand and Bros, Roorkee, 2014.
2. R. Srinivasa Kumar, —Textbook of Highway Engineering‖, Universities Press (India) Private Ltd., 2012.
3. L. R. Kadiyali& N. B. Lal, —Princple and Practice of Highway Engineering‖, Khanna Publications, 2005.
4. Relevant IRC Publications –such as IRC99, IRC-35, IRC-82, etc.

B18CE7054	Open Channel Hydraulics	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Hydraulic & Hydraulic Machines.

Course Objectives:

1. Understand the different types of Flows.
2. Understand the Critical flow depth measurements.
3. Understand the different Flow Profiles.
4. Understand the concept of Hydraulic Jumps.

Course Outcomes:

1. Design of Open channels for uniform flow, critical flow, and gradually varied flow.
2. Analyse and solve practical problems on Critical Flow.
3. Analyse the problems on flow profiles,
4. Explain about concept of rapidly varied flow, of hydraulic jump and its applications as energy dissipater.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7054	CO1	3	3	3	1								3	3	3	3	3
	CO2	3	2	3	2								3	3	3	3	3
	CO3	3	2	3	2								3	3	3	3	3
	CO4	3	2	3	2			1					3	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

Introduction:Difference between pipe flow and open channel flow, classification of flow, energy equation (No numerical problems), momentum equation (No numerical problems), kinetic energy and momentum factors (Only theoretical concepts).

Uniform Flow:Concepts, uniform flow equations, conveyance and hydraulic exponent for uniform flow, design of channels for uniform flow (trapezoidal channel only).

UNIT-II [12 HOURS]

Critical Flow: Concept of specific Energy – Classification of flow. Design of channel, Section Factor, Hydraulic exponent for critical flow critical depth as a flow measurement.

Gradually Varied Flow: Concepts, GVF equation, its different forms, Basic assumptions, Dynamic equation (No numerical problems), Characteristics of flow profile and classification.

UNIT-III [12 HOURS]

Analysis of flows profiles, Method of singular point and transitional depth, Methods of computation. Gradually Varied Flow Computations: Different methods, direct integration method, Bress's Solution, Chow's solution, direct method, standard step method (No numerical problems).

UNIT-IV [12 HOURS]

Rapidly Varied Flow:Concepts, hydraulic jump in rectangular channels, classification of jumps, characteristics of jump – length location height, application of hydraulic jump stilling basins, Hydraulic jump in rectangular channels, Sloping channels, Jump in non-rectangular channels, application of hydraulic jump as energy dissipater.

REFERENCE BOOKS:

1. Subramanya , Open Channel Hydraulics, Tata McGraw Hill Publishing Co Ltd, New Delhi
2. Madan Mohan Das, Open Channel Flow ,Prentice Hall of India Pvt. Ltd., New Delhi, 2008 Edition.
3. Rajesh Srivastava , Flow through Open Channels , Oxford Press, New Delhi 2008 Edition.
4. French , Open Channel Hydraulics, McGraw Hill Book Company, New Delhi.
5. Modi and Seth , Fluid Mechanics, Standard Book Home, New Delhi.
6. Henderson , Open Channel Hydraulics, Mr.Millan Publishing Co. Ltd., New York.
7. VenTeChow , Open Channel Hydraulic, McGraw Hill Book Company, New Delhi.

B18CE7061	Numerical Methods in Civil Engineering	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

Structural Analysis

Course Objectives:

1. Understand the different linear simultaneous equation.
2. Understand the development of algorithm by using various methods.
3. Understand New Marks method for Computation of beams.
4. Understand the Finite difference method for analyse the beams.

Course Outcomes:

1. Develop a flow charts using various Linear Simultaneous equations.
2. Develop an algorithm using Trapezoidal and Simpsons Rule.
3. Development of algorithm and application of solution of ordinary differential equations.
4. Identify the applications of Finite difference method for the analysis of beams.

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
B18CE7061	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-I [12 HOURS]

Introduction: Historical development of Numerical techniques, role in investigations, research and design in the field of civil engineering. Development of algorithm/ flow charts for following methods for solution of linear simultaneous equation:

a) Gaussian elimination method, b) Gauss-Jordan matrix inversion method,

c) Gauss-Siedel method and d) Factorization method.

Application of solution of linear system of equations to civil engineering problems :Slope deflection method applied to beams, frames and truss analysis

UNIT-II [12 HOURS]

Application of Root Finding to Civil Engineering Problems : Development of algorithm for a) Bisection method and b) Newton-Raphson method and its applications for solution of nonlinear algebraic and transcendental equations from problems in hydraulics, irrigation engineering, structural engineering and environmental engineering.

Application Of Numerical Integration For Solving Simple Beam Problems:Development of algorithm for a) Trapezoidal rule and b) Simpson's one third rule and its application for computation of area of BMD drawn for statically determinate beams.

UNIT-III [12 HOURS]

New Marks method for computation of slopes and deflections in statically determinate beams.

Development of algorithm and application of solution of ordinary differential equation to civil engineering problems by

a) Euler's method b) Runge Kutta 4th order method

UNIT-IV [12 HOURS]

Application of Finite Difference Technique in Structural Mechanics: i.Introduction, expression of derivatives by finite difference: backward differences, forward differences and central differences. ii. Application of finite difference method for analysis of a) statically determinate beams, b) statically indeterminate beams.

Application of Finite difference technique in structural mechanics: a) Buckling of columns, b) Beams on elastic foundation

REFERENCE BOOKS:

1. Chapra S.C and R.P.Canale , Numerical Methods for Engineers, McGraw Hill publishers
2. N.KrishnaRaju and K.U.Muthu , Numerical Methods in Engineering Problem, McMillan Ltd
3. Iqbal.H.Khan,Q.Hassan ,Numerical Methods for Engineers and scientists, Galgotia-New Delhi

4. PallabGhosh ,Numerical Methods in Computer Program in C++, Prentice Hall of India Private Limited, New Delhi
5. Numerical Methods for engineers Using MAT LAB and C-I Edition Schilling Thomson Publications

B18CE7062	**Earth & Earth Retaining Structures**	L	T	P	C
Duration: 16weeks		2	1	0	3

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	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE	CO1	**3**	**1**	**1**	**2**					**1**				**3**	**3**	**3**	**3**

7062	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**

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Course Contents:

UNIT-I [12 HOURS]

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 cohesion less soils, Influence of movement on earth pressure stresses due to compaction and surcharge loads.

UNIT-II [12 HOURS]

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.

UNIT-III [12 HOURS]

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.

UNIT-IV [12 HOURS]

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.

REFERENCE BOOKS:

1. Braja M. Das ,Principles of Foundation Engineering.
2. Bowles, JE , Foundation analysis and design , McGraw Hill.
3. Terzaghi, K and Rolph, B.peck , Soil Mechanics in Engineering Practice, 2nd Edn., John Wiley &Co. publishers

4. Prakash.S ,Analysis and Design of Foundations and Retaining Structures,SarithaPrakashan, Meerut.
5. 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

B18CE7063	**Urban Transport and Smart City**	L	T	P	C
Duration: 16weeks		2	1	0	3

Prerequisites:

High Way Engineering

Course Objectives:

1. Understand the methods of data collection and analysis of Data
2. Introducing four stages of urban transportation planning i.e., trip generation, trip distribution, and mode choice modelling and route assignment.
3. Integrating land use with transportation and compare land use models
4. To educate students about the various types of smart cities, technologies adopted for the development.

Course Outcomes:

1. Illustrate the transportation planning process activities
2. Analyse the required data by performing Transportation surveys
3. Give exposure to land-use transport models.
4. Assess applicability of land use models for solving urban transport problems, Enumerate the need, technologies contributing to development of smart city..

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P02	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO2	PSO3	PSO4
B18CE 7063	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

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Course Contents:

UNIT-I [12 HOURS]

Introduction: -concepts and definitions, scope and elements of urban transport planning, Interdependency of land use and traffic, Systems approach to urban planning, Stages in urban Transport planning, Difficulties in transport planning, Urban Transport planning for small and medium sized cities.

Transport Surveys:Definition of Study Area Zoning, Types of Movements, and Types of Surveys, Transport modelling, Transport demand and supply- Traffic surveys for mass transit system planning.

UNIT-II [12 HOURS]

Trip Generation:Factors governing trip generation and attraction, Application of Regression Analysis Category Analysis, Numerical examples

Trip Distribution - Basis of Trip Distribution, Presentation of Trip-Distribution Data, Gravity Models and synthetic models of Trip Distribution, Calibration of Gravity Model, Numerical examples

UNIT-III [12 HOURS]

Modal Split:Factors affecting modal split, Earlier Modal Split Models, recent developments in modal split analysis.

Traffic Assignment and Evaluation: Principles of traffic assignment; Route Assignment Techniques, All-or-Nothing Assignment, Multipath Traffic Assignment, Capacity-Restrained Traffic Assignment, Need for evaluation, Economic evaluation.

UNIT-IV [12 HOURS]

Land use Transport Models: Introduction, Selection of Land use models, Lowry Derivative Model, Garin-Lowry Model, Matrix operations for simplifying Computations, Applications in India.

Smart Cities: Definition, Need for smart city, factors responsible for smart city, Environmental, Economical and technological factors, different technologies adopted for development of smart cities, various types of smart cities across the world- Case studies

REFERENCE BOOKS

1. Ortuzar, J.D.D. and Willumsen, L.G. "Modelling Transport", John Wiley & Sons, 1990.
2. Hutchinson, B.G., "Principles of Urban Transport Systems Planning", McGraw Hill Book Company, 1974.
3. Kadiyali, L.R., "Traffic Engineering and Transport Planning" Khanna Publishers, New Delhi, 2006.
4. Papacostas, C.A., 'Fundamentals of Transportation Engineering', Prentice-Hall of India Private Limited, New Delhi - 2000.
5. Institute of Traffic Engineers - An Introduction to Highway Transportation Engineering' New York., 1982
6. M.J.Bruton , Introduction to Transportation Planning, Hutchinson of London Ltd.

B18CE7064	**Environmental Assessment Methodologies**	L	T	P	C
Duration:16 Wks		2	1	0	3

Prerequisites:

Knowledge in Water Supply Engineering and Waste Water Treatment, Solid and Hazardous Waste Management, Air and Noise Pollution control, Industrial Waste Water Treatment

Course Objectives:

1. To provides instruction in the theory and methods of environmental impact assessment (EIA).
2. To Gain a critical understanding of the use, strengths, and limitations of EIA, and develop working familiarity with EIA methods and analytic techniques.
3. To use for professional planning for different ways which includes evaluation of proposed public and private development projects, government policies and programs.

Course Outcomes:

1. Strengthen understanding of the impacts related to developing projects on Environment, culture and socio-economic environment.
2. Understanding the methodology for preparation of a systematic EIA report.
3. Learn to discuss adaptive management and monitoring as follow up activities.

4. Through case studies, students get exposed to a variety of different resettlements, scenarios, challenges and solutions.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18C E 7064	CO1	3	3	2	3	3	-	-	-	2	-	-	3	3	3	3	3
	CO2	3	3	2	3	2	-	-	-	2	-	-	3	3	3	3	3
	CO3	3	3	2	1	2	-	2	-	2	-	-	3	3	3	3	3
	CO4	3	3	1	2	2	-	2	-	2	-	-	3	3	3	3	3

Course Contents:

UNIT-I [12 HOURS]

Introduction: Environmental Impact Assessment (EIA), Historical development of Environmental Impact Assessment - Environmental Impact Statement (EIS) - Environmental Risk Assessment (ERA) - Legal and Regulatory aspects in India - Types and limitations of EIA - Terms of Reference in EIA- Issues in EIA - national - cross sectorial - social and cultural.

UNIT-II [12 HOURS]

Components and Methods & Quality Control: Components - screening - setting - analysis - prediction of impacts - mitigation. Matrices - Networks - Checklists. Importance assessment techniques - cost benefit analysis - analysis of alternatives - methods for Prediction and assessment of impacts - air - water - soil - noise - biological - cultural - social - economic environments.

Standards and guidelines for evaluation, Public Participation in environmental decision making, Trends in EIA practice and evaluation criteria - capacity building for quality assurance

UNIT-III [12 HOURS]

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-IV [12 HOURS]

Case Studies of EIA of Developmental Projects- EIA for Water resource developmental projects, Highway projects: Nuclear- Power plant projects, Mining project (Coal, Iron ore), Thermal Power Plant, Infrastructure Construction Activities.

RERERENCE BOOKS:

1. Canter, L.W., "Environmental Impact Assessment ", McGraw Hill, New York, 1996.
2. Petts, J., "Hand book of Environmental Impact Assessment Vol. I and II ", Blackwell Science, London, 1999.
3. The World Bank Group. "Environmental Assessment Sourcebook Vol. I, II and III ", the World Bank.
4. Guidelines for EIA of developmental Projects Ministry of Environmentand Forests, GOI.

B18CE7070	Design and Drawing of Hydraulic Structures	L	T	P	C
Duration: 16weeks		1	0	2	3

Prerequisites:

Hydraulic structures

Course Objectives:

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

Course Outcomes:

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

Mapping of Course Outcomes with programme Outcomes

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

Code														1			
B18CE 7070	CO1	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO2	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**
	CO3	**3**	**3**	**3**	**3**		**2**				**1**	**3**	**3**	**3**	**3**	**3**	**3**

Course Contents:

Design and Drawing with all the three views of:

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

REFERENCE BOOKS:

1. R.K.Sharma , Textbook of Irrigation Engineering and Hydraulic Structures-, oxford and IBH Publishing co., New Delhi,2002
2. G.L.Aswa , Irrigation and water resource engineering, New Age International publishers New Delhi, 2005
3. Modi P. N. ,Irrigation, water resources and water power engineering, Standard book house, New Delhi.
4. C. SathyanarayanaMurthy ,Design of minor irrigation and canal structures, Wiley eastern limited, New Delhi, 1990
5. Dr. N. Balasubramanya ,Hydraulic structures & Irrigation Design Drawing , Tata Mcgraw-Hill Education Pvt. Ltd., New Delhi

B18CE7080	**Highway and Water Supply Project With DPR**	**L**	**T**	**P**	**C**
Duration:16 Weeks		1	0	2	3

Prerequisites:

Highway Engineering and Environmental Engineering

Course Objectives:

1. To carry out survey for water supply to identifies and locate source and treatment plant
2. To carry out survey for sanitary system for sewer lines and treatment plant

3. To carry out survey to plan a safe highway network
4. To carry out the survey to plan for future development and anticipated traffic Planning of highway

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Course Outcomes:

1. Conduct the survey for water supply to identifies and locate source
2. Conduct the survey for sanitary system for sewer lines and treatment
3. Conduct the survey to plan a safe highway network
4. Conduct the survey to plan for future development and anticipated traffic Planning of highway

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO 1	P0 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O 1	PS O2	PS O3	PS O4
B18CE 7080	CO1	3	3	3	3	3							3	3	3	3	3
	CO2	3	3	3	3	3							3	3	3	3	3
	CO3	3	3	3	3	3		3					3	3	3	3	3
	CO4	3	3	3	3	3		3					3	3	3	3	3

Course Contents:

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

Water Supply and Sanitary Project:

Examination of sources of water supply, Calculation of quantity of water required based on existing and projected population. Preparation of map by any suitable method of surveying (like plane tabling), location of sites for treatment plants, ground level and overhead tanks, pipe lines underground drainage system surveys for laying the sewers.

Highway project: Preliminary and detail investigations for a New alignment of a road between two obligatory points (minimum1KM to 1.5 KM stretch). The investigation shall consists 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 design for traffic and design speed is

assumed. Drawing shall include, key plan initial alignment and final alignment, longitudinal sections and Cross Sections along final alignment, typical cross sections of roads.

REFERENCES BOOKS:

1. S.K.Garg , Water supply Engineering , Khanna Publishers
2. B C Punima and Ashok Jain , Environmental Engineering I
3. khannaS.K&C.E.G.Justo , Highway engineering,Nem Chand and Bros,Roorkee

B18CE7090	**Field Visit**	L	T	P	C
Duration:16 Weeks		0	0	3	3

Description of the course:

Field Visit consist of taking the students for visit to field with respect to the various courses studied in civil engineering. The students with the concepts of different courses studied will understand the practical applications of civil engineering during the visit to various industries, construction works and other activities related to the field of 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
B18CE 7090	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

VIII Semester

B18CE8010	Intership (Practical)	L	T	P	C
Duration:16 Weeks		0	0	3	3

Description of the course:

Intership (Practical) consists ofundergoing through 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 will complete the intership study and present the report of intership taken up in the context of civil engineering.

Mapping of Course Outcomes with programme Outcomes

Course Code	POS/ COs	PO1	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO 4
B18CE 8010	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

B18CE8020	Project Work With Seminar (Term Work)	L	T	P	C
Duration:16 Weeks					8

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	P02	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO3	PSO 4
B18CE 8020	CO	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

B18CE8030	MOOCS (Massive Open Online Courses) Certification Course	L	T	P	C
Duration:16 Weeks					3

Description of the course:

Massive Open Online Courses (MOOCS) certification courses consists of taking up of course work of different engineering aspects available as Online courses in the context of advanced topics of civil engineering. Every student after undergoing the online courses of prescribed duration, will submit the certificatIon of the online courses undergone for evaluation.