# SHRI VENKATESHWARA UNIVERSITY



# SYLLABUS

## B.TECH
## CIVIL ENGINEERING
## VI<sup>TH</sup> SEMESTER
### (FOUR YEARS DEGREE PROGRAMME)

### (W.E.F. 2019-20)

## SCHOOL OF ENGINEERING & TECHNOLOGY

# Civil Engineering

## SEMESTER-VI

| Sl. No. | Subject Codes | Subject | Periods | | | Evaluation Scheme | | | | End Semester | | Total | Credit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | CT | TA | Total | PS | TE | PE | | |
| 1 | SCE-601 | Engineering Economics, Estimation & Costing | 2 | 1 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 2 | SCE-602 | Construction Engineering & Management | 2 | 1 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 3 | SCE-603 | Design of RCC Structures | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 4 | SCE-604 | Computer Aided Design in Civil Engineering | 3 | 1 | 0 | 20 | 10 | 30 | | 70 | | 100 | 4 |
| 5 | SCE-605 | Intelligent Transportation Systems | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 6 | SCE-606 | Railway Engineering | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 7 | SOE-061 | Sociology, Society and Culture | 3 | 0 | 0 | 20 | 10 | 30 | | 70 | | 100 | 3 |
| 8 | SCE-611 | Engineering Economics, Estimation & Costing Lab | 0 | 0 | 4 | | | | 25 | | 25 | 50 | 2 |
| | | Total | | | | | | | | | | 750 | 24 |

| SCE-601 | Engineering Economics, Estimation & Costing | 2L:1T:0P | 3 credits |
|---|---|---|---|

**Module 1**: Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro-economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes (3 lectures)

**Module 2**: Public Sector Economics –Welfare, Externalities, Labour Market. Components of Monetary and Financial System, Central Bank –Monetary Aggregates; Commercial Banks & their

functions; Capital and Debt Markets. Monetary and Fiscal Policy Tools & their impact on the economy – Inflation and Phillips Curve. (2 lectures)

**Module 3:** Elements of Business/Managerial Economics and forms of organizations. Cost & Cost Control –Techniques, Types of Costs, Lifecycle costs, Budgets, Break even Analysis, Capital Budgeting, Application of Linear Programming. Investment Analysis – NPV, ROI, IRR, Payback Period, Depreciation, Time value of money (present and future worth of cash flows). Business

Forecasting – Elementary techniques. Statements – Cash flow, Financial. Case Study Method. (3 lectures)

**Module 4:** Indian economy - Brief overview of post-independence period – plans. Post reform Growth, Structure of productive activity. Issues of Inclusion – Sectors, States/Regions, Groups of people (M/F), Urbanization. Employment–Informal, Organized, Unorganized, Public, Private. Challenges and Policy Debates in Monetary, Fiscal, Social, External sectors. (2 lectures)

**Module 5:** *Estimation /* Measurements for various items- Introduction to the process of Estimation; Use of relevant Indian Standard Specifications for the same, taking out quantities from the given requirements of the work, comparison of different alternatives, Bar bending schedules, Mass haul Diagrams, Estimating Earthwork and Foundations, Estimating Concrete and Masonry, Finishes, Interiors, MEP works; BIM and quantity take-offs; adding equipment costs; labour costs; rate analysis; Material survey-Thumb rules for computation of materials requirement for different materials for buildings, percentage breakup of the cost, cost sensitive index, market survey of basic materials. Use of Computers in quantity surveying (7 lectures)

**Module 6:** Specifications-Types, requirements and importance, detailed specifications for buildings, roads, minor bridges and industrial structures. (3 lectures)

**Module 7:** Rate analysis-Purpose, importance and necessity of the  same,  factors affecting, task work, daily output from different equipment/ productivity. (3 lectures)

**Module 8:** Tender- Preparation of tender documents, importance of inviting tenders, contract types, relative merits, prequalification. general and special conditions, termination of contracts, extra work and Changes, penalty and liquidated charges, Settlement of disputes, R.A. Bill & Final Bill, Payment of advance, insurance, claims, price variation, etc. Preparing Bids- Bid Price buildup: Material, Labour, Equipment costs, Risks, Direct & Indirect Overheads, Profits; Bid conditions, alternative specifications; Alternative Bids. Bid process management (6 lectures)

**Module 9:** Introduction to Acts pertaining to-Minimum wages, Workman's compensation, Contracts, Arbitration, Easement rights. (1 lecture)

*Term Work Assignments may include:*
1. Deriving an approximate estimate for a multistoried building by approximate methods.
2. Detailed estimate for the following with the required material survey for the same.
   a. Ground plus three storied RCC Framed structure building with blockwork walls
   b. bridge with minimum 2 spans
   c. factory building
   d. road work

   e. Ground plus three storied building with load-bearing wallsg Cost of cross drainage work
   f. finishes, MEP works for (f) above

3. Preparation of valuation report in standard Government form.
4. Assignments on rate analysis, specifications and simple estimates.
5. Detailed estimate of minor structure.
6. Preparation of Bar bending schedule.

   a.

*Text/Reference Books:*
1. Mankiw Gregory N. (2002), *Principles of Economics,* Thompson Asia
2. V. Mote, S. Paul, G. Gupta(2004), *Managerial Economics,* Tata McGraw Hill
3. Misra, S.K. and Puri (2009), *Indian Economy,* Himalaya
4. Pareek Saroj (2003), *Textbook of Business Economics,* Sunrise Publishers
5. M Chakravarty, Estimating, Costing Specifications & Valuation
6. Joy P K, Handbook of Construction Management, Macmillan
7. B.S. Patil, Building & Engineering Contracts
8. Relevant Indian Standard Specifications.
9. World Bank Approved Contract Documents.
10. FIDIC Contract Conditions.
11. Acts Related to Minimum Wages, Workmen's Compensation, Contract, and Arbitration
12. Typical PWD Rate Analysis documents.
13. UBS Publishers & Distributors, Estimating and Costing in Civil Engineering: Theory and Practice including Specification and Valuations,2016
14. Dutta, B.N., Estimating and Costing in Civil Engineering (Theory & Practice), UBS Publishers, 2016

*On completion of the course, the students will:*
- Have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses
- Be able to perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.
- Be able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.
- Be able to understand the technical specifications for various works to be performed for a project and how they impact the cost of a structure.
- Be able to quantify the worth of a structure by evaluating quantities of constituents, derive their cost rates and build up the overall cost of the structure.
- Be able to understand how competitive bidding works and how to submit a competitive bid proposal.

| SCE-602 | Construction Engineering & Management | 2L:1T:0P | 3 credits |
|---------|--------------------------------------|----------|-----------|

**Module 1**: *Basics of* Construction- Unique features of construction, construction projects- types and features, phases of a project, agencies involved and their methods of execution;

**Module 2**: Construction project planning- Stages of project planning: pre-tender planning, pre-construction planning, detailed construction planning, role of client and contractor, level of detail. Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; Techniques of planning- Bar charts, Gantt Charts. Networks: basic terminology, types of precedence relationships, preparation of CPM networks: activity on link and activity on node representation, computation of float values, critical and semi critical paths, calendaring networks. PERT- Assumptions underlying PERT analysis, determining three time estimates, analysis, slack computations, calculation of probability of completion.

**Module 3:** Construction Methods basics: Types of foundations and construction methods; Basics of Formwork and Staging; Common building construction methods (conventional walls and slabs; conventional framed structure with blockwork walls; Modular construction methods for repetitive works; Precast concrete construction methods; Basics of Slip forming for tall structures; Basic

construction methods for steel structures; Basics of construction methods for Bridges.

**Module 4:** Construction Equipment basics*:* Conventional construction methods Vs Mechanized methods and advantages of latter; Equipment for Earthmoving, Dewatering; Concrete mixing, transporting & placing; Cranes, Hoists and other equipment for lifting; Equipment for transportation of materials. Equipment Productivities

**Module 5:** Planning and organizing construction site and resources- Site: site layout including enabling structures, developing site organization, Documentation at site; Manpower: planning, organizing, staffing, motivation; Materials: concepts of planning, procurement and inventory control; Equipment: basic concepts of planning and organizing; Funds: cash flow, sources of funds; Histograms and S-Curves. Earned Value; Resource Scheduling- Bar chart, line of balance technique, resource constraints and conflicts; resource aggregation, allocation, smoothening and leveling. Common Good Practices in Construction

**Module 6:** *Project Monitoring & Control-* Supervision, record keeping, periodic progress reports, periodical progress meetings. Updating of plans: purpose, frequency and methods of updating. Common causes of time and cost overruns and corrective measures. Basics of Modern Project management systems such as Lean Construction; Use of Building Information Modelling (BIM) in project management; Quality control: concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control. Safety, Health and Environment on project sites: accidents; their causes, effects and preventive measures, costs of accidents, occupational health problems in construction, organizing for safety and health

**Module 7:** *Contracts Management basics:* Importance of contracts; Types of Contracts, parties to a contract; Common contract clauses (Notice to proceed, rights and duties of various parties, notices to be given, Contract Duration and Price. Performance parameters; Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination. Changes & variations, Dispute Resolution methods.

**Module 8:** *Construction Costs: Make-up of construction costs;* Classification of costs, time-cost trade-off in construction projects, compression and decompression.

*Text/Reference Books:*
1. Varghese, P.C., "*Building Construction*", Prentice Hall India, 2007.
2. *National Building Code,* Bureau of Indian Standards, New Delhi, 2017.
3. Chudley, R., *Construction Technology*, ELBS Publishers, 2007.
4. Peurifoy, R.L. Construction Planning, Methods and Equipment, McGraw Hill, 2011
5. Nunnally, S.W. Construction Methods and Management, Prentice Hall, 2006
6. Jha, Kumar Neeraj., Construction Project management, Theory & Practice, Pearson Education India, 2015
7. Punmia, B.C., Khandelwal, K.K., Project Planning with PERT and CPM, Laxmi Publications, 2016.

| S. No | Module (No of Lectures in brackets) | Tutorials |
|---|---|---|
| 1 | Basics of Construction (2) | |
| 2 | Construction Planning (6) | Develop a WBD structure for the construction of one storeyed building; Develop a bar chart for the construction of this building, including finishing activities, assuming reasonable activity durations. |
| 3 | Construction Methods basics (6) | Develop a CPM chart for a 5 span bridge on open foundations. Develop a comparative table for a 10-storeyed building constructed by at least three different methods, listing their pros and cons. |
| 4 | Construction Equipment Basics (3) | Develop a Gantt Chart for the construction of a two storeyed precast framed structure, including open foundations, along with list of equipment resources, assuming reasonable quantities and productivities. Develop a bar chart for concreting 1500 sq.m. of a 15cm. thick slab using various equipment for production to placing of concrete at 3m height above ground level; show all equipment resources required, along with a site layout. |
| 5 | *Planning and Organizing Construction Site and Resources(4)* | *For the construction of a typical 3 storeyed, framed structure with 400 sq.m. area per floor develop the histograms for the various resources required, showing all intermediate calculations; also, draw S-curves for concrete placing and blockwork doneover the period.* |

| S. No | Module (No of Lectures in brackets) | Tutorials |
|-------|--------------------------------------|-----------|
| 6 | Project Monitoring and Control (4) | Write a 500-word note on the advantages of Lean Construction method over conventional project management systems. Write a 500-word note on the Safety and Health precautions you would take for a typical 3 storeyed building with 400 sq. m. plinth area. |
| 7 | Contract Management basics (3) | Assuming a 4 month delay in a construction contract of 24 months duration, form 3 groups for arguing the case for or against levying penalty on the contractor; Group A to formulate the contract conditions, Group B to act as Client and Group C to act as the Contractor. One person to act as Arbitrator/ Judge. |
| 8 | Construction Costs (2) | Refer to a Standard Schedule of Rates of any PWD (available on the Net), develop the approximate cost of a 3 storey, 400 sqm plinth area building. |
| | Total: 30 Lectures | 15 Tutorials |

*On completion of the course, the students will have:*
- An idea of how structures are built and projects are developed on the field
- An understanding of modern construction practices
- A good idea of basic construction dynamics- various stakeholders, project objectives, processes, resources required and project economics
- A basic ability to plan, control and monitor construction projects with respect to time and cost
- An idea of how to optimise construction projects based on costs
- An idea how construction projects are administered with respect to contract structures and issues.
- An ability to put forward ideas and understandings to others with effective communication processes

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| SCE-603 | DESIGN OF RCC STRUCTURES | 3L:0T:0P | 3 credits |
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**Objectives:** To introduce the students to the fundamentals of reinforced concrete design with emphasis on the design of rectangular and T beams, short and slender columns, slabs, and footings and foundations. In addition, student will learn how to analyze and design reinforced concrete structural members under bending, shear, and/or axial loads according to the ACI building code requirements (including computer applications).

**Outcome:**

Students who successfully complete this course will be able to:

1. Identify and compute the main mechanical properties of concrete and steel.
2. Identify and calculate the design loads and distribution.
3. Apply the strength method to design R.C. structural members.
4. Analyze and design R.C. beams for flexure and shear
5. Analyze and design short and slender R.C. columns

| S.N. | Unit number | Topics | Sub Topics |
|------|-------------|--------|------------|
| 1 | 1 | **Concrete Making materials** | Concrete Making materials , mix design , Properties of concrete and reinforcements , testing of concrete , Introduction to Various Design Philosophies, Design of Rectangular Singly and Doubly Reinforced Sections by Working Stress Method. |
| 2 | 2 | **Limit State Design Method** | Assumptions in Limit State Design Method, Design of Rectangular Singly and Doubly Reinforced beams, T-beams, L-beams by Limit State Design Method. |
| 3 | 3 | **Behavior of RC beam** | Behavior of RC beam in Shear, Shear Strength of beams with and without shear reinforcement, Minimum and Maximum shear reinforcement, design of beam in shear, Introduction to development length, Anchorage bond, flexural bond. (Detailed Examples by Limit State Design Method), Failure of beam under shear, Concept of Equivalent Shear and Moments. |
| 4 | 4 | **Design of one way and two way solid slabs** | Design of one way and two way solid slabs by Limit State Design Method, Serviceability Limit States, Control of deflection, cracking and vibrations |
| 5 | 5 | **Design of Columns** | Design of Columns by Limit State Design Method- Effective height of columns, Assumptions, Minimum eccentricity, Short column under axial compression, requirements for reinforcement, Column with helical reinforcement, Short column under axial load and uni-axial bending, Design of columns under bi-axial loading by Design Charts. |

# SCE-604
# COMPUTER AIDED DESIGN IN CIVIL ENGINEERING

**Objectives:** All major manufacturing companies and their suppliers use CAD software to design parts and evaluate them with respect to fit, form and function. This course introduces students to CAD software in general and SolidWorks 2016 software in particular. Students will learn theory and practice related to solid modeling, assembly modeling, drafting, parametric modeling, freeform surface modeling, and use of CAD models for some downstream engineering activities such as motion simulation and manufacturing.

**3.** On completing the course, the student will be able to:

**4.** 1. Use basic and advanced features of current CAD software.

**5.** 2. Understand how CAD technology can be leveraged in the design process.

**Outcome:**

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

1. Design a part or assembly of parts using Computer-Aided Design software.
2. Use parametric modeling techniques to reflect engineering requirements.
3. Apply top-down design principles to model a design.
4. Use motion and interference checking to ensure that parts will not interfere throughout their complete range of motion.
5. Use CAD software collaboratively when designing on a team.
6. Make appropriate selection of CAD functionality to use as tools in the design process.
7. Communicate effectively the geometry and intent of design features.

| S.N. | Unit number | Topics | Sub Topics |
|------|-------------|--------|------------|
| 1 | 1 | **Introduction** | Introduction to CAD/CAED/CAE, Elements of CAD, Essential requirements of CAD, Concepts of integrated CAD/CAM, Necessity & its importance, Engineering Applications |
| | | **Computer Graphics-I** | CAD/CAM systems, Graphics Input devices-cursor control Devices, Digitizers, Keyboard terminals, Image scanner, Speech control devices and Touch, panels, Graphics display devices-Cathode Ray Tube, Random & Raster scan display, Colour CRT monitors, Direct View Storage Tubes, Flat Panel display, Hard copy printers and plotters. |
| | | **Computer Graphics-** | Graphics standards, Graphics Software, Software Configuration, Graphics Functions, Output primitives- Bresenham's line drawing |

| | | II | algorithm and Bresenham's circle generating algorithm 4 |
|---|---|---|---|
| 2 | 2 | **Geometric Transformations:** | World/device Coordinate Representation, Windowing and clipping, 2 D Geometric transformations- Translation, Scaling, Shearing, Rotation & Reflection Matrix representation, Composite transformation, 3 D transformations, multiple transformation. |
| 3 | 3 | **Curves:** | Curves representation, Properties of curve design and representation, Interpolation vs approximation, Parametric representation of analytic curves, Parametric continuity conditions, Parametric representation of synthetic curves-Hermite cubic splines-Blending function formulation and its properties, Bezier curves-Blending function formulation and its properties, Composite Bezier curves, B-spline curves and its properties, Periodic and non-periodic B-spline curves |
| 4 | 4 | **3D Graphics:** | Polygon surfaces-Polygon mesh representations, Quadric and Superquadric surfaces and blobby objects; Solid modeling-Solid entities, Fundamentals of Solid modeling-Set theory, regularized set operations; Half spaces, Boundary representation, Constructive solid geometry, Sweep representation, Color models Application commands for AutoCAD & ProE software. |
| 5 | 5 | **Numerical Methods:** | Introduction, Errors in numbers, Binary representation of Computer Graphics-I numbers, Root finding- Bisection method, Newton Raphson method, Curve fitting-Least square method, Numerical differentiation-Newton's interpolation, Numerical Integration-Trapezoidal and Simpson method  Finite Element Method: Introduction, Principles of Finite elements modeling, Stiffness matrix/displacement matrix, Stiffness matrix for spring system, bar & beam elements, bar elements in 2D space (truss element) |

| SCE-605 | **INTELLIGENT TRANSPORATION SYSTEMS** | **3L:0T:0P** | **3 credits** |
|---------|----------------------------------------|--------------|---------------|

Introduction to Intelligent Transportation Systems (ITS) – Definition of ITS and Identification of ITS Objectives, Historical Background, Benefits of ITS - ITS Data collection techniques – Detectors, Automatic Vehicle Location (AVL), Automatic Vehicle Identification (AVI), Geographic Information Systems (GIS), video data collection. Telecommunications in ITS – Importance of telecommunications in the ITS system, Information Management, Traffic Management Centres (TMC). Vehicle – Road side communication – Vehicle Positioning System; ITS functional areas – Advanced Traffic Management Systems (ATMS), Advanced Traveler Information Systems (ATIS), Commercial Vehicle Operations (CVO), AdvancedVehicle Control Systems (AVCS), Advanced Public Transportation Systems (APTS), Advanced Rural Transportation Systems (ARTS); ITS User Needs and Services – Travel and Traffic management, Public Transportation  Management, Electronic Payment, Commercial  Vehicle Operations, Emergency Management, Advanced Vehicle safety systems, Information Management; 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.

| SCE-606 | **RAILWAY ENGINEERING** | **3L:0T:0P** | **3 credits** |
|---------|-------------------------|--------------|---------------|

Railway track gauge, alignment of railway lines, engineering surveys and construction of new lines, tracks and track stresses; rails, sleepers; ballast; subgrade and formation, rack fittings and fastenings, creep of rails, geometric design of track, curves and super-elevation, points and crossings, track junctions and simple track layouts; rail joints and welding of rails; track maintenance, track drainage; modern methods of track maintenance, rehabilitation and renewal of track; tractive resistance and power, railway stations and yards; railway tunneling; signaling and interlocking; maintenance of railways and high speed trains.

| SOE-061 | **SOCIOLOGY SOCIETY AND CULTURE** | **3L:0T:0P** | **3 credits** |
|---------|-----------------------------------|--------------|---------------|

### 1.  OBJECTIVE:

This is one of the foundation course of Humanities (in Foundation Area 1). It strengthens the interest of the student in social issues and demonstrate both the process and challenge of scientific observationand analysis of social behaviour and social data. It focuses on the understanding of basic concepts and descriptive materials of sociology which is considered a tool for identifying the process of idea and a scientific approach for continuing social observation and analysis.

### 2.  COUSE TOPICS:

**2.1  Unit I:Sociology as a Science** (7 hours)

1. Sociology and common Sense
2. Sociology and current affairs
3. Sociology as a science
4. Logic in sociological inquiry

5. Sociology of action
6. The field and relevance of sociology
7. Positivism

**2.2 Unit II: Society and Culture** (12 hours)
1. Culture and society
2. The structure of culture
- Cultural Traits and complexes
- Subcultures and counter cultures
- Cultural integration
- Cultural relativism
- Real and Ideal culture
- Ethnocentrism
- Xenocentrism
- Cultural lag

**2.3 Unit III: Social Institutions** (17 hours)
1. The concept of varna.
2. The Caste system:
- Origin and characteristics (of caste) as a system
- Hierarchy based on birth
Religious sanctions on social participation
- Caste and subcaste
- Caste conflicts
- Caste councils
- An appraisal of caste system
- Prospects of caste in modern India
3. The Class system:
- What is social class?
- Development of class
- Self-identification and class consciousness
- Class in itself and class for itself
- Class having blue collar status and white collar status
- Industrial class
- Significance of social class
- The future of social classes: From Proletariat to status seekers

**2.4 Unit IV: Environment and Ecology** (10 hours)
1. Conceptualising environment
2. Forest, ecology and society
3. Common Property Resources and its management
4. Significance of forest and environment in modern life
5. Environmental movement with reference to forest and water management

**2.5 Unit V: Issues of modernity** (14 hours)
1. Concept of modernity
2. Tradition Vs Modernity
3. Globalization
- Is globalization new and real?
- Has globalization weakened the state?
- Has globalization led to cultural homogenisation?
- Does globalization lead to a clash of cultures?

**6. READINGS:**

**6.1 Reference Books:**

- Gisbert, P. (2011), Fundamental of Sociology, Orient Blackswan Private Ltd.
- Horton, Paul B. and Hunt, Chester L. (Sixth edition), Sociology, Mc Graw Hill Book Company.
- Haralambos, M. and Heald, R.M. (26th impression, 2004), Sociology: Themes and Perspectives, Oxford University Press, New Delhi.
- Betteille, Andre (2014), sociology: essays on Approach & Method, Oxford Uninversity Press, New Delhi.