

**CIVIL**  
**6<sup>TH</sup> SEM**

COURSE CODE	COURSE TITLE	TEACHING SCHEME			EXAMINATION SCHEME				
		L	T	CREDITS	THEORY		total		
					ESE	PA	ESE	PA	
3360601	DESIGN OF REINFORCED CONCRETE STRUCTURES	3	1	5	70	30	20	30	150
3360602	CONSTRUCTION QUALITY CONTROL & MONITORING	3	0	9	70	30	60	90	250
3360603	CONSTRUCTION PROJECT MANAGEMNETENGINEERING	3	0	5	70	30	20	30	150
3360604	BUILDING SERVICES	3	0	5	70	30	20	30	150
3360605	MAINTANANCE & REHABILATION OF	3	0	5	70	30	20	30	150
3360613	PROJECT-II	0	0	4	-	-	40	60	100
<b>TOTAL</b>			<b>1</b>	<b>1</b>	<b>350</b>	<b>150</b>	<b>180</b>	<b>270</b>	<b>950</b>

**COURSE TITLE: DESIGN OF REINFORCED CONCRETE STRUCTURES**

**(COURSE CODE: 3360601)**

TEACHING AND EXAMINATION SCHEME Teaching			Total Credits			Examination		
Theory Marks			Practical Marks			Total Marks		
L	T	P	C	ESE	PA	ESE	PA	200
03	00	04	0	70	30	40	60	

**UNIT – I :- LIMIT STATE METHOD**

Reinforced Cement concrete , necessity of steel in concrete , normal location of Tension steel in beams , slabs & in footing , Limit State , Limit State of Collapse – Flexure , Shear , Compression , Torsion , Limit State of Serviceability- Deflection , Cracking. , Characteristic Strength of Concrete and Steel , Partial Safety Factor for Concrete and Steel , Characteristic or Working Load , Partial Safety Factor for Load , Limit State or Factored Load

**UNIT – II :-LIMIT STATE OF COLLAPSE: FLEXURE**

Assumptions for Limit State of Collapse due to Flexure , Stress and Strain Diagram of SRRS , Equation ( No Derivation ) related to maximum depth of N.A-  $X_{umax}$  , Actual Depth of N.A-  $X_u$  , Limiting Moment of Resistance-  $M_{lim}$  , Actual Moment of Resistance-  $M_u$  , maximum % limiting steel –  $P_{lim}$  as per IS 456-2000 & Design Aid SP-16 , Balance Section , Under Reinforced Section , Over Reinforced Section , Minimum and Maximum steel in beam and in slab and clear cover as per IS 456-2000(Clause 26.4, 26.5, Table 16) , Numerical to find Moment of Resistance or to find External load carried by SRRS ( Beam & Slab ) , Numerical to find steel area in SRRS ( Beam & Slab ) to resist limit state Bending

Moment , Numerical to find  $M_{lim}$  and  $P_{lim}$  for SRRS ( Beam & Slab ) , Design problem to find size of SRRS Beam and steel area for limit state Bending Moment , Numerical related to 1.6 to 1.9 using ,SP-16-Flexure Chart and Flexure Table

### **UNIT – III :-LIMIT STATE OF COLLAPSE: SHEAR**

Diagonal Tension Crack in Beam due to Shear , Equation related to Limit State of Collapse due to Shear as per IS 456-2000 (Clause 40). IS 456-2000 clauses(26.5.1.5 & 1.6) related to Minimum and Maximum Spacing of Stirrups , minimum shear reinforcement , Numerical to find spacing of stirrups in Beam for the Limit State Shear Force when tension steel in beam is provided straight , Numerical to find spacing of stirrups in Beam for the Limit State Shear Force when tension steel in beam is provided with bent up bars , Clauses (40.2) related to

Limit State of Collapse due to Shear for Slab in IS 456-2000 , Numerical to check the slab shear

### **UNIT – IV :-LIMIT STATE OF SERVICEABILITY**

Span to effective depth ratio , Modification factor for SRRS as per IS 456-2000(Clause 23.2.1, 24. Numerical to check Slab & Beam for Deflection , Maximum and Minimum spacing of Main steel and distribution steel in slab , Maximum and minimum spacing of bars in beam (Clause 26.3) Numerical to check spacing of steel in slab for cracking , Equation to find Development Length of IS 456 -2000(Clause 26.2.1,) , Numerical to find Development Length ,Anchoring reinforcing bars in Tension and in Compression (Clause 26.2.2) , Clauses related to Lap Length of Is 456-2000 (Clause 26.2.5.1)

### **UNIT – V :-DESIGN OF SLAB**

Slab –Spanning in Shorter Span , Steel for Bending Moment, Distribution Steel, Depth of Slab as per Deflection , Effective span as per IS 456-2000 (Clause 22.2) , Dead Load , Live Load on Slab , Shear and Cracking in Slab , Numerical to design and detail Cantilever Slab for Bending Moment , Shear , Deflection , Cracking and for development length for the assigned Floor Finish & Live Load Numerical to design and detail Simply Supported One Way Slab for Bending Moment , Shear , Deflection , Cracking for the assigned Floor Finish & Live Load , Numerical to design and detail One Way Continuous Slab for Bending Moment , Shear , Deflection , Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M and S.F coefficients(Table 12 & 13) , Numerical to design and detail Two Way Simply Supported Slab with and without Torsion Steel for Bending Moment , Shear , Deflection , Cracking for the assigned Floor Finish & Live Load using IS 456 -2000 B.M coefficients (Annexure D) ,\*\*\* Numerical in 2.1 to 2.4 , use of SP-16 is permitted

### **Unit – VI :-DOUBLY REINFORCED BEAM**

Condition for Doubly Reinforced Section , Equation stated in SP-16 for D.R.S , Numerical to analyse DRS to find Moment of Resistance , Numerical to design DRS for the assigned limit state bending moment only , Numerical to design DRS for the assigned Limit state bending moment using SP-16 , Flexure Chart and/or Flexure Table

### **Unit – VII :-FLANGED BEAM**

Conditions for the beam to act as Tee Beam , Width of Flange as per IS 456-2000 (Clause 23.1.2) Equation regarding Tee Beam from IS 456-2000 (Annexure G) , Numerical to find Moment of Resistance of Tee Beam , Numerical to find main steel area in tension of Tee Beam , Numerical to find Limiting Moment of Resistance of Tee Beam using equation of IS 456-2000 and using Flexure Table of Sp-16 regarding Tee beam

**Unit – VIII :- AXIALLY LOADED SHORT COLUMN :**Column , slenderness Limit for Short & Long Column , Minimum Eccentricity in column , condition for axially loaded column , equation for axially loaded short column of IS 456-2000(Clause 25 & 39.3) ,Clauses(26.5.3.1, 26.5.3.2(C ,1-2)) of IS 456-2000 related to % compression steel , numbers of compression bars and its spacing , lateral ties – diameter and pitch , Numerical to find axial load carrying capacity of Square , Rectangular & Circular Column , Numerical to design Square , Rectangular & Circular Column for the assigned limit state compression load

**Unit – IX :-ISOLATED FOOTING**

SBC of Soil , Types of Footing like Isolated foundation , combined footing , raft foundation , pile foundation ,Numerical to design & to detail Isolated Pad and Slope Foundation for assigned limit state compression load of column and SBC of soil for Bending Moment , One Way Shear , Punching or Double Shear , Load Transfer from Column to Footings (Clause 34)

**TEXT Book:** Reinforced Concrete by Dr.H.J.SHAH

**COURSE TITLE: CONSTRUCTION QUALITY CONTROL & MONITORING**

**(COURSE CODE: 3360602)**

TEACHING AND			Total Credits			Examination Scheme		
Theory Marks			Practical Marks			Total		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

**Unit-I :-Total Quality Management (TQM) in Construction**

Concept of quality control, Quality assurance, Quality management. , Aims of TQM , Development and design Concept of TQM ,Accuracy and precision in observation, reading theodolite, digital theodolite, total station, calibration, etc. , Accuracy in calculation, finding area, volume, etc.

**Unit-II :-Construction Quality Control Inspection Program**

Duties, responsibilities, qualification of staff in organization. ,Checklists for Quality of Materials Masonry ,Plastering, Concrete construction- Batching, Mixing, Transporting, Placing, Compaction, Finishing, Curing ,Reinforcement Work , Formwork , Timber & steel construction, Doors & windows, Plumbing & drainage.

**Unit-III :-Statistical Quality Control& Monitoring**

Statistical Quality Control ,Quality Measurement: Attributes and Variables , Statistical Process Control (SPC) Methods , Control Charts for Attributes: p-Charts - Proportion Defective ,c-Charts - Number of Defects Per Unit ,Control Charts for Variables ,Other Types of Attribute-Sampling Plans Acceptance Sampling

**Unit-IV:-Quality References**

Quality standards in construction related to Building materials and other inputs for construction processes. Quality standards for Construction outputs, products and services. Indian Standard Code (a) Methods of referring it (b) Use of IS for quality references ,National Building code (NBC 2005) (a) Why to refer & How to refer (b) Methods of referring it & application. Study of International Organization for Standardization (ISO) (a) ISO-9000, ISO14000 & certification procedures.

**Unit-V :-Sustainable Built Environment- Green Building**

Green building ,Definition – Green Building, Green Construction, Sustainable building ,Goals of Green building ,Advantages and disadvantages ,Strategies, Certification Agencies – GRIHA, LEED ,(Highlights & Criteria) , Life cycle assessment (LCA) ,Siting and structure design efficiency , Energy efficiency , Water efficiency , Materials efficiency , Indoor environmental quality enhancement ,Operations and maintenance optimization , Waste reduction

**TEXT Book:** Total Quality Management By G.KANJI

**COURSE TITLE: CONSTRUCTION PROJECT MANAGEMENT**

**(COURSE CODE: 3360603)**

TEACHING AND			Total Credits			Examination Scheme		
Theory Marks			Practical Marks			Total Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

**UNIT-I :-Construction Project and Organization management**

Construction Project management-importance, Functions, Scope. Organization-Types, Characteristics, Functions, principles. Construction team-Roles, responsibilities and skills of construction team. Stages in Construction. Causes of Project failure.

**UNIT-II :-Tendering and Accounting**

Contract-Introduction, requirement, types. Contract documents and conditions of Contract, Contract agreement. ,Per-qualification of Contract- Importance. Tender-Types, Terms and Conditions, issue procedure, opening, Scrutiny, Acceptance, Rejecting. Prepare tender Notice. Technical terms-Administrative ,approval, Technical Sanction, Issue rate, Competent Authority, Secured Advance,

Mobilization Advance, Heads of accounts in government organization, Original and repair work, Earnest money deposit (EMD) and Security deposit(SD), Accounting terms- Work Abstract, Cash book, Work resister, imprest, accounting for the materials, Measurement book, Muster roll, types of bills and recording. Methods of getting work done in government organization.

### **UNIT-III :-Construction Planning, Scheduling and time management**

Project Planning-methods and factors affecting planning. Scheduling and types of Schedules. Critical path method-Important terms, Basic Rules, Advantages and disadvantages. Examples of CPM network. PERT analysis-Important terms, Advantages and Disadvantages, Examples on PERT. Cost optimization. Introduction and importance of Primavera and MS Project for Construction Project Management.

### **UNIT-IV :-Construction Resource Management**

Material management-Purpose, Objective, material Scheduling, material handling, Storage, safety precautions, Economy Order Quantity, inspection and testing. Job Layout. Labour management-Labour Scheduling, Characteristics, Output of labours, Wages of Workers, Labour Incentives, Labour Welfare, Trade Unions, Trade union act- 1926, Mini Wage act- 1948, Contract labour act-1970,etc Equipment management- equipment Scheduling, Classification of various equipment, Factor affecting selection of construction Equipment, Owning & operating cost of equipment, Inspection & testing of equipment, Maintenance & repair of equipment.

### **UNIT-V:-Human Resource development (HRD) & MIS**

Importance of HRD. Supervisor’s role as trainer & Motivator. Techniques to deal human resources effectively. Professional Ethics in Engineering. Management Information System- Purpose, need, Types, Characteristics, Implementation and Applications.

### **UNIT-VI :-Safety Management**

Safety management-requirement, importance. Causes of accidents and its type. Safety precaution-Excavation work, Demolition, Erection. Safety measures- Scaffolding, Ladder, Piling, Bituminous works.

## **COURSE TITLE: BUILDING SERVICES**

**(COURSE CODE: 3360604)**

<b>TEACHING AND</b>			<b>Total Credits</b>			<b>Examination Scheme</b>		
<b>Theory Marks</b>			<b>Practical Marks</b>			<b>Total Marks</b>		
<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>	<b>ESE</b>	<b>PA</b>	<b>ESE</b>	<b>PA</b>	<b>150</b>
<b>3</b>	<b>0</b>	<b>2</b>	<b>5</b>	<b>70</b>	<b>30</b>	<b>20</b>	<b>30</b>	

#### **Unit – I :-Introduction**

Definitions, Objective and uses of services, Applications of services for different types building Classification of building services ,Types of services and selection of services

#### **Unit – II :-Electrical Services and Layout**

Introduction of electrical services,Technical terms related with electrical wiring ,Conventional symbols for electrical installations and Accessories of wiring,Various system of wiring like wooden casing, cleat wiring, CTS wiring conduit wiring, Various types of insulation, Understand the electrical layout Preparation of electrical layout for a small residence, small work shop, show room, school building, etc.

#### **Unit – III :-Mechanical Services**

Introduction of mechanical services , LIFT (a) Definition, Types of Lifts, Design ,Considerations, Location, Sizes,Component parts- Lift Well, Travel, Pit, Hoist Way, Machine, Buffer, Door Locks, Suspended Rope, Lift Car, Landing Door, Call Indicators, Call Push ELEVATORS (a) Different types of elevators, Freight elevators, Passenger elevators, Hospital elevators,(b) Uses of different types of elevators. DUMBWAITER (a) Different types of Dumbwaiters (b) Uses of different types of Dumbwaiter. CONVEYORS (a) Different types of Conveyors 3.5(b) Uses of different types of Conveyors ESCALATORS (a) Definition, General requirements (b) Locations and Functions (c ) Advantages of Escalators AIR CONDITIONING (a) Definition, Purpose, Principles, Temperature Control, Air Velocity Control, Humidity Control, Air Distribution system, Cleaners, Filters, Spray washers, Electric preceptors, (b) Types of Air Conditioners, (Central type, Window Type, Split Unit)

**Unit – IV :-Lighting and Ventilation**

LIGHTING (a) Introduction (b) Types – Natural and artificial (c ) Requirements of good lighting Day light factors and day penetration (d) Aim of good lighting (e) General principles of openings to afford good lighting (f) Reflection factors, illumination (g) Units of measurements –Lux, candela, Luminous flux, (h) Orientation of buildings – External and Internal reflected components (i) Necessity of artificial lighting (j) Arrangement of luminaries, Distribution of illumination, Utilization factors (k) Temperature rise due to artificial lighting (l) Remedial Measures VENTILATION : (a) Introduction and definition (b) Necessity of Ventilation (c) Types – Natural and Mechanical (d) Factors to be considered in the design of Ventilation (e) General rules for Natural Ventilation (f) Advantages and disadvantages of Mechanical Ventilation (g) Methods of Mechanical Ventilation (i) Combined Systems

**Unit – V :-Fire Protection**

Introduction ,Causes of fire and Effects of fire , General Requirements of Fire Resisting building as per IS and NBC 2005 ,Characteristics of Fire resisting materials ,Maximum Travel Distance ,Horizontal Exit, Roof Exit / Fire Lifts, External Stairs ,Fire Fighting Installations

**Unit – VI :-Acoustic and Sound Insulations**

Characteristics of Sound ,Terminology related to sound- Pitch,Intensity and Tone, Measurement of intensity of Sound ,Behavior of Sound and its effects ,Echoes and Reverberation. Acoustic defects Requirement of good Acoustic ,Principals and factors in Acoustic design,Various sound absorbent Absorption coefficient ,Factors to be followed for noise control in residential building

**Unit – VII :-Miscellaneous services**

Need of Rain water Harvesting for buildings ,Concept of GREEN buildings, Components of GREEN building.Introduction to Grey water ,Significance of Grey water,Components of Grey water system Management of Grey water system

**COURSE TITLE: MAINTENANCE & REHABILITATION OF STRUCTURES**

**(COURSE CODE:3360605)**

Teaching Scheme (InHours)			TotalCredits (L+T+P)			Examination Scheme		
Theory Marks			PracticalMarks			Total Marks		
L	T	P	C	ESE	PA	ESE	PA	150
3	0	2	5	70	30	20	30	

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## **UNIT-I :-MAINTENANCE OF BUILDINGS**

Introduction ,Importance of maintenance , Types of maintenance - daily, weekly, monthly, Annually  
General Maintenance ,Painting of Buildings - Home Electricity System - House plumbing and sanitary system

## **UNIT-II :-REPAIR STRATEGIES**

Causes of distress in structures , Construction and design failures ,Condition assessment and distress-diagnostic techniques , Inspection and evaluating damaged structure.

## **UNIT-III :-DURABILITY AND SERVICEABILITY OF CONCRETE**

Quality assurance for concrete construction based on concrete properties like (a) strength (b) Permeability

(c ) Thermal properties (d) cracking, Effects due to (a) climate (b) temperature (c ) chemicals

(d) corrosion , Design and construction errors ,Effects of cover and cracks

## **UNIT-IV :-MATERIALS AND TECHNIQUES FOR REPAIR**

Materials for Repair - Special concretes and mortar - concrete chemicals - construction chemicals -Expansive cement - polymer concrete - sulphur infiltrated concrete - Ferro cement - Fibre reinforced concrete - Rust eliminators and polymers coating for rebars - foamed concrete - dry pack - vacuum concrete - asphalt sheeting ,Techniques for Repairs - Guniting, grouting and Shotcrete - Epoxy injection

- Mortar-repair for cracks - Jacketing - shoring and underpinning - Methods of corrosion protection (a) corrosion inhibitors (b) corrosion resistant steels

## **UNIT-V :-REPAIR, RETOFITTING AND REHABILITATION**

Repair of - stone, brick and block masonry (Cracks, dampness, efflorescence, joint separation, etc.) - Flooring - Roofs (sloping, flat, pitched, etc.) - Concrete members due to (i) Steel Corrosion (ii) Lack of Bond (iii) shear, tension, torsion, compression failure - Rainwater Leakage in Buildings - Leakage in Basement, toilet area ,Control on Termites (White Ants) in Buildings ,Fungus Decay of wood works in Buildings ,Estimation of Repair and retrofitting.

## **UNIT-VI :-DEMOLITION TECHNIQUES**

Define: Demolition ,Demolition techniques ,(a) Non Engineering Demolition o - Manual Demolition · (b) Engineering Demolition - Mechanical Method 1. (i) Wrecking Ball Method 2. (ii) Pusher Arm technique 3. (iii) Thermic Lance Technique 4. (iv) Non – Explosive Demolition 5. (v) Concrete Sawing Method 6. (vi) Deliberate Collapse Method 7. (vii) Pressure Jetting o - Implosion • - Deconstruction Method Safety measures during demolition operation

Case Studies

**Text Book:** Maintenance & Repair Of Civil Structures By B .L.Gupta

(COURSE CODE: 3360613)

Teaching Scheme (In Hours)			Total Credits	Examination Scheme				
L	T	P		Theory Marks		Practical		Total
			ESE	PA	ESE	PA		
0	0	6	6	---	---	40	60	100

**COURSE DETAILS**

**Each Project batch must not exceed 8 students.**

During the semesters, Students will have to write two types of reports.

1. Course-work reports : i.e. reports for communication with your tutor or guide ,

Technical reports to communicate with a specific individual who might be a ‘senior’ person in the formats specified by Gujarat Technological University.

2. A summary of work carried out , the readings, calculations, results and answers in numerical or graphical form, and a discussion of the results, answers and conclusions.

Effort should be made to identify actual field problems to be given as project work to the students. Project selected should not be too complex which is beyond the comprehension level of the students. The placement of the students for such a practical cum project work should match with the competency profile and interest of students. Students may be assessed both by industry and polytechnic faculty.

The suggested performance criteria is given below:

- a) Punctuality and regularity (Log book - mandatory and produced during IA verification)
- b) Initiative in learning/working at site
- c) Level/proficiency of practical skills acquired
- d) Sense of responsibility
- e) Self-expression/Communication skills
- f) Interpersonal skills.
- g) Report writing skills
- h) Viva voce

Some of suggested projects are given below: These are only guidelines, teacher may take any project related to Civil Engineering depending upon the availability of projects. Preference should be given to practical oriented projects. According to the local needs. The following major projects are suggested:

1. Construction of a small concrete road consisting of following activities
  - Survey and preparation of site plan
  - Preparation of drawings i.e. L-Section and X-Section
  - Estimating of earth work



- Material estimating and costing with specifications
- Testing of Aggregates
- Design of Concrete Mix
- Preparation of sub grade with stone ballast
- Laying of concrete
- Testing of slump, casting of cubes and testing
- Technical report writing

## 2. Water Supply /Drainage system for a village / Layout

- Surveying
- Design of water requirements and water distribution system
- Preparation of drawing of overhead tank
- Material estimating and costing
- Specifications
- Technical report writing

## 3. Construction of shopping complex/School Building/Hostel Building/PHC/Residential

Complex/Industrial Building/Bridges/Foundations/Flyovers/Under Passes

Preparation of detailed drawing – Plan, Elevation, section, layout, structural drawing, working drawing  
Preparation of Detailed and Abstract Estimate, Quantity of Materials

## 4. Rainwater harvesting and Recharging

- Assessment of catchment's area
- Intensity of rainfall

