GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)
ADVANCED CONSTRUCTION AND EQUIPMENTS
SUBJECT CODE: 2160601
B.E. 6th SEMESTER

Type of course: The core subject of civil engineering.

Prerequisite: Study of building construction.

Rationale: The study of advanced construction and equipments is necessary for civil engineers..

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	1	0	4	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	**Module - I**		**20**
	Pile Foundations: Introduction, uses, selection of pile, types of piles, pile cap and pile shoe, pile driving methods, micro piling, causes of failures of piles, Heaving of piles **Caissons:** Definition, uses, construction material, types of caissons, loads on caisson, design features of caissons, floating of caissons, cutting edges, sinking of caisson, tilting of caisson, shifting of caisson, caisson diseases	**04** **04**	
2	**Module – II**		**10**
	Diaphragm wall construction Introduction, uses, site selection criteria **Coffer Dams:** Definition, uses, selection of coffer dams, types of coffer dams, design features of coffer dams, leakage prevention, economic height **Control of Ground water in Excavations:** Methods-pumping, well points, bore wells, electro-osmosis, injections with cement, clays and chemical, freezing process, vibro- flotation.	**01** **02** **02**	

3	**Module - III**		**20**
	Form work Form work for R.C.C. Wall, slab, beam and column, centering for arches of large spans and dams, design features for temporary works, slip formwork, False work for Bridges **Construction of tall structures.** Materials of tall structures. Structural system for tall structures. Methods of construction of tall structures. **Demolition of Structure:** Demolition, taking down, dismantling, methods, safety	**04** **03** **01**	
4	**Module – IV**		**10**
	Construction Equipment : 1. Mechanization in Construction: Importance of construction equipments their classification, selection and contribution rate of production (Output), Owning and operating cost. 2. Engineering fundamentals : Related to performance of IC engines, rimpull, drawbar pull, Coefficient of traction, Gradability.	**02** **03**	
5	**Module – V**		**20**
	Excavating equipments : • Selection, basic parts, operation, factors affecting output • Tractors and related equipment: Bulldozers, Rippers, Scrapers • Excavating Equipment: Power shovels, Draglines, Hoes, Clam shells and trenching machines.	**08**	
6.	**Module - VI**		**20**
	Hauling and conveying equipments : • Belt conveyor system : Terminology, Classification, Components, Power requirement estimation and design. • Hauling and lifting equipment: Trucks, wagons, cranes etc. • Pile boring / driving equipment • Concrete Batching plant • Tunnel Boring machines • Crushers • Air compressors • Drilling and blasting equipments	**08**	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
30	**40**	**30**	**0**	**0**	**00**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Building Construction by B.C.Punamia
2. Building Construction by S.C.Rangwala
3. Building Construction by Gurucharan Singh
4. Heavy Construction by Vazirani & Chandola
5. Construction, Planning, Equipment and Methods by R.L.Peurifoy
6. Building Construction By Dr. Jha & S.K. Sinha
7. Hand book of Heavy construction: O'Brien, Havers & Stubb
8. Construction Engineering and Management By S.Seetharaman
9. Construction Equipment and Its Management By S C Sharma
10. Construction Equipment By Jagdish Lal
11. Construction equipment and its planning and application By Mahesh Verma Metropolitan Book Co.,

Course Outcome:

After learning the course the students should be able to:

1. Supervise the heavy construction sites.
2. Understand the working principle and use of various equipments
3. Select appropriate construction equipments for desired construction works.
4. Execute the operations of Demolition of structures with safety.
5. Erect the false work for Bridges and form work for Heavy structures

List of Tutorials:

There shall be at least one construction site visit and students shall prepare visit report.

1. The student shall visit the construction failure site and investigate the reasons of failure under supervision of faculty member.
2. Student shall actually observe the working of construction equipment and work out the out put of equipment from site observations the and compare it with that claimed by manufacturer.
3. The student shall work out the number of trucks required for hauling earth continuously with zero waiting period at sites requiring heavy excavation and hauling of earth
4. Workout owning and operating cost from field observations.
5. Contact the construction equipment manufacturer visit the factory and suggest their views in a visit report.

6. Work out how much money is saved daily by employing machines at construction sites, instead of labour force.

Major Equipment:

Working models of various construction equipments.

List of Open Source Software/learning website:

http://www.equipmentworld.com/
www.constructionequipment.com

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)
APPLIED FLUID MECHANICS
SUBJECT CODE: 2160602
B.E. 6th SEMESTER

Type of course: Applied Physics

Prerequisite: Fluid Mechanics

Rationale: To develop basic understanding for solving field problems related to fluid flow through pipes, open channels, turbo-machines and perform model analysis.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Contents

Sr No	Contents	Teaching hrs	Weightage %
1	**Module I** **Flow Through Pipes:**Introduction-Continuity equation-Energy equation-Momentum equation-Major and minor energy losses, hydraulic gradient and total energy line-pipes in series and parallel-pipe networks- hydraulic transmission of power. Navier-Stokes equation of motion- Initial conditions and boundary conditions. Viscous flow-Couette flow, Hagen-Poiseuille equation-flow between parallel plates. Turbulent flow in pipes-Prandtl's mixing length theory- velocity distribution- Smooth and rough boundaries-water hammer phenomenon	12	30
2	**Module II** **Boundary Layer**: Boundary layer concept-laminar and turbulent boundary layer growth over a flat plate, Von-Karman momentum integral equation- Separation of boundary layer and wake formation.	4	10
3	**Module III** **Open Channel Flow**: Basic concept of open channel flow- Steady uniform flow-Velocity distribution-Optimum shape of cross section for uniform flow- Energy equation-specific energy-specific energy diagram-discharge diagram-Application of specific energy and discharge diagrams. Non-Uniform steady flow-equations for gradually varied flow- Direct Step method, Rapidly varied flow- Hydraulic jump- Location of hydraulic jump- flow under sluices-Water surface profiles.	11	30
4	**Module IV** **Turbo Machinery**:Water Turbines: Impulse turbine-Reaction turbine-	9	20

	Specific speed-Unit quantities, Performance characteristics for water turbines,Centrifugal pumps: Pumps in series and parallel, Specific speed, Unit quantities, and characteristics curves, Cavitation in turbines and pumps. Introduction to Ventilation System.		
5	**Module V** **Dimensional Analysis and Similitude**: Fundamental dimensions-Physical Quantity and Dimensions-Dimensional Homogeneity- Non Dimensional parameters, π-Theorem dimensional analysis, Choice of variables, Determination of Dimensionless parameters. Model Similitude-Physical models- geometric-kinematic and dynamic similarity, Model studies.	6	10

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**10**	**15**	**15**	**10**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Theory and Applications of Fluid Mechanics by K Subramanya, McGraw Hill Publication
2. Fluid Mechanics by A.K. Jain, Khanna Publishers, New Delhi
3. Hydraulics and Fluid Mechanics by P.N. Modi and S.M. Seth, Standard Book House, New Delhi
4. Fluid Mechanics by Victor L. Streeter, E. B. Wylie by, McGraw Hill Publication
5. Fluid Mechanics by Frank M White , McGraw Hill Publication

Course Outcomes:

After successful completion of the course the students shall be able to:

1. Analyze fluid flow through pipes in series, parallel and pipe networks under laminar and turbulent flow conditions
2. Analyze and design streamlined objects considering boundary layer effects.
3. Analyze open channel flow and design optimal sections; calculate forces on sluice gates considering specific energy and momentum principle.
4. Understand, analyze and study the performance characteristics of hydraulic machines
5. Carry out model studies for fluid flow problems

List of Experiments:

Students will have to perform following experiments in laboratory and prepare the laboratory manual. The students will have to solve five problems covering all modules.

1. Viscous flow through parallel plates
2. Pipe friction
3. Pressure distribution around objects
4. Uniform flow in Open Channel
5. Application of specific energy and momentum principle (Hydraulic jump)
6. Performance characteristics of Centrifugal pump
7. Performance Characteristics of Water Turbines
8. Similitude and Model Studies
9. Development of Computer programs for fluid flow in pipes, open channel, hydraulic machines and dimensional analysis.

Design based/open ended problem on:

1. Pipes in series and parallel
2. Pipe network analysis
3. Design of optimal open channel sections for uniform flow
4. Specific energy and hydraulic jump, forces on Sluice gates
5. Design of Pelton turbine, Francis turbine, Kaplan turbine, pumps in series and parallel
6. Model studies related to pipe flow, open channel flow, hydraulic machines etc.
7. Any other relevant problem suggested by faculty members.

Major Equipments:

1. Pipe friction apparatus
2. Wind tunnel
3. Open channel with necessary attachments for Uniform flow and Hydraulic Jump experiment
4. Test rig for Centrifugal pump
5. Test rig for Pelton turbine
6. Test rig for Francis turbine and
7. Test rig for Kaplan turbine

List of Open Source Software/learning website: www.nptel.ac.in

Active Learning Assignments (ALA):

Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work - The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING
RAILWAY, BRIDGE AND TUNNEL ENGINEERING
SUBJECT CODE: 2160603
B.E. 6thSEMESTER

Type of course: Compulsory

Prerequisite: Nil

Rationale: Railway is important mode of surface transportation. Railways are economic for the long distance transportation of passengers and freight on the land. India has the second largest Railway network in the world. At present in the India, the share of goods transportation in railway is reduced than the roadways. There is a very good scope of developing high speed trains and special corridors for freight transportation in India. Bridges and Tunnels are essential to provide safe and economic passage over/through obstructions to railway or road corridor. The study of this subject provides necessary knowledge of railway track, its component parts, geometric design, points and crossings, stations and yards, signaling and control system, maintenance, modern development and safety in railways. It also provides knowledge of types of bridges, bridge super structure and sub structure, loads acting on bridges, bridge hydrology, bridge maintenance, tunnel alignment, tunnel construction in different types of grounds, tunnel - ventilation, lining, safety and lighting.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	1	0	4	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, function and types of rails, rail sections, defects in rails, creep of rails, rail joints and welding of rails, sleepers – types, spacing and density, rail fixtures and fastenings, ballast, subgrade and embankment.	**5**	**12**
2	Geometric design of railway track: gradients, grade compensation, speed of trains on curves, super elevation, cant deficiency, negative super elevation, curves, widening on curves.	**5**	**13**
3	Railway traction and track resistance, stresses in railway track – rails, sleepers, ballast. Points and crossings – turnouts, switches, crossings. Track junctions – types, splits, diamond, gauntlet, scissor crossovers. Railway stations - requirements, facilities, classifications, platforms,	**6**	**15**

	loops, sidings. Railway yards – types, required equipments in yards. Signalling and control system – objectives, classification, Interlocking of signals and points.		
4	Railway track - construction, drainage, maintenance. Recent developments in railways – high speed trains, modernization in track for high speed, Metro rails, Monorail, automation in operation and control. Safety in railways – accidents and remedial measures.	**4**	**10**
5	Bridges: Classification of bridges – with respect to construction materials, structural behavior of super structure, span, sub structure, purpose. Temporary and movable bridges. Factors affecting site selection. Various loads/stresses acting on bridges. Bridge hydrology – design discharge, water way, afflux, scour depth, economical span. Bridge components – foundation, piers, abutments, wing wall, approach, bearings, floor, girders, cables, suspenders. Methods of erection of different types of bridges. River training works and maintenance of bridges. Testing and strengthening of bridges. Bridge architect.	**14**	**30**
6	Tunnels: Necessity/advantage of a tunnel, Classification of Tunnels, Size and shape of a tunnel, Alignment of a Tunnel, Portals and Shafts, Methods of Tunneling in Hard Rock and Soft ground, Mucking, Lighting and Ventilation in tunnel, Dust control, Drainage of tunnels, Safety in tunnel construction.	**8**	**20**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**20**	**20**	**20**	**15**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Satish Chandra and M.M. Agrawal, Railway Engineering, Oxford University Press, New Delhi
2. S.C. Saxena and S. P. Arora, A Text Book of Railway Engineering, Dhanpat Rai & Sons, New Delhi
3. S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, Principles of Railway Engineering, Charotar Publishing House, Anand.
4. S.P. Bindra, Principles and Practice of Bridge Engineering, Dhanpat Rai & Sons, New Delhi
5. S.C. Saxena, Tunnel Engineering, Dhanpat Rai & Sons, New Delhi
6. D.J. Victor, Essential of Bridge Engineering, Oxford & IBH Pub. Co. Ltd. Mumbai

Course Outcome:
After learning the course the students should be able to:

1. Know about railway track components, their materials, size, function and importance
2. Carry out geometric design of railway track
3. Know about various components in diverging, merging and crossings of railway tracks, stations, yards, signaling, interlocking and control systems.
4. Know about requirements of railway track for high speed trains, safety aspects and maintenance.
5. Understand about different types of bridges, their components, loads/stresses acting on bridges, requirement and function of the components, hydrological design, methods of erection, maintenance of bridges.
6. Understand about importance, types, methods of construction, mucking, ventilation, lining and lighting in Tunnels.

List of Tuturials:
Field visit of - Railway station and yard, Bridge site, Tunnel site.

1. Geometric design of railway track
2. Bridge components' design using hydrological data of a selected river site.

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)
WATER & WASTE WATER ENGINEERING
SUBJECT CODE: 2160604
B.E. 6th SEMESTER

Type of course: Core Subject in Civil Engineering

Prerequisite: Study of basic Environmental Engineering

Rationale: The water is basic requirement for humans and should be available in pure and potable form to keep the community away from waterborne diseases and treatment of wastewater is absolutely needed to protect the health of people .

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	0	2	5	70	20	10	20	10	20	150

Content:

Sr. No.	Content	Total Hrs.	% Weightage
1	Water treatment plant: Layout plan and section of water treatment plant, Estimation of raw water discharge for treatment plant, Design period, and factors considered for selection of design period. Treatment plant site selection, factors considered, future stages of expansion, selection of treatment train.	6	15
2	Collection and conveyance of raw water from source: Intakes, types of intakes, conveyance of water, design of pumps and gravity and rising mains	6	10
3	Water treatment processes and treatment units: Plain sedimentation, aeration, sedimentation tank & its design, sedimentation with coagulation, types of coagulants, optimum dose of coagulants, mixing devices, design of flocculation unit. theory of filtration, types of filters and their comparison, design of rapid sand filter, washing of filter, methods of disinfection, methods of removing hardness Computation of dose of chemicals for removal of hardness	8	20
4	Distribution system: Layouts of distribution networks, Components of distribution system, Newton's and Hardy cross methods for network analysis, storage capacity of ESR and underground reservoir, determination of location and height of ESR.	4	10
5	Collection of sewage &estimation of its discharge: Different types of sewers, sewerage systems, variation in sewage flow, sewer appurtenance, estimation of wastewater discharge in a sewer in sewerage system, estimation of storm water discharge in urban area, separate and combined sewerage systems, laying and testing of sewers.	4	10

6	Unit operations/ processes for wastewater treatment: Layout plan and section of municipal wastewater treatment plant, Physical unit operation screening, flow equalization, mixing, flocculation, sedimentation. Chemical unit processes-chemical precipitation. Biological unit processes: Aerobic attached growth and aerobic suspended growth treatment processes, anaerobic suspended growth treatment processes, an aerobic suspended growth treatment processes, low cost sanitation systems, septic tanks, soak pit, stabilization ponds.	8	20
7	Design of wastewater treatment units: Design of racks, screens, grit chamber, aeration units, primary & secondary clarifiers, activated sludge plant and trickling filter units, rotating biological contactors, sludge dewatering units, sludge digesters and drying beds.	6	15

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
40	**20**	**20**	**10**	**5**	**5**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. Environmental engineering volume 1 and 2 by S.K.Garg, Khanna publisher
2. Environmental engineering volume 1 and 2 by B.C.Punamia, laxmi publication
3. Environmental engineering volume 1 and 2 by Dr.P.M.Modi
4. Water supply and sanitary engineering by G.S.Birdie and J.S.Birdie
5. Environmental pollution engineering by C.S. Rao wiley eastern
6. Water supply and wastewater engineering by B.S.N Raju, Tata McGraw hill, New Delhi
7. H.S. Peavy, D.R.Row & G.Tchobanoglous, environmental engineering,Mc Graw Hill Intranational Edition
8. Viesman, Hammer and Chadik, water supply and pollution control, PHI Publication.
9. M.L.Devis and D.A.Cornwell,Introdution to environmental engineering:-2nd edition-1997,Mc Graw Hill Intranational Edition
10. Metcalf and eddy,(revised by G.Tchobanoglous) Wastewater Engineering:Treatment,disposal reuse,Tata-Mc Graw Hill,New Delhi
11. Waste water treatment plants, Planning Design and Operation, Syed Qasim, CRC Press.
12. Water Works Engineering: Planning, Design and Operation, Syed R. Qasim, Edward M. Motley, Guang Zhu, CRC Press

Course Outcome:

After learning the course the students should be able to:

1. Design the water supply and wastewater treatment systems.

2. Determine the treatment efficiency of treatment units

List of Experiments:

1. Introduction to standards, collection and preservation of samples, sampling techniques and laboratory equipment
2. Determination of turbidity and jar test
3. Determination of DO and BOD
4. Determination of COD
5. Treatability study of domestic wastewater
6. Determination of langelier's saturation index
7. Determination of dose of chemicals for removal of hardness of given water sample

Design based Problems (DP)/Open Ended Problem:

1. Design and preparation of layout plan and section of water treatment plant for a given town with water level shown in each unit in section. The student shall compute water levels in each unit, prepare design report and drawing.
2. Design and preparation of layout plan and section of wastewater treatment plant for a given town with wastewater levels shown in different units in sections the student shall compute wastewater levels in different units and prepare design report and drawing
3. Analyze the pipe network by Hardy cross and Newton's method and compare both methods
4. Design of sewerage system for proposed extension area of a town.
5. Measurement of efficiency of trickling filters, ASP etc by field observation in existing wastewater treatment plant.
6. In campus constructions of model treatment plant for water with guidance from teacher
7. In campus construction of model treatment plant for wastewater with guidance for teacher.

Major Equipment:

1. BOD incubator
2. COD Apparatus
3. Jar test Apparatus
4. Auto zero set Burette
5. Digital DO meter
6. Top Loading Electronic balance
7. Aerator

List of Open Source Software/learning website:

Epanet, relevant websites of IIT's

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING (06)
ELEMENTARY STRUCTURAL DESIGN
SUBJECT CODE: 2160607
B.E. 6th SEMESTER

Type of course: Applied Mechanics

Prerequisite: Mechanics of Solids, Structural Analysis-I,II

Rationale: This subject is applications of structural engineering principles to design basic structural elements using of reinforced concrete and steel concrete as materials. This subject is specifically aim to develop understanding of various design philosophy, Indian codal provisions, design basis used in design of basic elements of framed structures and its detailing requirement.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
				Theory Marks			Practical Marks			
L	T	P	C	ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
4	1	0	5	70	20	10	30	0	20	150

Content:

Sr. No.	Topics	Teaching Hrs.	Weightage %
1	**Introduction:** Objectives, Properties of Reinforced Concrete and Structural Steel, Loads & load combinations, Methods of Analysis, Codes & specifications, Design Philosophies - Working stress Method, Ultimate Load Method, Limit State Method, Plastic Method.	04	10
2	**Limit state design of RC elements:**	26	40
	(A) Philosophy of Limit state design: Limit state of collapse & serviceability, partial safety factors for material & loading. Limit State of Flexure**:** Stress-strain characteristics of concrete & reinforcing steel, Type of section-under reinforced, over reinforced & balance section, Neutral Axis depth, Moment of Resistance for singly reinforced, doubly reinforced and flanged sections. Limit State of Shear and Torsion, combined flexure & torsion, Bond & Anchorage, Development length, splicing	06	
	(B) Design of Beams: Simply supported, cantilever and continuous beams	04	
	(C) Design of Slab: One way, two way simply supported and continuous slabs	06	
	(D) Design of Column: Classifications, Assumptions, Design of Short Columns under axial load.	04	
	(E) Design of Foundations: Design of isolated footing under axial load and uni-axial bending, combined footing	06	
3	**Limit State design of Steel elements:**	26	40

	(A) Philosophy of Limit state design: Limit state of collapse & serviceability, partial safety factor for material and loading, Type & behavior of sections – Plastic, compact, semi-compact, slender.	02	
	(B) Connections: Bolted connections – bearing type, behavior of bolted joints, Design strength of ordinary & HSFG bolts. Welded connections-Fillet and Butt weld, design of simple connections such as lap and butt joints, truss joint connections.	06	
	(C) Axial force design: Tension member: types of tension member, behavior, modes of failure, Design of tension member, splices, lug angle. Compression member: Behaviour, classification of sections, possible modes of failure, elastic buckling of slender member, design of compression member having single & built-up section, lacing & battening,	08	
	(D) Design for Beams and Beam-Columns: Type of sections, classification, Lateral stability, Design strength of laterally restrained and unrestrained beams, shear strength, deflection, web buckling & crippling, Design of simply supported beam. Combined axial and flexural design of member (Beam-Column)	06	
	(E) Footing : slab based, gusseted base foundation	04	

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
05	**15**	**30**	**25**	**05**	**20**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

Reference Books (RC Design)

1. Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
2. Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
3. A.K.Jain; Design of Concrete Structures, Nemchand Publication
3. IS: 456 - Code of practice for plain and reinforced concrete
4. IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
5. IS: 1893 - Criteria for earthquake resistant design of structures
6. IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force

Reference Books (Steel Design)

1. N.Subramanian; Steel Structures, Oxford Publication
2. Arya A.S. & Ajamani J.L.; Design of Steel Structures; Nemchand & Bros., Roorkee
3. Dayaratnam P.; Design of Steel Structures; Wheelor pub. co., Delhi
4. Ramamrutham S. & Narayanan R.; Design of Steel Structures; Dhanpatrai & Sons, Delhi

5. K. S. Sai Ram; Design of Steel Structures, Pearson
6. IS: 800 – 2007, Code of practice for General Construction in steel
7. IS: 875 - (Part I to V) - Code of practice for structural safety of building loading standards
8. IS: 226 - Structural steel (Standard Quality)
9. SP: 6(1) - Structural steel section
10. SP: 6(6) - Application of plastic theory in design of steel structures

Course Outcome:

After learning the course the students should be able to:

1. Understand various design philosophy to be used in the design of structural elements.
2. Design basic structural elements like slab, beams, columns and foundation etc. using steel and concrete as materials
3. Design basic structural elements slab, beams, columns and foundation etc. using limit state approach.

Term-Work:
The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial (minimum 30 problems). Practical examinations shall consist of oral based on term work and above course. The students have to draw at least five structural components (RCC and Steel) with proper details in sketch book/A3 size sheet.

List of Tutorials:

1. Design, casting and testing of under reinforced and over reinforced beam.
2. Design and testing of steel beam section.
3. Prepare model of various connections/elements in steel structures.
4. Prepare model showing reinforcement detail of singly reinforced, doubly reinforced simply supported and continuous beams.
5. Prepare model showing reinforcement detail of one way and two way slabs with various end conditions.
6. Prepare model for detailing of beam column junction and column-footing junction.

List of Open Source Software/learning website:

www.nptel.iitm.ac.in/courses/

ACTIVE LEARNING ASSIGNMENTS: Preparation of power-point slides, which include videos, animations, pictures, graphics for better understanding theory and practical work – The faculty will allocate chapters/ parts of chapters to groups of students so that the entire syllabus to be covered. The power-point slides should be put up on the web-site of the College/ Institute, along with the names of the students of the group, the name of the faculty, Department and College on the first slide. The best three works should submit to GTU.

GUJARAT TECHNOLOGICAL UNIVERSITY

CIVIL ENGINEERING
URBAN TRANSPORTATION SYSTEM
SUBJECT CODE: 2160608
B.E. 6thSEMESTER

Type of course: Departmental Elective - I

Prerequisite: Nil

Rationale: Due to rapid urbanization, population and number of vehicles are increased very fast in urban areas. Sprawl in urban area necessitates efficient road/railway network and reliable mass transportation systems to cater the increased need of the passengers and goods trips within urban as well as suburban area. Safe, economic, timely and comfortable urban mass transportation systems reduce private vehicle trips, which ultimately reduce traffic congestion, accidents and environmental pollution. Study of this subject imparts knowledge of urbanization process, urban transportation system planning, land use planning, travel demand modeling procedure, different urban mass transportation systems and urban goods movement.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks						Total Marks
L	T	P	C	Theory Marks			Practical Marks			
				ESE (E)	PA (M)		ESE (V)		PA (I)	
					PA	ALA	ESE	OEP		
3	1	0	4	70	20	10	30	0	20	150

Content:

Sr. No.	Content	Total Hrs	% Weightage
1	Urbanization, urban class groups, transportation problems and identification, impacts of transportation, urban transport system planning process, modeling techniques in planning.	**4**	**10**
2	Urban mass transportation systems: urban transit problems, travel demand, types of transit systems, public, private, para-transit transport, mass and rapid transit systems, BRTS and Metro rails, capacity, merits and comparison of systems, coordination, types of coordination.	**6**	**15**
3	Introduction to land use planning models, land use and transportation interaction. The transportation study area definition; division into traffic zones; network identification and coding; types of trips, characteristics of various surveys; home interview; roadside survey; goods, mass transit and intermediate public transport surveys; sampling and expansion factors; accuracy checks, screen line checks, consistency checks.	**9**	**20**
4	Travel demand modeling: Trip generation-zonal regression and category analysis, Trip distribution-growth factor models, gravity model, opportunity models, Desire line diagram. Modal split analysis-trip end	**15**	**35**

	models, trip interchange models, logit models, Trip assignment techniques-route choice, diversion curves, shortest path algorithms, all-or-nothing assignment, capacity restraint models and Direct demand models.		
5	Mass transit systems: Introduction to routing and scheduling, transit system's performance parameters. Corridor identification and corridor screen line analysis. Urban forms and structures: point, linear, radial, poly-nuclear developments and suitable transit systems, Urban goods movement. Preparation of comprehensive plan and transportation system management planning.	**8**	**20**

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	**15**	**10**	**20**	**30**	**10**

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Note: This specification table shall be treated as a general guideline for students and teachers. The actual distribution of marks in the question paper may vary slightly from above table.

Reference Books:

1. B.G.Hutchinson, Principles of urban transportation system planning- McGraw-Hill, New York, 1974
2. Edward K.Morlok, Transportation Engg. and Planning
3. W.Dickey, Metropolitan Transportation Planning Tata McGraw-Hill, New Delhi, 1975
4. Blunder and Black, Land useTtransportation System
5. J.Ortuzer and L.G. Willumsen, Modelling Transport, Johan Wiley and Sons Chincester,1994
6. Vukan R. Vuchic, Urban Transit : Operations, Planning and Economics, Wiley Sons Publishers.
7. Peter White, Public Transport, UCL Press
8. Kadiyali L.R., Traffic Engineering and Transport Planning, Khanna Publishers
9. Khisty, C J., Transportation Engineering – An Introduction, Prentice-Hall, NJ
10. S.C. Saxena, Traffic Planning and Design, Dhanpat Rai Pub., New Delhi.
11. Partho Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI
12. C. S. Papacostas, Fundamentals of Transportation System Analysis, PHI.
13. James H. Banks, Introduction to Transportation Engineering, WCB-McGraw Hill, New York

Course Outcome:

After learning the course the students should be able to:

1. Know about urban transportation system planning process, land use planning, different urban mass transit systems-their merits and limitations, different types of transportation surveys, travel demand modeling, urban mass transit system operation and urban goods movement.
2. Carry out trip generation, trip distribution, modal split and trip assignment analysis.

List of Tutorials:

- Field Visit to Urban Mass Transportation System Service - Depot, Terminals, Offices.

1. Students can conduct home interview survey in group for the different zone/ward areas of city. From the collected data, they can develop zonal regression models, carry out category analysis, prepare base year O-D matrix and desire line diagram, mode wise and purpose wise trip distribution, trip length frequency distribution and prepare power point presentation of all this analysis.

2. Students can evaluate the existing mass transportation system. They can conduct the survey of boarding and alighting of passengers, find the actual demand on the routes and ascertain the optimum routing and scheduling.

List of Open Source Software/learning website:

Tirps, TransCad - academic version for the students.

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