



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106601

Course/Subject Name: Water Resources Engineering and Hydrology

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	PCC	

Prerequisite:	Fluid Mechanics, Environmental Engineering
Rationale:	To develop technical competence in hydrological analysis, water resource planning, and sustainable management of water systems through computational and field-based methods.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
4	0	2	5	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Hydrological Parameters: Hydrological cycle, Water balance concept, Climate and availability of water, types and forms of precipitation, Variability in rainfall, Measurement & Data analysis of precipitation, Evaporation and its measurement, Transpiration and its measurement, Measurement of Evapotranspiration, Potential and actual evapotranspiration, Penman Monteith method. Infiltration indices, Factors affecting infiltration, Horton's equation and Green Ampt method.	10	24
2.	Runoff & Hydrographic Analysis Drainage basin and watershed characteristics, Types of runoff, Surface, subsurface flow, base flow. Mass curve, Hyetograph, Hydrograph with types, assumptions, rationale and limitations of unit hydrograph, Derivation of unit hydrograph and its conversions, S- hydrograph and its uses, Snyder's Hydrograph, Flow duration curve and its uses.	10	24
3.	Groundwater Hydrology Occurrence, Darcy's law, Well hydraulics, Well losses, Yield, Pumping and recuperation test. Dams and Reservoirs: Types, Investigations, Site selection, Zones and levels of storage in reservoir, Safe and Design yield,	8	19



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	Reservoir capacity, Reservoir sedimentation and control, Bed load, suspended load. Types of dams, Selection of type and site of dam, Information about major dams and reservoirs of India.		
4.	Flood Terminology and Hydrological Analysis Indian rivers and floods, Causes of floods, Alleviation and flood management, Levees and floodwalls, Floodways, Channel improvement works, Flood damage analysis. Design flood, Standard Project flood, Probable maximum flood, Flood estimation, Frequency analysis, Flood routing through reservoirs and open channels, Muskingham Routing. Hydel Power: Micro, Small, High generation plants, Low, Medium and High head plants, Power house components and Hydel schemes.	8	19
5.	Drought Management and Water Harvesting Definition of drought, Causes and types of drought, measures for water conservation and augmentation, drought contingency planning and execution. Water harvesting: rainwater collection, small dams, runoff enhancement, runoff collection, ponds, tanks, rooftop model of rainwater harvesting. Water Resources Planning and Management: Requirement of Water Resources schemes, Principles and objectives of Water resources planning. Levels in planning, Functional requirements of water resources projects, steps in water resources planning, Environmental aspects in water resources planning.	6	14
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	8	10	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:



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No	Course Outcomes	RBT level
1	Compute precipitation, infiltration, and evapotranspiration	A
2	Analyze runoff and flood estimation methods	N
3	Design reservoir capacity and well yield calculations	C
4	Evaluate flood routing and hydropower potential	E
5	Propose water harvesting and drought management solutions	C

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping						
PO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge		3	3	3	3	2
PO-2 Problem Analysis		3	3	3	3	3
PO-3 Design/Development		2	2	3	2	3
PO-4 Investigations		3	3	2	3	2
PO-5 Modern Tool Usage		2	2	2	2	1
PO-6 Engineer & Society		2	2	2	2	3
PO-7 Environment & Sustainability		3	2	2	2	3
PO-8 Ethics		1	1	1	1	1
PO-9 Individual & Team Work		1	1	1	1	1
PO-10 Communication		2	2	2	2	2
PO-11 Project Management		2	2	2	2	2
PO-12 Lifelong Learning		2	2	2	2	2
CO-PSO Mapping						
PSO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills		1	2	1	1	1
PSO-2 Analytical Ability		3	3	2	3	2
PSO-3 Software Tools Use		2	2	1	2	1



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Level: Degree

Course/ Subject Code: BE106601

Course/Subject Name: Water Resources Engineering and Hydrology

Reference Books/Suggested Learning Resources:

- K. Subramanya, Engineering Hydrology, Tata McGraw Hill Pub. Co. New Delhi.
- C.S.P. Ojha, R. Berndtsson and P. Bhunya, Engineering Hydrology, Oxford University Press, New Delhi.
- R.A. Wurbs and W.P. James, Water Resources Engineering, Prentice Hall of India, New Delhi.
- R.K. Sharma and T.K. Sharma, Hydrology and Water Resources Engineering, Dhanpat Rai Publications, New Delhi.
- H. M. Raghunath, Hydrology: Design, Principles and Analysis, New Age International Publishers.

Open Sources Software and Website:

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

List of Practical/ Exercise -

- To determine rate of infiltration and infiltration capacity using double ring infiltrometer
- Measurement of rainfall
- Estimation of flood using unit hydrograph
- Computation of rate of infiltration using infiltrometer
- Computation of live and dead storage capacity of reservoir
- Flood routing of reservoir and channel
- Calculation of dependable flow
- Determination of capacity of well
- Calculation of power of a hydro-power plant



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106602

Course/Subject Name: Environmental Engineering

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	PCC	

Prerequisite:	Fluid Mechanics, Basic Chemistry
Rationale:	To equip civil engineers with technical skills for designing water supply/sewage systems and implementing pollution control measures as per Indian standards.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Water Supply scheme/System Components and layout of water supply scheme, Sources of water, Types of water demand, Estimation of quantity of water required, Collection and conveyance of water, Quality characteristic of drinking water, Drinking water standard, Water borne diseases Water, Treatment processes: aeration, sedimentation, coagulation flocculation, filtration, disinfection, advanced treatments like adsorption, ion exchange, membrane processes, Water Distribution system: components, type of layouts, determination of capacity of elevated reservoirs, The Water (prevention and control of pollution) Act-1974	12	28
2.	Sewage : Characteristics, Treatment and Disposal Physical, chemical and biological characteristics of sewage, Methods of sewage disposal, Indian standards for disposal of sewage, Self-purification capacity of river, Sewage farming, Unit operations and unit processes in sewage treatment, Layout of sewage treatment plant, Preliminary, Primary treatment of sewage, Aerobic and anaerobic biological treatment: attached growth and suspended growth processes, Low cost sanitation: septic tank and soak pit.	11	26



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3.	Collection of sewage Type of sewerage systems: combined and separate, Quantity of Sewage, Sewage flow variations. Conveyance of sewage: Sewers, shapes design parameters, laying and testing of sewer, Sewer appurtenances.	5	12
4.	House Drainage Principles of house drainage, Pipes and traps, Classification of traps: nahn trap, gulley trap, interception trap, grease trap, Sanitary fitting, System of plumbing, House drainage plan for building.	2	05
5.	Solid Waste Management Quantity, composition and characteristics of solid wastes, Classification of solid wastes. Hazardous solid wastes, Biomedical solid wastes, Typical generation rate for solid wastes, Factors affecting the generation rate. Estimation of quantity of solid waste, Onsite handling, storage and processing, Collection services, Types of collection systems, Transfer stations, Solid waste processing techniques, Disposal of solid waste.	5	12
6	Air and noise pollution Classification and sources of air pollutants. Air quality standards, Effects of air pollution on human, plant and material, Basic Air pollution control methods, Salient features of the Air (Prevention and control of pollution) Act – 1981 Noise pollution: definition, measurement, standards, sources, effect and control measure.	4	10
7	Environment Impact Assessment(EIA) Environment Protection Act, Need of EIA, Steps for EIA, Role of EIA is sustainable develop met	3	07
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	10	8	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106602

Course/Subject Name: Environmental Engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Design water treatment systems per Indian standards	C
2	Analyze sewage characteristics for treatment selection	N
3	Evaluate solid waste management strategies	E
4	Propose pollution control measures for urban areas	A
5	Conduct EIA studies for sustainable development	C

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	2	2	2
PO-2 Problem Analysis	3	3	3	3	3
PO-3 Design/Development	3	2	1	2	2
PO-4 Investigations	2	3	2	2	3
PO-5 Modern Tool Usage	2	2	1	3	3
PO-6 Engineer & Society	3	2	3	3	3
PO-7 Environment & Sustainability	3	2	3	3	3
PO-8 Ethics	2	1	2	1	2
PO-9 Individual & Team Work	1	1	1	2	2
PO-10 Communication	2	1	1	2	2
PO-11 Project Management	2	2	2	2	2
PO-12 Lifelong Learning	2	2	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	1	1	1	1	1
PSO-2 Analytical Ability	3	3	2	2	3
PSO-3 Software Tools Use	2	2	1	3	3



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Course/ Subject Code: BE106602

Course/Subject Name: Environmental Engineering

Reference Books/Suggested Learning Resources:

- P. C. Vargheese, Limit State Design of Concrete structure,
- Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
- Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
- A.K.Jain; Design of Concrete Structures, Nemchand Publication
- N.Subramanian; Steel Structures, Oxford Publication
- Arya & Ajamani.; Design of Steel Structures; Nemchand & Bros., Roorkee
- Dayaratnam P.; Design of Steel Structures; Wheelor pub. co., Delhi
- Ramamrutham S. & Narayanan R.; Design of Steel Structures; Dhanpatrai & Sons, Delhi

Open Sources Software and Website:

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

List of Practical/ Exercise -

- The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
- Prepare sketches of structural detailing of RC and steel components in sketch book/A3 size sheet.
- Experiments may be designed and carried out related to the topics of the course such as
 - a. Design, casting and testing of under reinforced, over reinforced and limiting section.
 - b. Design and testing of steel sections as tie, strut, beam etc.
- Practical examinations shall consist of oral based on term-work and above course.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106602

Course/Subject Name: Environmental Engineering



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106603

Course/Subject Name: Design Of Reinforced Concrete Structure

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective-3	

Prerequisite:	Mechanics of Materials, Basic Structural Analysis
Rationale:	To equip students with limit state design philosophy and Indian standard-compliant detailing skills for safe, durable RC structures including seismic-resistant systems

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Unit-1: Building Layout and Design Loads as per I.S., distribution & flow of loads, lateral load due to wind and seismic as per latest IS standards, load combinations, guide lines for preparation of structural layout for building. Analysis, design & detailing	12	28
2.	Unit-2: Design of Retaining wall Types, behavior and application of retaining wall, stability criteria, design & detailing of cantilever & counter-fort type retaining wall for various ground conditions.	8	20
3.	Unit-3: Design of Water Tank Classification of water tank and method of analysis, permissible stresses, codal provisions, Design of circular and rectangular under-ground water tanks using IS code method, Design of elevated water tank with Intze type of container, frame and shaft type of staging and foundation considering effect of earthquake and wind forces. Design of Foundations: Design of isolated footing under axial load and uni-axial bending, combined footing.	9	21
4.	Unit-4: Design of Flat Slab Direct design method – Distribution of moments in column strips and middle strip-moment and shear transfer from slabs to columns – Shear in Flat slabs-Check for one way and two	6	14



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106603

Course/Subject Name: Design Of Reinforced Concrete Structure

	way shears, Limitations of Direct design method, Introduction to Equivalent frame method.		
5.	Unit-5: Earthquake Resistant Design of building Earthquake resistant design philosophy, capacity design concept, four virtues of Earthquake Resistant design: strength, stiffness, ductility and configuration, Irregularities in structures, Lateral load distribution – Torsionally coupled & uncoupled system, Seismic coefficient Method, Ductile detailing as per IS:13920.	7	17
	Teaching hours	42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
12	18	15	8	5	2

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Design RC structural elements per IS codes	C
2	Analyze seismic/wind loads as per latest IS standards	N
3	Develop ductile detailing solutions for earthquake resistance	E
4	Prepare construction-ready structural drawings	A



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106603

Course/Subject Name: Design Of Reinforced Concrete Structure

Course Outcome to Programme Outcome (CO-PO) Mapping (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping				
PO \ CO	CO-1	CO-2	CO-3	CO-4
PO-1 Basic Engg Knowledge	3	3	2	2
PO-2 Problem Analysis	3	3	3	2
PO-3 Design/Development	3	2	3	3
PO-4 Investigations	2	3	2	1
PO-5 Modern Tool Usage	2	2	1	3
PO-6 Engineer & Society	2	2	3	1
PO-7 Environment & Sustainability	2	1	2	1
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	1	2
PO-10 Communication	2	1	1	3
PO-11 Project Management	2	2	2	2
PO-12 Lifelong Learning	2	2	2	2
CO-PSO Mapping				
PSO \ CO	CO-1	CO-2	CO-3	CO-4
PSO-1 Programming Skills	1	1	1	2
PSO-2 Analytical Ability	3	3	3	2
PSO-3 Software Tools Use	3	2	1	3



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106603

Course/Subject Name: Design Of Reinforced Concrete Structure

Reference Books/Suggested Learning Resources:

- P. C. Vargheese, Limit State Design of Concrete structure,
- Shah & Karve; Limit State Theory & Design of Reinforced Concrete; Structure Pub., Pune
- Dr. H.J. Shah; Reinforced concrete Vol-I; Charotar Pub. Anand
- Punmia B.C “Advanced RCC Design” Laxmi Publications Pvt. Ltd”. 2006.
- Varghese P. C., Advanced Reinforced Concrete, Varghese, Prentice Hall of India.
- Sinha S. N., Reinforced Concrete Design, Tata Mc-Graw Hill, Delhi.
- N. Krishna Raju, Advanced Reinforced Concrete Design, CBS Publishers.
- S. Unnikrishna Pillai and Devdas Menon, Reinforced Concrete Design, Tata McGraw Hill.
- IS: 456 - Code of practice for plain and reinforced concrete
- IS: 875 (Part I to V) - Code of practice for structural safety of Buildings Loading standards
- IS: 1893 - Criteria for earthquake resistant design of structures
- IS: 13920 -Code of Practice for ductile detailing of RC structure subjected to seismic force
- IS: 3370 (P-1 to 4)
- SP:16, SP:34.

List of Open Source Software/learning website:

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

List of Practicals /Tutorials:

- Full Design of following structures with detailing in A2 size drawing sheet covering all required details in structural drawing.
- design of G+3 building (design manually & check with software)
- Retaining wall/water tank
- Software applications of Multi-storied building subjected to wind and earthquake forces
- Preparation of EXCLE Worksheets for the design of various structural components of building and/or other structures of the syllabus.
- Prepare at least one drawing in any CAD software (like AutoCAD) for design of structures conducted in the syllabus.
- Practical examinations shall consist of oral based on the term-work and above course.



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106603

Course/Subject Name: Design Of Reinforced Concrete Structure

- The students will have to solve at least five examples and related theory from each topic as an assignment/tutorial.
- Prepare sketches of structural detailing of RC and steel components in sketch book/A3 size sheet.
- Experiments may be designed and carried out related to the topics of the course such as
 - a. Design, casting and testing of under reinforced, over reinforced and limiting section.
 - b. Design and testing of steel sections as tie, strut, beam etc.
- Practical examinations shall consist of oral based on term-work and above course.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106604

Course/Subject Name: Urban Transportation Planning

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective-2	

Prerequisite:	Transportation Engineering, Basic Statistics
Rationale:	To develop expertise in urban mobility planning, travel demand modeling, and mass transit systems to address rapid urbanization challenges through sustainable solutions.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Urbanization, urban class groups, transportation problems and identification, impacts of transportation on urban development, urban transport system planning process. Introduction to Preparation of comprehensive plan and transportation system management planning. Urban forms and structures: point, linear, radial, poly-nuclear.	5	12
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	14
3.	Survey and data collection for urban landuse and transportation planning models, Study area definition; division into traffic analysis zones; network identification and coding; types of trips, socio economic and trip characteristics of urban area; home interview survey/ Household Information Survey; roadside interview survey; goods transportation information survey, mass transit survey, Intermediate public transport/IPT surveys; methods of sampling and expansion factors; accuracy checks, screen line checks, consistency checks	9	21
	Travel demand modeling: Four stage modeling: Factors affecting trip	15	



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106604

Course/Subject Name: Urban Transportation Planning

4.	generation, methods of trip generation -zonal regression and cross category /classification analysis, Trip distribution-growth factor methods, gravity model, Desire line diagram. Trip Assignment models, Factors affecting mode choice and route choice. Captive rider and choice rider.		36
5.	Mass transit systems: Introduction to routing and scheduling, parameters to measure performance of transit system. Corridor identification and corridor screen line analysis. As per developments suitability of transit system	6	14
6	Introduction to goods movement study for urban area. Problems and issues of urban goods movement. Factors affecting goods movement, components of urban goods traffic.	1	3
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
8	12	15	10	10	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Analyze urban transport problems and planning frameworks	N
2	Conduct transport surveys and data validation checks	A
3	Develop trip generation/distribution models	C
4	Evaluate mass transit systems (BRTS/Metro)	E
5	Propose urban goods movement solutions	C



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106604

Course/Subject Name: Urban Transportation Planning

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High).

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	3	2
PO-2 Problem Analysis	3	3	3	3	3
PO-3 Design/Development	2	2	3	2	3
PO-4 Investigations	3	3	2	3	2
PO-5 Modern Tool Usage	2	3	3	2	1
PO-6 Engineer & Society	3	2	2	3	3
PO-7 Environment & Sustainability	3	2	2	3	2
PO-8 Ethics	1	1	1	1	1
PO-9 Individual & Team Work	1	2	1	1	1
PO-10 Communication	2	2	2	2	2
PO-11 Project Management	2	2	2	2	2
PO-12 Lifelong Learning	2	2	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	1	2	2	1	1
PSO-2 Analytical Ability	3	3	3	3	2
PSO-3 Software Tools Use	2	3	3	2	1

Reference Books/Suggested Learning Resources:



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Level: Degree

Course/ Subject Code: BE106604

Course/Subject Name: Urban Transportation Planning

- Kadiyali L.R., Traffic Engineering and Transport Planning, Khanna Publishers.
- Khisty, C J., Transportation Engineering – An Introduction, Prentice-Hall, NJ.
- S.C. Saxena, Traffic Planning and Design, Dhanpat Rai Pub., New Delhi.
- Partho Chakraborty and Animesh Das, Principles of Transportation Engineering, PHI.
- C. S. Papacostas, Fundamentals of Transportation System Analysis, PHI.

Open Sources Software and Website:

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

Field Visit:

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- A visit to Public Transportation System and office of operator for urban area.
- A visit to authority office-Town planning section, urban planning section, urban development. section.
- A visit to depot, terminal, bus stops.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106605

Course/Subject Name: Contracts Management

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective-2	

Prerequisite:	Basic Knowledge of Construction Projects
Rationale:	To make students understand various contracts, their suitability and procurement process in construction. To enable understanding of contract provisions and management processes in construction projects.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Introduction to Contract: Definition and legal issues in contract, Essential requirement of a contract as per Indian Contract Act 1872, Characteristics of a good contract, Legal enforceability of contract, Breach & termination of contracts, Major stake holders in construction contracts, Overview of Activities in Contract Management.	4	15
2.	Construction Contracts: Type of construction contracts: Lump sum contracts, Fixed price contracts, Percentage rate contracts, Cost plus contracts, Target contracts, Design-Build contracts, Turn-key contracts, BOT contracts. Parties to a Contract, Contract Formation, Common contract clauses: Notice to proceed, rights and duties of various parties, Contract Duration and Price	8	20
3.	Tendering: Process of tendering: Tender notice, EOI, RFQ & RFP, Bid security, Prequalification process, Bidding Models and bidding strategy, Tender submission and evaluation, Tender rejection, Security deposits/performance guarantee & Defect liability, Contract agreement & contract documents Performance Parameters: Delays, penalties and liquidated damages; Force Majeure, Suspension and Termination.	13	30



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Course/Subject Name: Contracts Management

4.	Conditions of Contracts: General conditions & special conditions, Contract conditions for payments, Time delay, Scope changes, Extra claims, Termination of contracts, subcontracting.	7	15
5.	Contract Administration: Elements of contract management, Major stake holders in construction contracts, Contract administration; Duties and responsibilities of parties, Stake holder agreements, Contract risk management, Management reporting, Dispute resolution mechanisms: Negotiation, Mediation	7	15
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	10	8	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Select appropriate contracts for project scenarios	A
2	Design performance parameters for contracts	E
3	Develop bidding strategies through tender evaluation	N
4	Formulate dispute resolution mechanisms	C



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106605

Course/Subject Name: Contracts Management

Course Outcome to Programme Outcome (CO-PO) Mapping.

CO-PO Mapping					
PO \ CO		CO-1	CO-2	CO-3	CO-4
PO-1 Basic Engg Knowledge		2	2	3	2
PO-2 Problem Analysis		3	3	3	3
PO-3 Design/Development		1	2	2	2
PO-4 Investigations		2	2	3	3
PO-5 Modern Tool Usage		1	1	2	2
PO-6 Engineer & Society		2	2	2	2
PO-7 Environment & Sustainability		1	1	1	1
PO-8 Ethics		3	3	3	3
PO-9 Individual & Team Work		2	2	2	2
PO-10 Communication		2	2	3	3
PO-11 Project Management		3	3	3	3
PO-12 Lifelong Learning		2	2	2	2
CO-PSO Mapping					
PSO \ CO		CO-1	CO-2	CO-3	CO-4
PSO-1 Programming Skills		1	1	1	1
PSO-2 Analytical Ability		3	3	3	3
PSO-3 Software Tools Use		1	1	2	2



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106605

Course/Subject Name: Contracts Management

Reference Books/Suggested Learning Resources:

- Keith Collier, "Construction Contracts" Reston Publishing Company, Inc, Reston, Virginia.
- Patil, B.S., "Building and Engineering Contracts" Mrs. S.B. Patil, Pune.
- John Murdoch & Will Hughes, "Construction Contracts - Law and Management" Spon Press, Taylor & Francis Group.
- Gajera, G.T., "Law relating to Building and Engineering Contracts in India" Butterworths.
- Govt of India, Central Public Works Department, "CPWD Works Manual 2003."
- Govt of India, Central Public Works Department, "CPWD 7/8: General Conditions of Contracts."
- V. K. Raina, Raina's Construction and Contract Management Vol.1 (Second Edition), SPD Publishers, 2009

Open Sources Software and Website:

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

List of Tutorials:

1. Collection of Evaluation of tender notices/ EOI, RFQ & RFP.
2. Tender notice preparation.
3. Exercise on pre-qualification of contractors.
4. Case Study & evaluation of tender documents for:
 - Tendering process
 - Security and performance bonds.
 - Risk assessments of contractual provisions.
 - Arbitration/dispute resolution.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106606

Course/Subject Name: Traffic Engineering and Management

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective -3	

Prerequisite:	Transportation Engineering, Basic Statistics
Rationale:	To develop expertise in traffic flow analysis, intersection design, and management strategies for urban/rural road networks using modern standards (Indo-HCM)

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Introduction: Traffic engineering administration and functions, Organization of the traffic engineering department, Road user and vehicular characteristics.	2	5
2.	Basic traffic flow parameter and Traffic Surveys: Definition – Flow, Volume, Speed, Space headway, Time headway, Density. Relationship between Flow, Speed and Density, Traffic Surveys: Speed, Journey time and Delay surveys, Classified volume count survey, Vehicle occupancy survey, Origin – Destination survey, Parking Survey, Use of photographic techniques in traffic survey.	8	19
3.	Lighthill and Witham's Theory: General, Assumption, Theory, Approach to signalized intersection, Bottleneck, Car following theory, Queuing theory concept	5	12
4.	Traffic Forecasting: Need for traffic forecasting, Types of traffic, Forecasts based on past trends and extrapolation, period for forecasting.	4	9



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106606

Course/Subject Name: Traffic Engineering and Management

5.	Parking studies: Traffic and parking problems, Ill effects of parking, Zoning and parking space requirement standards, Design standards for on street parking, Off street parking facilities, Peripheral parking system.	2	5
6	Design of Intersection: Design of at grade & grade separated intersection – rotary intersection – capacity of rotary intersection – Traffic signals, Advantages and disadvantages, Types of signals, Methods of setting signal timings, Warrants for signals, Coordinated control of signals, Necessity of signal coordination, Types of coordinated signal system.	10	24
7	Traffic Accidents – Causes and prevention: Accident situation in India, Collection of accident data, Statistical methods for analysis of accident data, Road and it's effect on accidents, Skidding, Speed in relation of safety, Traffic management measures and their influence on accident prevention, Condition and collision diagram and its utility, Legislation, Enforcement, Education and Propaganda.	4	9
8	Traffic system management: Introduction, Travel demand management, Traffic management measures, Restrictions to turning movements – one way streets – tidal flow operations-Traffic segregation –Traffic calming- Exclusive bus lanes, conflict point diagram for various types of streets, Introduction to ITS in traffic management.	2	5
9	Highway Capacity: Importance of 'Capacity' in Highway transportation studies, Capacity of uninterrupted flow conditions as per Indo-HCM, PCU in reference to Indo-HCM in urban and rural area, Determination of theoretical capacity, Level of service, Factors affecting capacity and level of service.	5	12
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	10	8	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106606

Course/Subject Name: Traffic Engineering and Management

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Analyze traffic flow parameters using survey methods	N
2	Forecast traffic demand using statistical techniques	A
3	Design parking systems as per urban requirements	C
4	Develop intersection solutions (rotaries/signals)	C
5	Evaluate highway capacity & LOS per Indo-HCM	E

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping						
PO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge		3	3	3	3	3
PO-2 Problem Analysis		3	3	3	3	3
PO-3 Design/Development		2	2	3	3	2
PO-4 Investigations		3	3	2	2	3
PO-5 Modern Tool Usage		2	2	2	2	2
PO-6 Engineer & Society		3	2	3	3	2
PO-7 Environment & Sustainability		2	2	2	2	2
PO-8 Ethics		1	1	1	1	1
PO-9 Individual & Team Work		1	1	1	1	1
PO-10 Communication		2	2	2	2	2
PO-11 Project Management		2	2	2	2	2
PO-12 Lifelong Learning		2	2	2	2	2
CO-PSO Mapping						
PSO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills		1	2	1	1	1
PSO-2 Analytical Ability		3	3	2	2	3
PSO-3 Software Tools Use		2	2	1	2	2

Reference Books/Suggested Learning Resources:



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106606

Course/Subject Name: Traffic Engineering and Management

- Dr. Kadiyali L. R., Traffic Engineering and Transport Planning, Khanna Publishers 2. Dr. Sharma S. K., Principles, Practice and Design of Highway Engineering (Including Airports), S. Chand & Company Ltd.
- Chakraborty Partho, Das Animesh, Principles of Transportation Engineering, PHI
- Khanna S.K., Justo C.E.G., Highway Engineering, Nem Chand & Bros., Roorkee.
- Bindra S.P., A course in Highway Engineering, Dhanpat Rai Publications
- Kadiyali L. R. and Lal, N. B., Principles & Practice of Highway Engineering, Khanna Publishers, Delhi.
- Chakraborty Partha, Das Animesh, Principles of Transportation Engineering
- Indo-Highway Capacity Manual, 2018
- Martin Whol, Brian V Martin , Traffic system Analysis for Engineers and Planners, McGraw Hill, NY, 1967
- IRC 67 - 2001 Road Signs
- IRC 108 - 2015 Guidelines for traffic forecast on Highways
- IRC 119 - 2015 Guidelines for traffic safety Barriers
- IRC 65 - 1976 Traffic Rotaries
- IRC 93 - 1985 Design & Installation of Road Traffic Signals

Open Sources Software and Website:

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

List of Practical/ Exercise -

- Determination of various speeds to be used for geometric design, traffic regulation at the urban/rural road
- Determination of signal timings at the intersection of the urban area List of
- Traffic Survey:
- Spot speed survey
- Moving car method of survey for journey time
- Delay studies survey
- Classified volume count survey
- Vehicle occupancy survey
- Origin – Destination survey
- Parking survey



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106606

Course/Subject Name: Traffic Engineering and Management



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106607

Course/Subject Name: Foundation Engineering

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective	

Prerequisite:	Soil Mechanics, Structural Analysis
Rationale:	To develop technical competence in selecting, analyzing, and designing foundation systems for varied soil conditions and structural loads per IS codes.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	2	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Foundation Classification and Soil exploration/investigation: Types of foundation, Factors affecting the selection of type of foundations, steps in choosing types of foundation based on soil condition, Objectives and planning of exploration program, methods of exploration-depth of boring, Soil samples and samplers- Methods of sampling, field penetration tests: SPT, SCPT, DCPT. Introduction to geophysical methods, Bore log and report writing and Data interpretation.	8	19
2.	Shallow Foundation: Introduction, significant depth, design criteria, modes of shear failures. Detail study of bearing capacity theories (Prandtl, Meyerhoff, Terzaghi, Skempton, Vesic etc), bearing capacity determination using IS Code (IS 6403), Presumptive bearing capacity. Settlements: components of settlement & its estimation (IS 8009), permissible settlement, Proportioning of footing for equal settlement, Allowable bearing pressure. Bearing capacity from in-situ tests (SPT, SCPT, PLT, DCPT), Factors affecting bearing capacity. Bearing capacity of raft/mat foundation as per codal provisions, Contact pressure under rigid and flexible footings. Floating foundation. Types of pavements & its design	10	24



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106607

Course/Subject Name: Foundation Engineering

3.	Pile Classifications & Load Transfer Principle of Pile foundation : Introduction, load transfer mechanism, types of piles and their function, factors influencing selection of pile, their method of installation and their load carrying characteristics for cohesive and granular soils, piles subjected to vertical loads- pile load carrying capacity.from static formula, dynamic formulae (ENR and Hiley), penetration test data & Pile load test (IS 2911). Pile group: Carrying capacity, Group Efficiency and settlement. Negative skin friction	10	24
4.	Foundations on problematic soil & Introduction to Geosynthetics : Significant characteristics of expansive soil, footing on such soils, Problems and preventive measures. Under-reamed pile foundation-its concept, design & field installation. Introduction to geosynthetics-types and uses.	6	14
5.	Retaining walls and Diaphragm walls: Types (types of flexible and rigid earth retention systems: counter fort, gravity, diaphragm walls, sheet pile walls etc.), Analysis of retaining and diaphragm walls	8	19
Teaching hours		42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	10	8	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106607

Course/Subject Name: Foundation Engineering

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Select soil investigation methods per IS codes	A
2	Design shallow foundations for bearing capacity/settlement	C
3	Analyze pile foundations under vertical loads	N
4	Design retaining/diaphragm walls	C
5	Recommend solutions for expansive soils & geosynthetics	E

Course Outcome to Programme Outcome (CO-PO) Mapping (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping						
PO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge		3	3	3	3	2
PO-2 Problem Analysis		3	3	3	3	3
PO-3 Design/Development		2	3	2	3	2
PO-4 Investigations		3	2	3	2	3
PO-5 Modern Tool Usage		2	2	2	2	1
PO-6 Engineer & Society		2	2	2	2	2
PO-7 Environment & Sustainability		2	2	2	2	2
PO-8 Ethics		1	1	1	1	1
PO-9 Individual & Team Work		1	1	1	1	1
PO-10 Communication		2	2	2	2	2
PO-11 Project Management		2	2	2	2	2
PO-12 Lifelong Learning		2	2	2	2	2
CO-PSO Mapping						
PSO \ CO		CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills		1	1	1	1	1
PSO-2 Analytical Ability		3	3	3	3	2
PSO-3 Software Tools Use		2	2	2	2	1



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106607

Course/Subject Name: Foundation Engineering

Reference Books/Suggested Learning Resources:

- Foundation Engineering, Peck hanson & Thronburg(1974). John Wiley & Sons,.
- Analysis and design of Substructures- Swami Saran (2009), Oxford & IBH
- Foundation Engineering Naryana S Naik(2012), Dhanphat Rai publishers, New Delhi
- Winterkorn, H.F. and Fang, Y.F., Foundation Engineering Handbook, Van Nostrand Reinhold, 1994.
- Hemsley, J.A, Elastic Analysis of Raft Foundations, Thomas Telford, 1998.
- Swami Saran, Gopal Ranjan, “Analysis & Design of Foundaions & Retaining Structures”, Sarita Prakashan.
- Poulos, H.G., Davis, E.H., Pile foundation analysis and design, John Wiley and Sons, New York, 1980.
- Grigorian, Pile Foundation for Buildings and Structures in collapsible Soil, Oxford & IBH Publishing Co, Pvt. Ltd., New Delhi, 1999.
- Bowles, J.E., "Foundation Analysis and Design, 5th Edition, McGraw Hill, New York, 1995.

Open Sources Software and Website:

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

List of Practical/ Exercise –

- Bearing capacity computations using Box Shear Test, Triaxial Test, UCS, Vane Shear test, SPT, PLT, CPT, DCPT, Pile load test, Geophysical tests and other in-situ tests
- Settlement computations using Consolidation test, Settlement calculations for layered soil and Soft Marine clay
- Swell pressure and swell index test for expansive soils
- CBR test



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106607

Course/Subject Name: Foundation Engineering



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106608

Course/Subject Name: Construction Equipment and Automation

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Professional Elective-3	

Prerequisite:	Construction Technology, Basic Mechanics
Rationale:	Equips students with knowledge of modern construction technologies including automated equipment, drones, robotics, and digital tools (BIM/AR/VR) to enhance productivity, safety, and quality in construction projects.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	1	0	4	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Introduction: Unique features of construction equipment, Need of construction Equipment, past history. Construction Equipment: Capacity, Feasibility, owning and operating cost and Productivity of Different Equipment: Excavators, Pavers, Plastering machines; Pre-stressing jacks and grouting equipment; Cranes and Hoists, Concrete Batching Plants, etc..	8	18
2.	Automation in Construction Industry: Need and Benefit of automation: Automation in Canal lining, Automation in Construction of Highway, Automation in concrete technology.	14	31
3.	Drones: Photogrammetry, Project Monitoring- real time data, aerial mapping, land survey, quantity survey, quality survey, structural health monitoring survey, under water survey.	8	18
4.	Robotics in Construction: Introduction, Benefits of robots in construction industry with respect to time, cost, quality, safety. Use of robots for construction activities like Brick laying, Demolition, Material	10	22



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106608

Course/Subject Name: Construction Equipment and Automation

	Handling, Structural steel cutting, Rebar tying/bending, Form work mould making, 3D printing- print complex, layered, parts and objects of homes, buildings, bridges and roads 3D Scanner for surveying and project management		
5.	Introduction to Advanced Technologies: Virtual Reality, Augmented Reality, Building Information Modeling (BIM).	5	11
	Teaching hours	45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
8	12	15	10	10	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Evaluate equipment feasibility for project conditions	E
2	Select automation techniques for construction processes	A
3	Apply drone technology for project monitoring	A
4	Compare robotic vs conventional construction methods	N
5	Implement BIM/AR/VR in construction workflows	C

Course Outcome to Programme Outcome (CO-PO) Mapping (Scale: 1-Low, 2-Medium, 3-High)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106608

Course/Subject Name: Construction Equipment and Automation

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	2	3
PO-2 Problem Analysis	3	3	3	3	3
PO-3 Design/Development	2	3	2	2	3
PO-4 Investigations	2	2	3	3	3
PO-5 Modern Tool Usage	3	3	3	2	3
PO-6 Engineer & Society	2	2	2	2	2
PO-7 Environment & Sustainability	2	2	2	2	2
PO-8 Ethics	1	1	1	1	1
PO-9 Individual & Team Work	1	2	1	1	2
PO-10 Communication	1	2	2	1	2
PO-11 Project Management	2	3	2	2	3
PO-12 Lifelong Learning	2	2	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	1	2	2	1	3
PSO-2 Analytical Ability	3	3	3	3	3
PSO-3 Software Tools Use	3	3	3	2	3



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106608

Course/Subject Name: Construction Equipment and Automation

Reference Books/Suggested Learning Resources:

- Construction Planning, Methods and Equipment, R.L Peurifoy, McGraw Hill, 2011.
- Construction Project management, Theory & Practice, Kumar Neeraj Jha,, Pearson Education India.
- BIM and Construction Management: Proven Tools, Methods, and Workflows By Brad Hardin, Dave McCool, John Wiley & Sons.
- Construction equipment and its planning and application Mahesh Varma Metropolitan Book Co.
- Robotics and Automation in Construction, Open access peer- reviewed edited volume
- Automation in Construction Management: Automated management of Construction Materials Using RFID Technology, Javad Majrouhi Sardroud, Scholars' Press.
- Enhancing BIM Methodology with VR Technology, Open access peer.

Open Sources Software and Website:

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

List of Tutorials:

1. Construction Equipment
 - Capacity, Feasibility, owning and operating cost and Productivity of pavers
 - Capacity, Feasibility, owning and operating cost and Productivity of cranes
 - Capacity, Feasibility, owning and operating cost and Productivity of Excavators
 - Capacity, Feasibility, owning and operating cost and Productivity of Concrete Batching Plants
2. Automation in Construction
3. Robotics in construction
4. Drones application in construction
5. Application of Virtual Reality and Augmented Reality in construction



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106609

Course/Subject Name: Soft Computing Techniques

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Open Elective-2	

Prerequisite:	Programming Fundamentals, Mathematics
Rationale:	To equip students with AI-driven computational techniques (Fuzzy Logic, GA, ANN) for solving complex civil engineering problems through intelligent systems.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
2	0	2	3	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Introduction to Soft Computing: Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing, Some applications of Soft computing techniques.	4	10
2.	Fuzzy logic: Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences, Defuzzification techniques, Some applications of Fuzzy logic.	10	24
3.	Genetic Algorithms: Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques, Basic GA framework and different GA architectures, GA operators: Encoding, Crossover, Selection, Mutation, etc. Solving single-objective optimization problems using GAs.	10	24
4.	Artificial Neural Networks: Biological neurons and its working, Simulation of biological neurons to problem solving, Different ANNs architectures, Training techniques for ANNs, Applications of ANNs to solve some real-life problems.	10	24



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106609

Course/Subject Name: Soft Computing Techniques

5.	Hybrid Systems: Fuzzy Neural systems, Genetic Fuzzy systems, Genetic Neural system	8	19
	Teaching hours	42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
8	10	12	10	10	5

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Explain soft computing paradigms and their applications	U
2	Design fuzzy logic systems for civil engineering problems	C
3	Implement genetic algorithms for optimization	A
4	Develop ANN models for predictive analysis	C
5	Integrate hybrid systems for complex problem-solving	E



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106609

Course/Subject Name: Soft Computing Techniques

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	3	2
PO-2 Problem Analysis	2	3	3	3	3
PO-3 Design/Development	1	3	2	3	3
PO-4 Investigations	2	2	3	3	3
PO-5 Modern Tool Usage	3	3	3	3	3
PO-6 Engineer & Society	1	2	2	2	2
PO-7 Environment & Sustainability	1	2	2	2	2
PO-8 Ethics	1	1	1	1	1
PO-9 Individual & Team Work	1	1	1	1	1
PO-10 Communication	2	2	2	2	2
PO-11 Project Management	2	2	2	2	2
PO-12 Lifelong Learning	2	2	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	3	2	3	3	3
PSO-2 Analytical Ability	2	3	3	3	3
PSO-3 Software Tools Use	3	3	3	3	3



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106609

Course/Subject Name: Soft Computing Techniques

Reference Books –

- Fuzzy Logic: A Practical approach, F. Martin, Mc neill, and Ellen Thro, AP Professional, 2000.
- Fuzzy Logic with Engineering Applications (3rd Edn.), Timothy J. Ross, Willey, 2010.
- Foundations of Neural Networks, Fuzzy Systems, and Knowledge Engineering, Nikola K. Kasabov, MIT Press, 1998.
- Fuzzy Logic for Embedded Systems Applications, Ahmed M. Ibrahim, Elsevier Press, 2004.
- An Introduction to Genetic Algorithms, Melanie Mitchell, MIT Press, 2000.
- Genetic Algorithms in Search, Optimization and Machine Learning, David E. Goldberg, Pearson Education, 2002.
- Practical Genetic Algorithms, Randy L. Haupt and sue Ellen Haupt, John Willey & Sons, 2002.
- Neural Networks, Fuzzy Logis and Genetic Algorithms: Synthesis, and Applications, S. Rajasekaran, and G. A. Vijayalakshmi Pai, Prentice Hall of India, 2007.
- Soft Computing, D. K. Pratihari, Narosa, 2008.
- Neuro-Fuzzy and soft Computing, J.-S. R. Jang, C.-T. Sun, and E. Mizutani, PHI Learning, 2009.
- Neural Networks and Learning Machines, (3rd Edn.), Simon Haykin, PHI Learning, 2011.
- Timothy J. Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill

Open Sources -

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

List of Exercise:

1. Problems based on GA and its applications in civil engineering.
2. Problems based on Fuzzy logic and its applications in civil engineering
3. Problems based on ANN and its applications in civil engineering
4. Problems based on hybrid systems and its application in civil engineering.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106610

Course/Subject Name: Instrumentation and Sensors

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Open Elective-2	

Prerequisite:	Basic Electronics, Structural Mechanics
Rationale:	To develop expertise in sensor technologies, data acquisition, and signal processing for structural health monitoring and infrastructure diagnostics

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
2	0	2	3	60	40	20	30	150

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Fundamentals of Measurement, Sensing and Instrumentation: Definition of measurement and instrumentation, physical variables, common types of sensors; Describe the function of these sensors; Use appropriate terminology to discuss sensor applications and qualitatively interpret signals from a known sensor type, types of instrumentation, Sensor Specifics, Permanent installations, Temporary installations.	10	22
2.	Sensor Installation and Operations : Predict the response of sensors to various inputs, Construct a conceptual instrumentation and monitoring program, Describe the order and methodology for sensor installation, Differentiate between types of sensors and their modes of operation and measurement ,Approach to Planning and Monitoring Programs, Define target, Sensor selection, Sensor siting, Sensor Installation & Configuration, Sensor design, Measurement uncertainty.	15	33
3.	Data Analysis and Interpretation : Fundamental statistical concepts, Data reduction and interpretation, Piezometer, Inclinator, Strain gauge, etc. Time domain signal processing, Discrete signals, Signals and noise and a few examples of statistical information to calculate Average value (mean), standard deviation, median, mode, range.	10	22



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106610

Course/Subject Name: Instrumentation and Sensors

4.	Frequency Domain Signal Processing and Analysis : Explain the need for frequency domain analysis and its principles, Draw conclusions about physical processes based on analysis of sensor data, Combine signals in a meaningful way to gain deeper insight into physical phenomena, Basic concepts in frequency domain signal processing and analysis, Fourier Transform, FFT (Fast Fourier Transform), Example problems: Noise reduction with filters, Leakage, Frequency resolution. Case Study.	10	22
Teaching hours		45	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	12	10	5	8

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Select appropriate sensors for structural monitoring	A
2	Design sensor installation programs	C
3	Analyze measurement data using statistical methods	N
4	Implement frequency domain signal processing techniques	C
5	Evaluate measurement errors and calibration requirements	E



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106610

Course/Subject Name: Instrumentation and Sensors

Course Outcome to Programme Outcome (CO-PO) Mapping. (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping					
PO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PO-1 Basic Engg Knowledge	3	3	3	2	2
PO-2 Problem Analysis	3	3	3	3	3
PO-3 Design/Development	2	3	2	3	1
PO-4 Investigations	3	2	3	2	3
PO-5 Modern Tool Usage	3	3	3	3	3
PO-6 Engineer & Society	2	2	2	1	2
PO-7 Environment & Sustainability	2	2	2	1	2
PO-8 Ethics	1	1	1	1	1
PO-9 Individual & Team Work	1	2	1	1	1
PO-10 Communication	2	2	2	2	2
PO-11 Project Management	2	2	2	2	2
PO-12 Lifelong Learning	2	2	2	2	2
CO-PSO Mapping					
PSO \ CO	CO-1	CO-2	CO-3	CO-4	CO-5
PSO-1 Programming Skills	2	2	2	3	1
PSO-2 Analytical Ability	3	2	3	3	3
PSO-3 Software Tools Use	3	3	3	3	2

Reference Books/Suggested Learning Resources:



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106610

Course/Subject Name: Instrumentation and Sensors

- Alan S Morris (2001), Measurement and Instrumentation Principles, 3rd/e, Butterworth Hienemann.
- David A. Bell (2007), Electronic Instrumentation and Measurements 2nd/e, Oxford Press.
- S. Tumanski (2006), Principle of Electrical Measurement, Taylor & Francis .
- Ilya Gertsbakh (2010), Measurement Theory for Engineers, Springer.

Open Sources Software and Website:

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

List of Practical/ Exercise -

- Instrumentation of typical civil engineering members/structures/structural elements.
- Use of different sensors, strain gauges, inclinometers and their performance characteristics .
- Errors during the measurement process.
- Calibration of measuring sensors and instruments .
- Measurement of noise.
- Analog Signal processing.
- Digital Signal Processing.
- Demonstration & use of sensor technologies.



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106611

Course/Subject Name: Disaster Management

w.e.f.Academic Year:	2022-23	
Semester:	6 th SEM / 4 th YEAR	
Category of the Course:	Open Elective-2	

Prerequisite:	Basic Knowledge of Environmental Science
Rationale:	To apply management principles for disaster mitigation using scientific, technological, and policy frameworks with focus on Indian context.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
L	T	PR	C	Theory		Tutorial/Practical		
				(E)	(M)	(I)	(V)	
3	0	0	3	60	40	00	00	100

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Understanding Disasters Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity – Disaster and Development, and disaster management	4	10
2.	Types, Trends, Causes, Consequences and Control of Disasters Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Disasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves); Biological Disasters (epidemics, pest attacks, forest fire); Technological Disasters (chemical, industrial, radiological, nuclear) and Manmade Disasters (building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemicals and biological disasters); Global Disaster Trends – Emerging Risks of Disasters – Climate Change and Urban Disasters	8	19
3.	Disaster Management Cycle and Framework Disaster Management Cycle – Paradigm Shift in Disaster Management Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Micro zonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity Development; Awareness During Disaster –	8	19



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106611

Course/Subject Name: Disaster Management

	Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment. IDNDR, Yokohama Strategy, Hyogo Framework of Action		
4.	Disaster Management in India Disaster Profile of India – Mega Disasters of India and Lessons Learnt Disaster Management Act 2005 – Institutional and Financial Mechanism National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national), Non-Government and InterGovernmental Agencies	10	24
5.	Applications of Science and Technology for Disaster Management & Mitigation Geoinformatics in Disaster Management (RS, GIS, GPS and RS) Disaster Communication System (Early Warning and Its Dissemination) Land Use Planning and Development Regulations Disaster Safe Designs and Constructions Structural and Non-Structural Mitigation of Disasters S&T Institutions for Disaster Management in India	12	28
	Teaching hours	42	100

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
15	20	12	8	3	2

Where R: Remember; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create (as per Revised Bloom's Taxonomy)



SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106611

Course/Subject Name: Disaster Management

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Classify disasters and analyze their causes/impacts	N
2	Apply disaster management cycle frameworks	A
3	Evaluate roles of Indian disaster management agencies	E
4	Propose tech solutions for disaster mitigation	C

Course Outcome to Programme Outcome (CO-PO) Mapping (Scale: 1-Low, 2-Medium, 3-High)

CO-PO Mapping				
PO \ CO	CO-1	CO-2	CO-3	CO-4
PO-1 Basic Engg Knowledge	2	3	2	2
PO-2 Problem Analysis	3	3	3	3
PO-3 Design/Development	1	2	1	3
PO-4 Investigations	3	2	3	2
PO-5 Modern Tool Usage	2	1	1	3
PO-6 Engineer & Society	3	2	3	2
PO-7 Environment & Sustainability	3	2	2	2
PO-8 Ethics	2	1	2	1
PO-9 Individual & Team Work	1	2	2	1
PO-10 Communication	2	2	2	2
PO-11 Project Management	2	3	2	2
PO-12 Lifelong Learning	2	2	2	2
CO-PSO Mapping				
PSO \ CO	CO-1	CO-2	CO-3	CO-4
PSO-1 Programming Skills	1	1	1	2
PSO-2 Analytical Ability	3	2	3	2
PSO-3 Software Tools Use	2	1	1	3



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Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106611

Course/Subject Name: Disaster Management

Reference Books/Suggested Learning Resources:

(a) Policy Documents:

- Disaster Management Act 2005 (India)
- National Policy on Disaster Management
- Hyogo Framework for Action

Open Sources Software and Website:

- NPTEL: www.nptel.iitm.ac.in/courses/
- NDMA India (ndma.gov.in)

Practical Components (Suggested):

1. GIS-based hazard mapping exercises
2. Case studies of Indian mega-disasters
3. Early warning system simulation
4. Disaster preparedness plan development

Technology Tools:

- QGIS for spatial analysis
- Early warning dissemination apps
- Remote sensing datasets



Swaminarayan University

Teaching & Examination Scheme

Course – Faculty of Engineering (Degree)

Branch – Civil Engineering

Semester – 6th

Subject Code	Subject Name	Category	L	T	P	Total Credit	E	M	I	V	Total Marks
BE100601	Contributor Personality Development Program	Personality Development (Elective)	2	0	0	2	60	40	20	30	150
BE100602	Integrated Personality Development Course		2	0	0	2	60	40	20	30	150
BE106601	Water Resources Engineering and Hydrology	Professional Core	4	0	2	5	60	40	20	30	150
BE106602	Environmental Engineering	Professional Core	3	0	2	4	60	40	20	30	150
BE106603	Design of Reinforced Concrete structures	Professional Elective - 2	3	0	2	4	60	40	20	30	150
BE106604	Urban Transportation Planning		3	0	2	4	60	40	20	30	150
BE106605	Contracts Management		3	0	2	4	60	40	20	30	150
BE106606	Traffic Engineering and Management	Professional Elective - 3	3	0	2	4	60	40	20	30	150
BE106607	Foundation Engineering		3	0	2	4	60	40	20	30	150
BE106608	Construction Equipment and Automation		3	1	0	4	60	40	20	30	150
BE106609	Soft Computing Techniques	Open elective - 2	2	0	2	3	60	40	20	30	150
BE106610	Instrumentation and Sensors		2	0	2	3	60	40	20	30	150
BE106611	Disaster Management		3	0	0	3	60	40	0	0	100
Total			18	0	8	22					

L=Lecture, T=tutorial, P=Practical, E=Theory External, M=Theory Internal, I=Practical Internal, V=Practical External