SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: **BE106701**

Course/Subject Name: Construction Engineering and Management

w.e.f.Academic Year:	2022-23
Semester:	7th SEM/ 4TH YEAR
Category of the Course:	PCC

Prerequisite:	Basic Civil Engineering, Project Management Fundamentals
Rationale:	Covers essential skills for construction project management including planning, resource allocation, cost estimation, quality control, and safety management for successful project execution

Teaching and Examination Scheme:

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

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	**General** Features of Construction Projects, phases of construction project, Stakeholders of construction management.	**5**	**11**
2.	**Construction project planning**- Stages of project planning: Process of development of plans and schedules, work break-down structure, activity lists, assessment of work content, concept of productivities, estimating durations, sequence of activities, activity utility data; **Techniques of planning**- Bar charts, Line of balance, Mile stone charts **Planning and organizing construction site and resources**- **Site**: Site layout including enabling structures, developing site organization; **Manpower**: Planning, organizing, staffing, motivation; **Materials**: Concepts of planning, procurement and inventory control; **Equipment**: Basic concepts of planning and organizing; **Funds**: Cash flow, sources of funds; Histograms and S-curves, resource scheduling, allocation, smoothening	**18**	**40**

	and leveling, common good practices in construction **Networks**: Basic terminology, types of precedence relationships, **Preparation of CPM networks**: activity on arrow and activity on node representation, computation of float		
3.	**Project Monitoring & Control** - Network crushing and cost time trade off, Periodic progress reports, and periodical progress meetings, purpose, frequency and methods of updating plans. **Modern project management Systems:** Lean construction; use of Building Information Modeling (BIM) in project management.	**5**	**11**
4.	**Quality control**: Concept of quality, quality of constructed structure, use of manuals and checklists for quality control, role of inspection, basics of statistical quality control, CONQUAS- Construction Quality Assessment System **Safety, health and environment on project sites:** Accidents; their causes, effects and preventive measures, costs of accidents, Health and Safety Policies/Standards: OSHA, ISO 45001, occupational health & safety hazards in construction.	**5**	**11**
5.	**Construction equipment:** Conventional construction methods Vs Mechanized methods **Equipment:** Capacity, Feasibility, owning and operating cost and Productivity of Different Equipment: Earthmoving, dewatering, concrete mixing, lifting, transporting & placing, pile boring/driving equipment, tunnel boring machines.	**12**	**27**
	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**
12	**18**	**15**	**8**	**4**	**3**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: **BE106701**

Course/Subject Name: Construction Engineering and Management

1	Outline components and phases of construction projects	U
2	Apply planning techniques (WBS, CPM/PERT	A
3	Demonstrate progress monitoring and cost optimization	A
4	Evaluate quality/safety criteria for construction projects	E
5	Analyze equipment selection and productivity	N

Course Outcome to Programme Outcome (CO-PO) Mapping

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

References:

(a) Books:

- Peurifoy, "Construction Planning & Equipment", McGraw Hill
- Jha, "Construction Project Management", Pearson
- Punmia, "PERT & CPM", Laxmi Publications
- Hardin, "BIM and Construction Management", Wiley

(b) Open Source:

- **NPTEL: www.nptel.iitm.ac.in/courses/**

Practical Exercises:

1. WBS and bar chart for 1-story building
2. CPM for 5-span bridge
3. Gantt chart for precast structure
4. Equipment resource planning for slab concreting
5. Safety protocols for 3-story building

Suggested Projects:

- Comparative analysis of construction methods
- Lean construction implementation plan
- Equipment productivity study

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106702

Course/Subject Name: Engineering Economics, Estimation and Costing

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	PCC	

Prerequisite:	Basic Accounting, Construction Materials
Rationale:	Develops competencies in economic decision-making, cost estimation, contract management, and valuation techniques essential for construction project management, with emphasis on IS standards and modern software tools

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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 Engineering Economics-** Flow in an economy, Law of supply and demand, Concept of Engineering Economics Engineering efficiency, Economic efficiency, Scope of engineering economics Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Value engineering, Cash flow, Replacement and maintenance analysis, Economic decision making, Evaluating alternatives by- effect of taxation on comparison of alternatives, effect of inflation on cash flow, Evaluation of public projects, Benefit cost ration method.	**6**	14
2.	**Estimation**: Definition, Units of measurements, types of estimates, Different methods to find the quantities of civil works. Estimated cost and its importance. Provisions of IS-1200, for working out quantities and deductions in civil works. Entering the measurements in quantity sheet and calculation of quantities of various items of civil works for residential, commercial and	**10**	24

	industrial buildings, Highway, Dam, Culvert etc. Market rates of material and labour, Introduction to schedule of rates, **Abstracting and Billing:** Purpose of abstract, preparation of abstract, measurement and billing, Checking of bills and final bill. **Book Keeping:** Work abstract,material at site account, measurement book, muster role hiring and maintenance of equipment, record of bills, vouchers and receipt book.		
3.	**Specifications**: Definition, Objectives and importance of specification, Types of specification, Care to be taken while drafting specifications, Drafting general specifications, and detailed specifications for various civil work items- Specification of materials, specification of works, specification as per building classification, Language of specific writing. **Market Survey:** Traditional and modular materials, Market survey of materials of Construction,Wages of labour,Tools plant and equipment of construction.	**6**	14
4.	**Rate Analysis:** Definition of rate analysis, Factors affecting rate analysis, overhead expenses, procedure for rate analysis, schedule of rates, Definition of task, Determination of man power and material requirement for a given quantity of items of civil works, study of present wages of labour and prices of traditional and modular materials in the market. Study of market rents of different construction tools plant and equipment, Determination of rate of different items of civil work. Working out rates of various items of civil works.	**6**	14
5.	**Contract:** Definition, legal requirements of a valid contract, types of contracts, conditions of contract, sub contracts and contractual disputes, Arbitration. Form of Contract, Responsibility of owner,Architect,Contractor and Engineer.	**3**	7
6	**Tender and Tender notice:** Bidding process, e-tendering, Prequalification process, tender notice and its essential features drafting tender notice Bid submission, Analysis of tenders, Basis for evaluation and acceptance, letter of intent, work order, agreement.	**3**	7

7	**Valuation:** Definitions of value, price and cost, depreciation, sinking fund, different type of values and their significance, factor affecting value, rent and standard rent, Lease hold and free hold property, obsolescence, Gross income, Outgoing and Net income, Capitalized value and Years purchase, valuation tables, Easement, types of easements,significance of easement in valuation, Methods of valuation of buildings and land, Estimation of values of different types of buildings and lands.	**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**	**18**	**10**	**4**	**3**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Apply economic principles for engineering decisions	A
2	Prepare rate analyses, contracts, and tender documents	C
3	Develop detailed estimates for civil works	C
4	Utilize software for quantity calculations	A
5	Conduct property valuation using standard methods	A

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106702

Course/Subject Name: Engineering Economics, Estimation and Costing

Course Outcome to Programme Outcome (CO-PO) Mapping

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

References:

(a) Books:

- Park, "Contemporary Engineering Economics", Prentice Hall
- Rangwala, "Estimating and Costing", Charotar
- Chakraborti, "Estimating & Valuation"
- IS 1200 (Measurement Standards)

Open Source:

- **NPTEL courses: www.nptel.iitm.ac.in/courses/**

Practical Components (Excluded from Weightage):

- 30 hours of:
    1. Quantity take-off exercises
    2. Rate analysis worksheets
    3. Tender document preparation
    4. Valuation case studies
    5. Estimation software applications

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106703

Course/Subject Name: Irrigation Engineering

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	Professional Elective-4	

Prerequisite:	Fluid Mechanics, Soil Mechanics
Rationale:	Equips students with design principles for irrigation systems including canals, dams, and drainage works, focusing on water requirements, diversion structures, and reclamation techniques essential for agricultural water management in India

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**Irrigation** Introduction- Definition, Necessity, Scope, Benefits and ill effects of irrigation,Types of irrigation schemes, Social and environmental considerations, Irrigation development and water resources potentials in India. **Water Requirement of Crops** Methods of irrigation; Macro and micro, sustainable irrigation methods. Various modes of application of irrigation water Crop seasons in India, Principal Indian crops Soil-water-plant relation- field capacity, wilting point, available water, Consumptive use and its empirical methods, Irrigation requirements – Net irrigation requirement, Field irrigation requirement,Gross Irrigation requirement, Soil moisture extraction pattern, Frequency of irrigation,Gross command area, Culturable command area, Intensity of irrigation, Duty and delta relation, Irrigation efficiency,assessment of irrigation water	**10**	22

2.	**Diversion Works:** Diversion head works, Weir and barrages, Various parts of diversion head works and their functions, Types of weir, Causes of failures of weir on permeable foundations, Principles of weir design on permeable formations -Bligh's creep theory, Lanes weighted creep theory and Khosla's theory, critical gradient, Exit gradient, Khosla's method of independent variables, location of hydraulic jump, basic factors for design of weir floor **Storage works:** **Embankment dam**: Classification of dams, site assessment and selection of type of dam, Environmental impacts of dam, Types of earthen dams, Methods of construction, causes of failures, Seepage in earth dams: Location of phreatic line in earthen dam, Rock-fill dams Gravity dams, Forces acting on a gravity dam, Modes of failure, load combinations for design of gravity dam, and stability analysis and design of gravity dam	**15**	33
3.	**Distribution works:** Modes of conveying irrigation water- Types of irrigation canals contour canal, ridge canal, side sloping canals, canal alignment Method of design of unlined section of irrigation canal, Kennedy's and Lacey's Silt theories, Silting and scouring of canals Canal sections-filling, cutting, partial cutting and partial filling, Balanced depth, Canal FSL, Capacity factor and Time factor, Longitudinal section, Schedule of area statistics and channel dimension, canal losses Lined canals, Design of lined canal, Link canals.	**8**	18
4.	**Regulating and Cross Drainage Works:** Canal falls, development of various type of falls, Classification of falls and its selection, Cross drainage works, Types of cross drainage works and its selection, Design consideration of cross drainage work, Design discharge of drainage and waterway, uplift pressure Canal escapes, Head regulator and Cross regulator, Meter flume, Irrigation outlets and types of outlets	**8**	18
5.	**Water logging**: causes and prevention ill effects of waterlogging, Land Reclamation, management of irrigation water, Characteristics of irrigation water, Types of Drainage system.	**4**	9
	Teaching hours	**45**	**100**

Suggested Specification Table with Marks (Theory):

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106703

Course/Subject Name: Irrigation Engineering

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**15**	**18**	**10**	**4**	**3**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Calculate irrigation water requirements using duty-delta	A
2	Design canals using silt theories	C
3	Analyze weirs/dams using piping theories	N
4	Plan canal structures (falls, regulators)	C
5	Select appropriate drainage systems	A

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106703
Course/Subject Name: Irrigation Engineering

Course Outcome to Programme Outcome (CO-PO) Mapping

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	3	2
PO-4 Investigations	2	2	3	2	3
PO-5 Modern Tool Usage	2	2	2	2	2
PO-6 Engineer & Society	3	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	2	1	2	1
PO-10 Communication	1	2	1	2	1
PO-11 Project Management	1	2	1	2	1
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	3
PSO-3 Software Tools Use	2	2	2	2	2

Reference Books/Suggested Learning Resources:

- Irrigation, Water Resources & Water Power Engineering - Dr. P.N.Modi, Standard Book House,Delhi
- Irrigation, Water Power & Water Resources Engineering Dr. K.R.Arora Standard Publishers Distributors, Delhi
- Irrigation Engineering and Hydraulic Structures - S.K.Garg, Khanna Publishers, Delhi
- Irrigation Engineering, S.K. Mazumder, Galgotia Publications Pvt Ltd., New Delhi
- Irrigation Engineering, G.L.Asawa, New Age publications, New delhi
- Hydraulic Structures, P. Novak, A.I.B. Moffat, C. Nalluri and R. Narayanan, Taylor and Francis Group

Open Sources Software and Website:

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

List of Practical/ Exercise -

- A detailed note on Irrigation development and water resources potentials in India.
- Design a storage capacity of reservoirs based on the crop sown in the area
- Compute field irrigation requirement of crop using soil water plant relationship
- Design weir floor using Khosla's theory
- Carry out stability analysis of gravity dam
- Design unlined canal using silt theories
- Design a lined canal section.
- Compute balanced depth of cutting and filling for a deigned channel section
- Compute design discharge and water way in case of cross-drainage work
- Describe a suitable cross drainage system to reclaim water logged soil

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106704

Course/Subject Name: Application of GIS in Civil Engineering

w.e.f.Academic Year:	2022-23
Semester:	7^{TH} /4^{TH} YEAR
Category of the Course:	Professional Elective -4

Prerequisite:	Basic knowledge of Civil Engineering concepts
Rationale:	To impart knowledge of data sciences and geo-spatial techniques in analysis of Civil Engineering issues. To build Civil Engineering projects on Geo-Spatial tools for better decision making

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			**Total Credits L+T+(PR/2)**	**Assessment Pattern and Marks**				**Total Marks**
				Theory		**Tutorial/Practical**		
L	**T**	**PR**	**C**	(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.	**GIS and civil engineering projects** – Urban planning, Hydrology and floods, Soil management, Water supply, Water distribution, Storm water, Solid and hazardous waste management, Transportation and utility system	8	19
2.	**Introduction to ArcGIS** / QGIS Desktop GIS - Exploring for spatial and non-spatial data operations, analysis and management	8	19
3.	**GIS and data science** – Spatial data structure and topology, Raster and vector data models, Map projections, Coordinate systems, Map scales, Selecting and editing features, Non-spatial database models, Data query, Displaying and editing tables, Joining and linking tables, GIS spatial data sources on the Internet, Creating new data sets, Data accuracy, Data	14	33

	redundancy.		
4.	**GIS modeling approaches in project management** – TIN and DEM analysis, Analytical modeling in GIS, GIS interfaces, GIS post processing, dynamic visualization, Decision making	12	29
		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**	**15**	**10**	**5**	**5**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Apply knowledge of GIS to different fields of civil engineering.	A
2	Implement ArcGIS/QGIS in civil engineering project	A
3	Create new datasets for geospatial analysis.	C
4	Perform modeling on GIS platforms.	A

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106704

Course/Subject Name: Application of GIS in Civil Engineering

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

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

References/Suggested Learning Resources:

(a) Books:

- Apply knowledge of GIS to different fields of civil engineering.
- Implement ArcGIS / QGIS in civil engineering project.
- Create new datasets for geospatial analysis.
- Perform modeling on GIS platforms

(b) Open source software and website:

- **QGIS (Free) https://qgis.org/en/site/forusers/download.html**
- **SRTM 90m Digital Elevation Data (Free) http://srtm.csi.cgiar.org/**
- **Commercial ERDAS Imagine http://gi.leica-geosystems.com/LGISub1x33x0.aspx**
- **ER Mapper http://www.ermapper.com/**
- **IDRISI http://www.clarklabs.org/**
- **Freeware MultiSpec http://cobweb.ecn.purdue.edu/~biehl/MultiSpec/**

Suggested Course Practical List:

- Mini-project on soil geospatial data mapping and management
- Mini-project on Land use/cover geospatial data mapping and management
- Mini-project on site selection for major infrastructure with geospatial data
- Mini-projects on natural disaster mitigation with geospatial data

List of Laboratory/Learning Resources Required:

- Computers with GIS software (ArcGIS/QGIS)
- Geospatial datasets for practical exercises

Suggested Project List:

- GIS-based urban planning analysis
- Hydrological modeling using GIS
- Transportation network analysis using GIS tools

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106704

Course/Subject Name: Application of GIS in Civil Engineering

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106705

Course/Subject Name: Design of Steel Structures

w.e.f.Academic Year:	2022-23	
Semester:	7^{th} SEM / 4^{th} YEAR	
Category of the Course:	Professional Elective - 4	

Prerequisite:	Structural Analysis, Mechanics of Materials
Rationale:	Equips students with limit state design methodology for steel structures as per IS codes, covering connections, plate girders, bridges, and plastic design for safe and serviceable structures.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**Loads & Load combinations:** Appraisal of loading standards such as I.S, I.R.C., Effect of wind and earthquake on structure **Connections:** Stiffened and unstiffened, moment & shear resisting structural connections, design and detailing of various connection - roof truss to column, column to beam, beam to beam and truss to bed block.	**10**	22
2.	**Design of Plate Girder Modes of failure**: Elastic buckling, Bending in the plane of web, Local buckling, Buckling in the plane of web, Vertical buckling of the compression flange, Shear buckling Design of bolted, welded plate girder by Tension field Method & Simple Post Critical Method including design of vertical & horizontal stiffeners, Splices, Curtailment. Detailing of various elements of Plate girder.	**12**	27

3.	**Design of foot-over bridge** Structural system of through & deck type bridges, design of foot-over bridge & its Supporting system. Detailing of Various elements of Foot over bridge.	**10**	22
4.	**Plastic Design** Introduction to plastic method of analysis, Design of continuous beams and portal frame using plastic design approach	**8**	18
5.	**Design of Gantry Girder Gantry** girder – static and moving loads selection & design of section. Detailing of Gantry girder.	**5**	11
	Teaching hours	**45**	

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
12	**15**	**18**	**10**	**3**	**2**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Determine loads and design steel connections	A
2	Prepare structural layouts with load calculations	U
3	Apply IS codes for design/detailing of steel components	A
4	Implement plastic design principles	C

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106705

Course/Subject Name: Design of Steel Structures

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	3	2	3	2
PO-2 Problem Analysis	3	3	3	3
PO-3 Design/Development	3	2	3	3
PO-4 Investigations	2	2	2	2
PO-5 Modern Tool Usage	2	2	3	2
PO-6 Engineer & Society	2	1	2	1
PO-7 Environment & Sustainability	2	1	2	1
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	1	2	1
PO-10 Communication	1	2	2	1
PO-11 Project Management	1	2	2	1
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	2	1
PSO-2 Analytical Ability	3	3	3	3
PSO-3 Software Tools Use	2	2	3	2

References:

(a) Books:

- Subramaniam, "Design of Steel Structures", Oxford
- Bhavikatti, "Limit State Design as per IS:800", IK International
- IS 800:2007 (Steel Construction Code)
- IS 875 (Parts I-V) & IS 1893 (Load Standards)

Open Source:

- **NPTEL courses: www.nptel.iitm.ac.in/courses/**

Practical Components (Excluded from Weightage):

- **30 hours of:**
    1. Full design of plate girder/footbridge/gantry girder
    2. CAD detailing (AutoCAD)
    3. Excel design worksheets
    4. Connection design software applications

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106706

Course/Subject Name: – Railway and Airport Engineering

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	Professional Elective - 5	

Prerequisite:	Transportation Engineering, Surveying
Rationale:	Equips students with design principles for railway tracks and airport infrastructure, covering geometric design, station planning, runway orientation, and air traffic management systems as per ICAO/FAA standards.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**RAILWAY ENGINEEIRNG:** **General:** Development of railways in India, Permanent way and railway track components, different gauges in India, conning of wheels, Functions of various Components - Rails, Sleepers and Ballast, Rails - types of rails, rail sections, defects in rails, creep of rails, rail fixtures and fastenings, rail joints and welding of rails, sleepers – types, spacing and density, Ballast – types, advantages and disadvantages, Subgrade – Requirement, embankment.	**8**	19
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. Track layouts, Switches, Tongue Rails, Crossings, Layout of Turnout – Double Turnout, Diamond crossing, Scissors crossing.	**5**	12

3.	**Railway station and Yard:** 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, loops, sidings. Railway yards – types, required equipment in yards. Signaling and control system – objectives, classification, Interlocking of signals and points.	**8**	19
4.	**AIRPORT ENGINEERING:** **General:** History, development, policy of air transport, aircrafts, aerodromes, air transport authorities, air transport activities, air crafts and its characteristics, airport classifications as per ICAO.	**1**	2
5.	**Airport Planning:** Regional planning-concepts and advantages, location and planning of airport as per ICAO and FAA. Airport Master plan, Airport site selection, Zoning laws, Airport Elements -airfield, terminal area, zoning laws, classification of obstructions, approach zone, turning zone, airport capacity, runway capacity, estimation of future air traffic, development of new airport, requirements of an ideal airport layout.	**6**	14
6	**Run Way Design:** Wind rose and orientation of runway, wind coverage and crosswind component, factors affecting runway length, basic runway length and corrections to runway length, runway geometrics and runway patterns (configurations), Runway marking, threshold limits cross section of runway. Taxiway Design: Controlling factors, taxiway geometric elements, layout, exit taxiway, location and geometrics, holding apron, turnaround facility. Aprons -locations, size, gate positions, aircraft parking configurations and parking systems, hanger-site selection, planning and design considerations, Fuel storage area, blast pads. Wind direction indicator. LCN system of Pavement Design, Airfield Pavement – Failures, Maintenance and Rehabilitation.	**8**	19
7	**Terminal Area:** Elements and requirements, terminal building functions, space requirements, location planning concepts, vehicular parking area and circulation network	**2**	5
8	**Grading and Drainage:** Airport grading-importance, operations, airport drainage aims, functions, special characteristics, basic requirements, Deign of drainage - surface and subsurface drainage systems,	**2**	5
9	**Air Traffic Control and Visual Aids**: Need of Air traffic control, Air traffic control network, Air traffic control aids -landing information system, airport markings and lighting.	**2**	5
	Teaching hours	**42**	**100**

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106706

Course/Subject Name: – Railway and Airport Engineering

4

Suggested Specification Table with Marks (Theory):

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

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 railway track components and materials	N
2	Design railway track geometry (curves, superelevation)	C
3	Plan railway stations/yards with signaling systems	A
4	Develop airport master plans as per ICAO standards	C
5	Design runways using wind rose analysis	C

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106706

Course/Subject Name: – Railway and Airport Engineering

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

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	3	2	3	3
PO-4 Investigations	2	2	3	3	3
PO-5 Modern Tool Usage	2	2	2	3	3
PO-6 Engineer & Society	2	2	2	3	2
PO-7 Environment & Sustainability	2	2	2	2	2
PO-8 Ethics	1	1	1	2	1
PO-9 Individual & Team Work	1	2	2	2	2
PO-10 Communication	1	2	2	2	2
PO-11 Project Management	1	2	2	3	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	3
PSO-3 Software Tools Use	2	2	2	3	3

Reference Books/Suggested Learning Resources:

- A Satish Chandra and M.M. Agrawal, "Railway Engineering", Oxford University Press, New Delhi.
- S.C. Saxena and S. P. Arora, "A Text Book of Railway Engineering", Dhanpat Rai & Sons, New Delhi.
- S.C. Rangwala, K.S. Rangwala and P.S. Rangwala, "Principles of Railway Engineering", Charotar Publishing House, Anand.
- Dr. S. K. Khanna, M.G.Arora and S.S. Jain, "Airport Planning & Design", Nem Chand & Bros., Roorkee
- G.V. Rao, "Airport Engineering", Tata McGraw Hill Pub. Co., New Delhi
- S.C. Rangwala, P. S. Rangwala,"Airport Engineering", Charotar Publishing House Pvt. Ltd, Anand

Open Sources Software and Website:

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

List of Practical/ Exercise -

- Component parts of Railway track, importance and their functions
- Geometric design of railway track
- Signal control system of Railway
- Runway and Taxiway design of Airport
- Terminal area, parking and drainage system at Airfield
- Air Traffic Control and Visual Aids

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106707

Course/Subject Name: Computational Geotechnics

w.e.f.Academic Year:	2022-23
Semester:	7^{th} sem /4^{th} yeaar
Category of the Course:	Professional Elective - 5

Prerequisite:	Basic Soil Mechanics, Numerical Methods
Rationale:	Specialized subject dealing with numerical modeling of geotechnical problems including soil/rock behavior, laboratory/field tests, tunnels, flow problems, and soil-structure interactions using numerical approaches

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**Solution of Linear &Non-linear Equations**: Jacobi's method, Gauss Seidal method, Successive over relaxation method. Bisection, False Position, Newton-Raphson, Successive approximation method, Iterative methods	12	29
2.	**Finite Difference Method:** Two point Boundary value problems Disichlet conditions, Neumann conditions; ordinary and partial differential equations.	8	19
3.	**Discrete modeling:** discrete versus continuum modeling, introduction to discrete element method (DEM), DEM solution procedure, contact model and detect algorithms	7	17
4.	**Classical plasticity and soil behavior:** One-dimensional (1D) plasticity theory basics, 1D frictional models, initial boundary value problems, integration algorithm, General framework of classical plasticity, elastic models and plastic models: Tresca, Huber-von Mises, Mohr-Coulomb,	11	26

	Drucker-Prager, Lade-Duncan, Cam clay, soil behavior and its relation to constitutive models, FEM solutions		
5.	**Numerical solutions:** General procedure, examples:1D consolidation, Tri-axial test, Embankments, Foundation, Flow Through Porous Media	4	9
		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**	**15**	**10**	**5**	**5**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(as per Revised Bloom's Taxonomy)

Course Outcome:

After Completion of the Course, Student will able to:

No	Course Outcomes	RBT level
1	Distinguish between linear/non-linear solutions and their relevance	
2	Identify appropriate constitutive models for soil types/loading	
3	Select correct integration algorithms for constitutive models	
4	Explain discrete modeling concepts and interpret results	
5	Conduct simulations using FDM/FEM for geotechnical problems	

Course Outcome to Programme Outcome (CO-PO) Mapping

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106707

Course/Subject Name: Computational Geotechnics

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

References/Suggested Learning Resources:

(a) Books:

- **Jain et al., "Numerical Methods for Scientific Computations", New Age**
- **Bowels, "Analytical Methods in Foundation", McGraw Hill**
- **O'Sullivan, "Particulate DEM", Spon Press**
- **Helwany, "Applied Soil Mechanics with ABAQUS", Wiley**

Open Source:

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

Practical List:

- Stress analysis modeling
- Constitutive modeling (elastic/plastic)
- Non-linear material simulations
- FEM for seepage/consolidation

Lab Requirements:

- Computers with numerical modeling software (e.g., PLAXIS, ABAQUS)
- Geotechnical datasets

Suggested Projects:

- Slope stability analysis using DEM
- Foundation settlement simulation
- Retaining wall design with FEM

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106708

Course/Subject Name: Design of hydraulic structures

w.e.f.Academic Year:	2022-23
Semester:	7th SEM / 4th YEAR
Category of the Course:	Professional Elective - 5

Prerequisite:	Fluid Mechanics, Geotechnical Engineering
Rationale:	Covers essential design principles for hydraulic structures including dams, spillways, and energy dissipators, focusing on site selection, stability analysis, and construction techniques for water resources projects.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**Types of Dams and Foundation Treatment:** Classification of Dams, Investigations for Dam Sites, Selection of site for Dams, Selection of Type of Dam, Merits and demerits of all types of dam, Importance of Subsurface Exploration, Foundation Treatment Methods, Materials and Techniques.	**2**	12
2.	**Gravity Dams:** Definition, Forces acting on the Dam, Combinations of load on the Dam, Causes of failure of Dams, Design criteria for Gravity Dams, Principal and Shear stresses, Elementary and Practical Profile of a Gravity Dam, High and Low Dam, Stability Analysis of a Gravity Dam, Design of Gravity Dams, Control of Temperature in Dams, Construction of dam, and joints in Dams, Galleries in Dams.	**10**	31
3.	**Earth and Rock-fill Dams:** Introduction, Earth Dam Definitions, Classification of Non – Rigid Dams, Causes of failure of Earth dams, Design Principles of Earth Dams, Profile of an Earth Dam, Side slopes and Protection Measures for Earth Dams, Core and Casing for Earth Dams, Construction Materials for Earth Dams, Cut off and Seepage Control Measures in Earth Dams, Drainage system for Earth Dams,	**5**	19

	Typical Sections of Earth Dams, Selection of Dam section, Construction of Earth Dams, Determination of Phreatic line, Stability of Slopes, Stability of Foundation against Shear, Design considerations in Earthquake Regions, Design of Earth Dams, Rock fill Dams		
4.	**Spillways, Sluices and Crest Gates** Definition and Types of Spillway, Components of Spillway, Chute Spillway, Side Channel Spillway, Shaft Spillway, Siphon Spillway, Design of Ogee Spillway, Profile of Ogee Spillway, Cavitation Erosion of Spillway Surface, Design of Chute spillway, Aeration Galleries, Spillway crest Gates, Sluices in dam	**5**	19
5.	**Energy Dissipators:** Energy Dissipation below Overflow Spillways, Energy Dissipation by Hydraulic Jump, Location of hydraulic jump, Design criteria for Stilling Basins and their design, IS Standardized Basins, Various methods of Energy Dissipation and their design.	**5**	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**	**15**	**10**	**5**	**5**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 dam types and construction sites	A
2	Analyze forces/stresses and verify gravity dam stability	N
3	Conduct seepage/stability analysis for embankment dams	A
4	Design ogee/chute spillway components	C
5	Develop energy dissipation systems	C

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106708

Course/Subject Name: Design of hydraulic structures

Course Outcome to Programme Outcome (CO-PO) Mapping

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	2	3	3	3	3
PO-3 Design/Development	2	3	2	3	3
PO-4 Investigations	2	2	3	2	2
PO-5 Modern Tool Usage	2	2	2	3	3
PO-6 Engineer & Society	2	1	2	1	1
PO-7 Environment & Sustainability	3	2	3	2	2
PO-8 Ethics	1	1	1	1	1
PO-9 Individual & Team Work	1	1	1	2	2
PO-10 Communication	1	1	1	1	1
PO-11 Project Management	1	1	1	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	2	2
PSO-2 Analytical Ability	3	3	3	3	3
PSO-3 Software Tools Use	2	2	2	3	3

References:

(a) Books:

- Sahasrabudhe, "Irrigation & Hydraulic Structures"
- Varshney, "Theory & Design of Hydraulic Structures" (Vol. I & II)
- Garg, "Irrigation Engineering & Hydraulic Structures"
- Punmia, "Irrigation & Water Power Engineering"

(b) Open Source:

- **NPTEL courses: www.nptel.iitm.ac.in/courses/**

Practical List:

1. Gravity dam stability analysis using software
2. Phreatic line determination for earth dams
3. Ogee spillway profile design
4. Stilling basin hydraulic calculations
5. Site selection case study for dam projects

Lab Requirements:

- Hydraulic modeling software (e.g., HEC-RAS, AutoCAD Civil 3D)
- Geotechnical testing equipment

Suggested Projects:

- Earthquake-resistant dam design
- Spillway retrofit analysis
- Sustainable sediment management system

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106709

Course/Subject Name: Port and Harbor Engineering

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	Professional Elective - 6	

Prerequisite:	Coastal Engineering, Fluid Mechanics
Rationale:	Equips students with design and planning principles for maritime infrastructure including ports, harbors, and navigation systems, focusing on cargo logistics, coastal phenomena, and IS code compliance for water transportation systems.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(E)	(M)	(I)	(V)	
3	1	0	4	60	40	0	0	100

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	**Introduction to Water Transportation:** History, Scope, Merits, Developments of Water Transportation in India, Inland waterways, River, Canal, Inland water transportation, Harbor, Port, Dock, Development of Ports & Harbors, classification, Harbor site selection, Harbor dimensioning.	**2**	5
2.	**Port Planning:** Characteristics of good seaport and principles of seaport planning, size of seaport, site selection criteria and layout of seaport, Dry ports, Bulk cargo, Transshipment ports, Port of call, Surveys to be carried out for seaport planning, regional and intercontinental transportation development, forecasting cargo & passenger demand, regional connectivity, cargo handling capacity of port.	**10**	24
3.	**Natural Phenomena:** Wind, Tides, Water waves, Wind rose and wave rose diagrams, wave diffraction, breaking, reflection, Littoral drift, sediment transport, Effects on Harbor and structure design.	**5**	12
4	**Harbor Infrastructures:**	**5**	12

	Ship characteristics. Design of Harbor entrance, channel, turning basin, IS provisions, Breakwaters - function, types, general design principles, wharves, quays, jetties, piers, pier heads, dolphin, fenders, mooring accessories, IS provisions. Repair facilities, wet docks, lift docks, dry docks, gates for graving docks, floating docks, slipways, locks and gates.		
5.	**Port Amenities & Operations:** Ferry, Transfer bridges, floating landing stages, transit sheds, warehouses, cold storage, aprons, cargo handling equipment, purpose and general description: stack area, single point mooring, IS provisions	**5**	12
6	**Navigational Aids:** Channel and entrance demarcation, buoys, beacons, light house electronic communication devices.	**5**	12
7	**Seaport Maintenance:** Costal protection-purpose and devices, sea wall protection-sea wall revetment, bulkhead. Dredging, dredgers-types and suitability, usage of dredged materials	**5**	12
8	**Impact analysis:** Economic evaluation of port project, Environmental impacts of port activities.	**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**
8	**12**	**15**	**10**	**10**	**5**

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106709

Course/Subject Name: Port and Harbor Engineering

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 port planning concepts and cargo forecasting	N
2	Design harbor components as per IS standards	C
3	Evaluate coastal phenomena impacts on structures	E
4	Assess economic/environmental impacts of port projects	E

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	3	3	3	2
PO-2 Problem Analysis	3	3	3	3
PO-3 Design/Development	2	3	2	1
PO-4 Investigations	3	2	3	3
PO-5 Modern Tool Usage	2	2	2	2
PO-6 Engineer & Society	2	2	2	3
PO-7 Environment & Sustainability	2	2	3	3
PO-8 Ethics	1	1	2	2
PO-9 Individual & Team Work	1	2	1	1
PO-10 Communication	1	2	2	2
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	1
PSO-2 Analytical Ability	3	3	3	3
PSO-3 Software Tools Use	2	2	2	2

Reference Books/Suggested Learning Resources:

- R. Srinivasan and S. C. Rangwala, Harbour, Dock and Tunnel Engineering, 1995, Charotar Pub.House, Anand.
- S. P. Bindra, A Course in Docks and Harbour Engineering, 1992, DhanpatRai& Sons, NewDelhi.
- IS Codes: 4651 (Part I to V), 7314, 9527 (Part I, III, IV, VI), 10020 (Part IV).

List of Practical/ Exercise -

- Forecasting of Cargo, Passengers for the Seaport.
- Components design of Seaport Infrastructure using IS codes.
- Environmental impact analysis of the Port area.

Open Sources Software and Website:

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

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106710

Course/Subject Name: Design of Prestressed Concrete structures

w.e.f.Academic Year:	2022-23	
Semester:	7^{th} SEM / 4^{th} YEAR	
Category of the Course:	Professional Elective - 6	

Prerequisite:	Fundamentals of Reinforced Concrete Design, Strength of Materials, Structural Analysi
Rationale:	This course is an elementary course on Design of Prestressed Concrete Structures. The course is specifically aim to familiarize with the basic concepts of prestressing and to develop understanding of various design philosophies, Indian Standard Codal provisions for the design of statically determinate Prestressed Concrete elements.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			**Total Credits L+T+(PR/2)**	**Assessment Pattern and Marks**				**Total Marks**
				Theory		**Tutorial/Practical**		
L	**T**	**PR**	**C**	(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.	**General** Basic Concepts of Prestressing, Historical Development of prestressing, Materials and systems for prestressing, Types of Prestressing, Advantages and Limitations of Prestressing.	**3**	14
2.	**Losses in Prestress** Introduction, Losses due to Friction, Losses due to Anchorage Slip, Losses due to Elastic Shortening, Time-Dependent losses due Creep, Shrinkage and Relaxation, Total immediate losses, Total Time-Dependent losses, Illustrative Examples.	**5**	24
3.	**Flexural Design of Prestressed Concrete Elements** Introduction, Types of Flexural Failures, Selection of concrete section and tendon profile, Strain Compatibility Method, Design of Pre-tensioned Beams, Design of Post-tensioned Beams, Design of Composite Prestressed Concrete Beams, Design of Simply supported Slabs, Camber, Deflection and Crack Control, End Block Design.	**16**	19

4.	**Shear and Torsional Strength Design** Introduction, Shear and Principal Stresses, Ultimate Shear Resistance of Prestressed Concrete Members, Design of Shear Reinforcements, Horizontal Shear strength in Composite Construction, Brackets and Corbels, Torsional behavior and strength, Design for Combined Shear and Torsion.	**12**	19
5.	**Prestressed Compression and Tension Members** Introduction, Types of prestressed Compression and Tension Members, their behavior, Analysis and design of prestressed Compression and Tension Members	**9**	24
	Teaching hours	**45**	

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**25**	**20**	**15**	**10**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 the fundamental concepts, systems, and types of prestressing along with its historical development.	U
2	Analyze various prestress losses including immediate and time-dependent losses.	N
3	Perform flexural design of prestressed concrete beams and slabs using different tendon profiles	A
4	Analyze and design prestressed members for shear, torsion, and end blocks.	C
5	Analyze and design prestressed compression and tension members.	A

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106710

Course/Subject Name: Design of Prestressed Concrete structures

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	3	3	2	2
PO-2 Problem Analysis	2	3	3	2
PO-3 Design/Development	1	2	2	3
PO-4 Investigations	2	3	3	3
PO-5 Modern Tool Usage	1	2	3	2
PO-6 Engineer & Society	3	2	2	3
PO-7 Environment & Sustainability	3	3	3	3
PO-8 Ethics	2	2	2	2
PO-9 Individual & Team Work	1	2	2	2
PO-10 Communication	2	2	2	3
PO-11 Project Management	2	2	2	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	2	3	3	2
PSO-3 Software Tools Use	1	2	3	2

Reference Books –

- T. Y. Lin and Ned H. Burns, Design of Prestressed Concrete Structures, 3rd Edition, John Wiley and Sons.
- Arthur H. Nilson, Design of Prestressed Concrete, 2nd Edition, John Wiley and Sons
- N. Krishna Raju, Prestressed Concrete, 6th Edition, McGraw Hill Education (India) Private Limited
- IS: 1343 – 2012, Prestressed Concrete – Code of practice

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 Prestressed Concrete Elements in sketch book/A3 size sheet.
- Experiments may be designed and carried our related to the topics of the course such as Design, casting, prestressing and testing of Prestressed Concrete Elements.
- Practical examinations shall consist of oral based on term-work and above course

Open Sources -

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

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106711

Course/Subject Name: Environmental Impact Assessment

w.e.f.Academic Year:	2022-23	
Semester:	7^{th} SEM / 4^{th} YEAR	
Category of the Course:	Professional Elective - 6	

Prerequisite:	Environmental Engineering, Ecology.
Rationale:	Equips students with methodologies to assess environmental impacts of development projects, ensuring sustainable decision-making through legal frameworks, predictive modeling, and mitigation strategies as per EIA Notification 2006.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	(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.	**Concepts of Environmental Impact Assessment:** Environment; Environmental Impacts; Environmental Impact Analysis; Environmental Impact Assessment And Environmental Impact Statement; EIA- As An Integral Part of The Planning Process	**6**	14
2.	**Detailed Contents of EIA:** Introduction; Project Description; Description of The Environment; Anticipated Environmental Impacts And Mitigation Measures: Analysis of Alternatives; Environmental Monitoring Programmed; Additional studies; Project Benefits; Environmental Cost Benefit Analysis	**10**	24
3.	**Environment attributes:** air; water; noise; land and soil. Description of the Baseline Environment : Purposes for defining the Environmental Setting; Selection of parameters, Monitoring of physical environmental parameters, Collection and interpretation of baseline data for various environmental attributes	**8**	19
4.	**Prediction and Methods** of Assessment of Impacts on Various aspects of Environment; Application of various models for the Prediction of impact on Air Environment, Water Environment, Noise Environment and	**8**	19

	Land		
5.	**EIA notification September 2006 and amendments:** Categorization of projects, Procedure for getting environmental clearance. Public participation in environmental decision making process. Case studies on EIA for Industries and Infrastructure projects	**10**	24
	Teaching hours	**42**	

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**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 EIA's role in sustainable planning	U
2	Analyze environmental attributes for impact assessment	N
3	Apply predictive models for environmental impacts	A
4	Develop EIA reports for clearance procedures	C

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106711

Course/Subject Name: Environmental Impact Assessment

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	3	3	2	2
PO-2 Problem Analysis	2	3	3	2
PO-3 Design/Development	1	2	2	3
PO-4 Investigations	2	3	3	3
PO-5 Modern Tool Usage	1	2	3	2
PO-6 Engineer & Society	3	2	2	3
PO-7 Environment & Sustainability	3	3	3	3
PO-8 Ethics	2	2	2	2
PO-9 Individual & Team Work	1	2	2	2
PO-10 Communication	2	2	2	3
PO-11 Project Management	2	2	2	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	2	3	3	2
PSO-3 Software Tools Use	1	2	3	2

Reference Books –

- Environmental Impact Analysis Handbook – by Rau Whooten; McGraw Hill publications
- Environmental Impact Assessment – by Larry Canter; McGraw Hill publications
- Environmental Impact Analysis – A Decision Making Tool by R K Jain
- Handbook of Environment Impact Assessment by Judith Petts; McGraw Hill publications

List of Practical/ Exercise -

- Determination of pH and conductivity for water and wastewater.
- Determination of DO of the sample from water body.
- Determination of biodegradability (BOD/COD) for industrial wastewater sample.
- Determination of SO 2 , NO 2 and PM of effluent gaseous sample.
- Tutorial based on Environmental Attributes and Environmental Setting.
- Tutorial based on Methods of Prediction for Assessment of impacts.

Open Sources -

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

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106712

Course/Subject Name: ICT For Development

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	Open elective - 3	

Prerequisite:	Basic Computer Literacy
Rationale:	This course introduces cutting-edge ICT technologies (IoT, AR/VR, smart infrastructure) and networking fundamentals to enable students to develop technology-driven solutions for societal development challenges.

Teaching and Examination Scheme:

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

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1	**Physical Network** Basics of Computer network, Ethernet, Fiber Optics, switching -- packet, circuit, routers, switches - managed, unmanaged	**4**	10
2.	**Communication Network Various Network Topology** – Star, Ring, Mesh, etc, Concepts of LAN, WAN, MAN, IP addressing, Class A, Class B and Class C addresses, Subnet, Proxy, OSI layer, Basics of Layered Protocol, Firewall and its importance, Introduction and usage of GIS, RFID technology, Introduction to wireless networks and Mobile network	**12**	29
3.	**Storage and Servers** Primary and Secondary storage, Cloud technology, mail server, data server, Concept of Data centers	**4**	10
4.	**Software and applications** What is Operating Systems, ERP, CRM, Service Architecture introduction — Concepts of SaaS, PaaS, IaaS	**4**	10

5.	**Introduction to Smart Infrastructure** Types of Sensors, How sensor works?, Moisture sensor, tilt sensor, smoke sensor, Temperature Sensor, Pressure Sensor, Level Sensor Fibre Optic Sensors etc,, Basics of Internet of Things (IoT), Concept of Smart Home, Smart Meter, Smart Mobility, Smart Public Safety, Smart Sanitation, Smart Security and Surveillance.	**12**	29
6	**Introduction to Virtualization** Concepts of Virtual Machine, Hypervisor, Para-Virtualization, Hardware-level virtualization, Operating System level virtualization	**3**	7
7	**AR-VR Technology for Development** Basics of Augmented Reality and Virtual Reality, AR in navigation, AR in Search Engine, etc.	**3**	7
	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**	**15**	**10**	**5**	**5**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 ICT fundamentals and network architectures	U
2	Demonstrate applications of ICT in development projects	A
3	Analyze smart infrastructure using IoT systems	N
4	Evaluate emerging AR/VR technologies for development	E

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106712

Course/Subject Name: ICT For Development

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	3	2	2	1
PO-2 Problem Analysis	2	3	3	2
PO-3 Design/Development	1	2	2	2
PO-4 Investigations	2	2	3	2
PO-5 Modern Tool Usage	3	3	3	3
PO-6 Engineer & Society	2	3	2	2
PO-7 Environment & Sustainability	1	2	2	1
PO-8 Ethics	1	1	1	1
PO-9 Individual & Team Work	1	2	1	1
PO-10 Communication	2	2	2	2
PO-11 Project Management	1	2	2	1
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	2	2	1	1
PSO-2 Analytical Ability	2	3	3	2
PSO-3 Software Tools Use	3	3	3	2

Reference Books –

- Online reference material for topics mentioned in syllabus

Open Sources -

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

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106713

Course/Subject Name: Infrastructure for smart Cities

w.e.f.Academic Year:	2022-23	
Semester:	7th SEM / 4th YEAR	
Category of the Course:	Open elective - 3	

Prerequisite:	Urban Planning Basics, Civil Engineering Fundamentals
Rationale:	Develops competencies in smart city infrastructure systems including energy, transport, water management, and policy frameworks to address urbanization challenges through technology-integrated solutions.

Teaching and Examination Scheme:

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

Course Content:

Unit No.	Content	No. of Hours	% of Weight age
1.	Fundamental of smart city & Infrastructure: Introduction of Smart City, Concept of smart city, Objective for smart cities, History of Smart city world and India. Need to develop smart city, Challenges of managing infrastructure in India and world, various types of Infrastructure systems, Infrastructures need assessment	**4**	10
2.	Planning and development of Smart city Infrastructure: Energy and ecology, solar energy for smart city, Housing, sustainable green building, safety, security, disaster management, economy, cyber security, Project management.	**12**	29
3.	Intelligent transport systems Smart vehicles and fuels, GIS, GPS, Navigation system, traffic safety management, mobility services, E-ticketing	**4**	10
4.	Management of water resources and related infrastructure Storage and conveyance system of water, sustainable water and sanitation, sewerage system, flood management, conservation system	**4**	10

5.	Infrastructure Management system & Policy for Smart city Integrated infrastructure management systems for smart city, Infrastructure management system applications for existing smart city. Worldwide policies for smart city Government of India - policy for smart city, Mission statement & guidelines, Smart cities in India, Case studies of smart city.	**12**	29
	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**	**15**	**10**	**5**	**5**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC: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 smart city infrastructure requirements	U
2	Develop infrastructure plans for smart cities	C
3	Analyze smart transport and water systems	N
4	Evaluate national/global smart city policies	E

SWAMINARAYAN UNIVERSITY

Program Name: Engineering

Level: Degree

Course/ Subject Code: BE106713

Course/Subject Name: Infrastructure for smart Cities

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	3	2	2	2
PO-2 Problem Analysis	2	3	3	3
PO-3 Design/Development	1	3	2	1
PO-4 Investigations	2	2	3	3
PO-5 Modern Tool Usage	2	3	3	2
PO-6 Engineer & Society	3	3	2	3
PO-7 Environment & Sustainability	3	3	3	2
PO-8 Ethics	1	2	1	2
PO-9 Individual & Team Work	1	2	1	1
PO-10 Communication	2	2	2	2
PO-11 Project Management	1	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	1
PSO-2 Analytical Ability	2	3	3	3
PSO-3 Software Tools Use	2	3	2	2

Reference Books –

- Smart City on Future Life - Scientific Planning and Construction by Xianyi Li
- The Age of Intelligent Cities: Smart Environments and Innovation-for-all Strategies (Regions and Cities) by Nicos Komninos
- Smart Cities: Big Data, Civic Hackers, and the Quest for a New Utopia by Anthony Townsend
- Grig N.S., Infrastructure engineering and management, Wiley-Interseience, 1988
- Hudson W.R., Haas R., Uddin W., Infrastructure Management, McGraw-Hill, 1997

List of Practical/ Exercise –

- Differentiate smart city with other city.
- Projects on Site Selection for major infrastructure.
- Site visit of Smart city and Prepare report on Case study of smart city
- List out various smart transport system for smart cities.
- Prepare breakdown structure for different units of the smart city.
- Prepare report on Case study of smart city

Open Sources -

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