Department of Civil Engineering

B. Tech. Honors in Civil Engineering

Scheme of Instruction and Examination

(Effective from 2020–21)

S. No.	Subject	Credits	Scheme of Instruction periods/week			Scheme of Examination Maximum Marks		
			L	D/T	P	End Exam	Continuous Internal Assessment	Total
	POOL - 1							
1	Sustainable Materials and Green Buildings	4	4	–	–	60	40	100
2	Finite Element Method	4	4	–	–	60	40	100
3	Advanced Design of Steel Structures	4	4	–	–	60	40	100
	POOL - 2							
1	Disaster Management	4	4	–	–	60	40	100
2	Irrigation and Drainage Systems Engineering	4	4	–	–	60	40	100
3	Water Supply Distribution System	4	4	–	–	60	40	100
4	Ground Water Engineering	4	4	–	–	60	40	100
	POOL - 3							
1	Advanced Foundation Engineering	4	4	–	–	60	40	100
2	Ground Improvement Techniques	4	4	–	–	60	40	100
3	Environmental Geotechnology	4	4	–	–	60	40	100
	POOL - 4							
1	Urban Transportation Planning	4	4	–	–	60	40	100
2	Intelligent Transportation Systems	4	4	–	–	60	40	100
3	Pavement Analysis and Design	4	4	–	–	60	40	100
4	Transportation System and Traffic Management	4	4	–	–	60	40	100
	MOOC / NPTEL - 1	2	–	–	–	–	–	100
	MOOC / NPTEL - 2	2	–	–	–	–	–	100

	MOOC / NPTEL - 1
1	Integrated Waste Management for a Smart City
2	Environmental Impact Assessment for Environmental Health
3	Remote Sensing & GIS
4	Ecology and Environment

	MOOC / NPTEL - 2
1	Municipal Solid Waste Management
2	Environment Natural Resources and Sustainability
3	Urbanisation and Environment
4	Remote Sensing of Leaf Area Index and Primary Productivity

Note: 1. Students has to acquire 16 credits with minimum one subject from each pool.

2. Compulsory MOOC / NPTEL courses for 04 credits (02 courses @ 2 credits each)

SUSTAINABLE MATERIALS AND GREEN BUILDINGS (SMGB)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE01	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concept of sustainability and green buildings.

CO2: Understand the different alternative cementitious materialsand its properties.

CO3: Use of energy performance of different sustainable materials in buildings.

CO4: Understand the concept of green buildings.

CO5: Apply the concept of OTTV, LEED & GRIHA

UNIT – I

Introduction: Embodied energy–Operational energy in Building and Life cycle energy – Ecological foot print–Bio-capacity and calculation of planet equivalent.

UNIT - II

Role of Material: Carbon from Cement – Alternative cements and cementitious material– Alternative fuel for cements for reduction in carbon emission–Sustainability issues for concrete–Role of quality–Minimization of natural resource utilization–High volume fly ash concrete– Geo-polymer concrete – Concrete with alternative material for sustainability.

UNIT – III

Reduction in water consumption in concrete – Recycled Aggregate – Energy for grinding crushing of cement aggregate and reduction. Operational energy in building role of materials and thermal conductivity.

Clay Bricks – Types of kilns – Comparative energy performance – Emission performance and financial performance – Indoor air quality

Paints – Adhesive and sealants for use in building – Volatile organic content (VOC) emission issues and indoor air quality for sustainability and health hazard.

UNIT – IV

Operational energy reduction and net zero building– Optimization for design of building for energy efficiency and example of optimization through use of Evolutionary genetic algorithm– Radiation budget– Urban heat island–Surface water balance–Effects of trees and microclimatic modification through greening.

UNIT - V

Use of Building Integrated Photo Voltaic (BIPV) and other renewable energy in buildings–

Basic concepts and efficiency– Energy codes ECBC requirement, Concepts of OTTV – Green Performance rating– Requirements of LEED,GRIHA.
Text Books
1. Newman, J. and Choo, Ban Sang, *Advanced Concrete Technology-Processes*, First Edition, Elsevier.
2. Newman, J. and Choo, Ban Sang, *Advanced Concrete Technology-Constituent Materials*, 1st Edition, Elsevier.
3. Ministry of Power, Energy Conservation Building Code 2018, Revised Version, Bureau of Energy Efficiency.
4. McQuiston, F.C., and Parker, J.D. *Heating, Ventilating, and Air Conditioning, Analysis and Design*, Fourth Ed. John Wiley & Sons, Inc.
5. TERI-*Griha's Green Design practices*.
Reference Books
1. Leadership in Energy and Environmental Design.
2. *Green Building Basics*, California Integrated Waste Management Board.
Question Paper Pattern:
Sessional Exam: The question paper for sessional examination is for 25 marks, covering half of the syllabus for first sessional and remaining half for second sessional exam. The question paper shall consist of Three Sections with Two Questions (EITHER / OR type) in each section. The student shall answer one question from each section. **End Exam:** The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

FINITE ELEMENT METHODS (FEM)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE02	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concepts of FEM and Energy principles

CO2: Analyse stiffness matrix and Shape Functions for Beam & Bar elements

CO3: Analyse stiffness matrix and Shape Functions for Two dimensional elements

CO4: Analyse Two Dimensional Isoparametric elements with Four and Eight nodes

CO5: AnalyseAxi-Symmetric bodies of revolution

UNIT – I

Introduction and Principles of Elasticity: Concepts of FEM-Steps involved – Merits and demerits – Energy principles – Descretization– Rayleigh–Ritz method of functional approximation –Stress equations – Strain displacement relationships in matrix form – Plane stress, plane strain and axi-symmetric bodies of revolution with axi-symmetric loading.

UNIT - II

One Dimensional FEM: Stiffness matrix for beam and bar elements–Shape functions for 1-D elements– Static condensation of global stiffness matrix – Solution – Initial strain and temperature effects.

UNIT – III

Two Dimensional FEM: Different types of elements for plane stress and plane strain analysis - Displacement models –Generalized coordinates – Shape functions – Convergent and compatibility requirements –Geometric invariance – Natural coordinate system – Area and volume coordinates–Generation of element stiffness and nodal load matrices–Static condensation.

UNIT – IV

Isoparametric Formulation: Concept – Different isoparametric elements for 2-D analysis – Formulation of 4-noded and 8-noded isoparametric quadrilateral elements –Lagrangian elements – Serendipity elements.

UNIT - V

Axisymmetric Analysis: Bodies of revolution – Axi-symmetric modeling – Strain displacement relationship – Formulation of axi-symmetric elements.

Text Books

1. C.S.Krishna Murthy, *Finite Element Analysis –Theory & Programming*, Tata McGraw Hill.

2. TirupathiChandruPatla A &Belugunudu, *Introduction to Finite Element Method*, Khanna Publishers.

Reference Books

1. Cook, R.D., *Concepts and Applications of Finite Element Analysis*, John Wiley and sons Inc., New York.

2. J.N. Reddy, *Introduction to Finite Element Method*, McGraw Hill Book Co.

3. Bathe K.J., *Finite Element Procedures in Engineering Analysis*, Prentice Hall.

4. Gallagher R.H., & Wilson, *Finite Element Analysis Fundamentals*, Prentice Hall Inc.

5. Hinton and Owen, *Finite Element Programming*, Academic press, London.

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ADVANCED DESIGN OF STEEL STRUCTURES (ADSS)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE03	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concepts of eccentric and moment connections and design of welded connections.

CO2: Design the Welded Plate Girders

CO3: Design the Gantry Girders

CO4: Design of Roof trusses

CO5: Design of Light gauge steel structures

UNIT – I

Eccentric and Moment Connections: Introduction – Beams-Column Connections – Connections Subjected to Eccentric Shear – Bolted Framed and Seat Connections– Welded Framed and bracket Connections – Moment Resistant Connections.

UNIT - II

Design of Welded Plate Girders: Elements of plate girders – Self-weight of plate girders– Economical depth–Shear buckling resistance of web– Design of bearing stiffeners– Weld for bearing stiffeners– Design of intermediate stiffeners and design of welded plate girder.

UNIT – III

Design of Gantry Girders: Loads, position of moving load for maximum effects– Profile of gantry girder and design of gantry girders.

UNIT – IV

Design of Roof trusses: Bracings, types of roof trusses – Pitch of trusses – Spacing of trusses – Purlins– Loads on trusses – Design of truss members – Design of joints – Design of tubular trusses.

UNIT - V

Light gauge steel structures: Light gauge steel – Types of sections – Specifications- Permissible stresses. Compression members – Local buckling of elements – Stiffened compression elements –Computation of permissible stresses – Design of columns. Flexural members – Bending – Deflection – Local buckling of compression elements – Laterally supported and unsupported beams.

Text Books

1. S. K. Duggal, *Limit State Design of Steel Structures*, McGraw Hill Education Private Ltd.

New Delhi.

2. K. S. Sairam, *Design of Steel Structures*, Pearson Education.

Reference Books

1. N. Subramanian, *Design of Steel Structures*, Oxford University Press.

2.Dr. Ramachandra&VivendraGehlot, *Design Steel Structures Volume–II*, Scientific Publishers Journals Department.

3. Indian Standard Code – IS – 800-2007 *General Construction in Steel- Code of Practice*.

4. Steel Tables.

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

DISASTER MANAGEMENT (DM)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE04	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5Hrs						End Exam Duration: 3 Hrs		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the different types of disasters.

CO2: Understand the impact of disasters throughdifferent case studies.

CO3: Analyze Risk and Vulnerability.

CO4: Understand the basic principles of disaster management.

CO5: ApplyGIS and Remote sensing techniques in disaster management.

UNIT – I

Definition and Types of Disaster: Introduction on Disaster–Different Types of Disaster–Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides–Man-made Disaster: such as Fire, Industrial Pollution,Nuclear Disaster, Biological Disasters, Accidents (Air, Sea,Rail& Road), Structural failures(Building and Bridge),War & Terrorism.

UNIT - II

Study of Important Disasters: Earthquakes and its types – Magnitude and intensity – Seismic zones of India – Major fault systems of India plate – Flood types and its management – Drought types and its management – Landside and its managements – Case studies of disasters in Sikkim (e.g.) Earthquakes, Landside) – Social Economics and Environmental impact of disasters.

UNIT – III

Risk and Vulnerability Analysis: Risk: Its concept and analysis–Risk Reduction–Vulnerability: Its concept and analysis–Strategic Development for Vulnerability Reduction.

UNIT – IV

Mitigation and Management Techniques of Disaster: Basic principles of disasters management –Disaster Management cycle – Disaster management policy –National and State Bodies for Disaster Management– Early Warming Systems – Building design and construction in highly seismic zones– Retrofitting of buildings.

UNIT - V

Training, Awareness Program and Project on Disaster Management: Training and drills for disaster preparedness –Awareness generation program – Usages of GIS and Remote sensing techniques in disaster management – Mini project on disaster risk assessment and preparedness for disasters with reference to disasters in Sikkim and its surrounding areas.

Text Books

1. *Disaster Management Guidelines*, GOI-UND Disaster Risk Program (2009-2012)

2. Damon P.Copola,*Introduction to International Disaster Management*, ButterworthHeineman.

3. Gupta A.K., Niar S.S and Chatterjee S.,*Disaster management and Risk Reduction, Role of Environmental Knowledge*, Narosa Publishing House, Delhi.

4. Murthy D.B.N.,*Disaster Management*, Deep and Deep Publication Pvt. Ltd., New Delhi.

5. ModhS.,*Managing Natural Disasters*, Mac Millan publishers India Ltd.

6. Chitkara. K.K.,*Construction Project Management: Planning Scheduling and Control*, Tata McGraw Hill Publishing Company, New Delhi.

Reference Books

1.Dr.MrinaliniPandey,*Disaster Management*, Wiley India Pvt. Ltd.

2.TusharBhattacharya,*Disaster Science and Management*, McGraw Hill Education

3.J. P. Singhal,*Disaster Management*, Laxmi Publications.

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IRRIGATION AND DRAINAGE SYSTEMS ENGINEERING

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE05	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: UnderstandNational water policy for water resources development.

CO2: Evaluate consumptive use and irrigation efficiencies.

CO3: Model themethods of irrigation.

CO4: Understand theSalt affected land and their reclamation.

CO5: Understand thesurface and sub-surface drainage systems.

UNIT – I

Introduction:Available water resources and its present utilization – Development through five-year plans –Roles of various commissions on irrigation and agriculture –National water policy for development – Types of irrigation –Irrigation techniques and quality of irrigation water.

UNIT - II

Soil Water Crop Relationship:Determination of soil moisture– Estimation of consumptive use and frequency of irrigation – Irrigation efficiencies for economical use of water – Design of various irrigation methods – Assessment water charges – Conjunctive use of surface and ground water – Multi-crop irrigationscheduling

UNIT – III

Modeling of Irrigation Systems:Governing equations and their solutions – Computation of inundation front – Cumulative infiltration estimation – Modeling for sprinklers and other methods of irrigation.

UNIT – IV

Salt Affected Land and their Reclamation:Salt accumulation in soil water– Classification of salts affecting the soils and their characteristics – Reclamation of saline and alkaline soils – Leaching and salinity control.

UNIT - V

Drainage of Irrigated Soils:Need and purpose of drainage, water logging of agricultural lands and its reclamation – Steady state and transient designs of surface and sub-surface drainage systems – Drainage by wells.

Soil Erosion and Conservation:Water and wind erosion – Design of various types of soil conservation measures.

Text Books

1. Asawa G L, *Irrigation and Water Resources Engineering*, New Age International Publishers, New Delhi.

2. Dan Yaron, *Salinity in irrigation and water resources*, Morcel Dekker Inc., New York.

3. Michael A M, *Irrigation theory and practices*, Vikas Publishing House, New Delhi.

Reference Books

1.Richard H Cuenca, *Irrigation system design–An Engineering Approach*, Prentice Hall, Englewood Cliffs, New Jercy.

2.Dilip Kumar Mujumdar, *Irrigation Water Management Principles and Practice*, PHIPublication, New Delhi.

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

WATER SUPPLY DISTRIBUTION SYSTEM (WSDS)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE06	PCC	4	-	-	4	40	60	100
Sessional Exam Duration : 1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the types of water supply systems.

CO2: Plan thewater supply systems.

CO3: Formulate the equation for distribution system.

CO4: Analyse the distribution system.

CO5: Applythe linear programming techniques for optimization.

UNIT – I

Introduction:Water requirement– Sources of water – Water demand – Reservoir storage nodal hydraulic gradient level values – Water supply consideration – Types of water supply systems – Piping system – Distribution network labeling – Network components – Network models.

UNIT - II

Hydraulic Parameters and Network Parameters:Energy and hydraulic gradient line– Head loss in links –Equivalent pipe – Pipes in series – Pipes in parallel – Pipe material.

Need for Transport of water – Water quality – Planning of water supply systems – Intake structures.

UNIT – III

Types of Distribution Systems:Equivalent pipe – Parameters in distribution system analysis – Parameters interrelationship – Formulation of equation. Gravity and rising main – Location and design principles.

UNIT – IV

Analysis of Water Distribution System:Methods of analysis: Hardy–Cross method, Newton-Raphson method and Linear theory method.

UNIT - V

Design and Optimization of Water Distribution System:Design: Trial and error method of design– Cost- head loss ratio method –Optimization using linear programming techniques – Surge analysis in water distribution systems –Pump duty stations and detailing valves –Pressure transients in pipe flow.

Text Books

1. Bhave P R, *Analysis of Flow in Water Distribution Network*, TechnomicPublishingCo., Lancaster, USA.

2. Bhave P R, *Optimal Design Of Water Distribution Networks*, Narosa Publishing House, New Delhi.

3. Streter V L and Wylie E D, *Fluid Transients*, McGraw Hill Book Co.

Reference Books

1. Pramod R. Bhave and Rajesh Gupta, *Analysis of Water Distribution Networks*, Narosa Publishing House, New Delhi and Alpha-Science Publication,UK.

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

GROUND WATER ENGINEERING (GWE)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE07	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the occurrence and movementof groundwater.

CO2: Estimate the yield of a well.

CO3: Understand the methods of artificial recharge of ground water.

CO4: Applygroundwater modeling techniques.

CO5: Understandthe concept of salt water intrusion.

UNIT – I

Introduction:Occurrence of ground water – Geological formations as aquifers – Types of aquifers – Groundwater movement – Darcy's law –Permeability and its measurement –Tracing of ground watermovement –Fundamental equations for steady and unsteady ground water flow– Flow nets.

UNIT - II

Well Hydraulics:Steady and unsteady flow in confined, semi-confined and unconfined aquifers –Radial flow– Superposition – Multiple well system –Different methods of well construction – Construction of well casings and screens –Natural and Artificial gravel packed wells – Safe yields – Estimation – Pumping and recuperation tests –Infiltration galleries.

UNIT – III

Artificial Recharge of Ground Water: Ground-water replenishment –Artificial recharge of ground water –Different methods– Merits-Demerits –Selection criteria for various methods – Cone of depression.

UNIT – IV

Ground Water Modeling Techniques:Porous media models – Analog models – Electric analog models –Digital computer models.

UNIT - V

Salt Water Intrusion:Concept – Interface and its location –Control of intrusion.

Transport of Pollutants in Ground Water:Pollutant transport – Plume Transport –Source identification –Tracer methods.

Text Books

1. David Keith Todd, *Groundwater Hydrology*, John Wiley publishers.
2. Jacob and Bear, *Hydraulics of Groundwater*, McGraw Hill.

3. Mutreja K.N., *Applied Hydrology*, Tata McGraw-Hill Publishing company Ltd., NewDelhi.
4. Raghunath, *Groundwater & Well Hydraulics*, Wiley Eastern Ltd, New Delhi.

Reference Books

1. Singh Vijay. P, *Elementary Hydrology*, Prentice Hall, India.
2. Mutreja K.N., *Applied Hydrology*, Tata McGraw-Hill Publishing company Ltd., NewDelhi.

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ADVANCED FOUNDATIONENGINEERING (AFE)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE08	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: Determinethe bearingcapacityofSoil under inclined loads and on layered soils.

CO2: Determine the bearing capacity of soil under raft foundation and design foundation.

CO3: Determine the settlements for the design of shallow footings.

CO4: Designthepilefoundationsunderdifferentloadingconditions.

CO5: Designthefoundationsonproblematicsoils.

UNIT – I

Shallow Foundations: Bearing Capacity – General formulae – Effect of water table – Footing with eccentric or inclined loads – Foundations on layered soils – Foundations on finite layer with rigid base at shallow depth – Effect of compressibility of soil.

UNIT - II

Raft Foundations: Bearing capacity of raft foundation – Floating raft – Types of rafts – Beam on elastic foundation – Conventional methods of design – Determination of modulus of sub-grade reaction.

UNIT – III

Settlement: Components – Immediate, consolidation & creep – Stresses and displacements inhomogeneous, layered and anisotropic soils – Consolidation settlement – One, Two & Threedimensional consolidation – Secondary compression settlement –Bearing pressure using SPT,CPT, Dilatometer and Pressuremeter – Settlement of foundations on sands –Schmertmann andBurland&Busbridge methods – Structure tolerance to settlement and differential settlements–Rotationof tall structures.

UNIT – IV

Pile Foundations: Single Pile: Vertically loaded piles –Static capacity α, β and λ methods– Dynamicformulae–PointbearingresistancewithSPTandCPT results– Bearingresistanceofpilesonrock–Settlement–Pileloadtest–Upliftresistance–Laterallyloadedpiles– Ultimatelateralresistance–Negativeskinfriction–Batterpiles–Under-reamedpiles– Ultimatecapacityofpilegroupsincompression,pullout&lateralload–Efficiency–Settlementsof pilegroups– Interactionofaxially &laterally loaded pilegroups.

UNIT - V

Foundations on Collapsible Soils: Origin and occurrence – Identification –

Samplingandtesting–Preventive andremedial measures.

Foundations on Expansive Soils: The nature, origin and occurrence –Identifying, testing andevaluatingexpansivesoils– Typicalstructuraldistresspatternsandpreventivedesign&constructionmeasures.

Text Books

1. Das,B.M., *PrinciplesofFoundationEngineering*, 7th CengageLearning.
2. DonaldPCoduto, *FoundationDesignPrinciplesandPractices*,Pearson Indian Edition.
3. Bowles,J.E., *FoundationAnalysis&Design*, McGraw-HillCompanies,Inc.
4. Poulos,H.G.&Davis,E.H., *PileFoundationAnalysisandDesign*,JohnWiley&SonsInc.

Reference Books

1. Reese,L.C.&VanImpe,W.F., *SinglePilesandPileGroupsunderLateralLoading*, Taylor& Francis Group.
2. Tomlinson,M.J., *FoundationDesignandConstruction*, PrenticeHall.
3. LymonC.Reese,WilliamM.Isenhower,Shin-TowerWang, *AnalysisandDesignofShallowand Deep Foundations.*
4. Salgado,R., *TheEngineeringofFoundations*,McGraw-Hill,Boston.

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GROUND IMPROVEMENT TECHNIQUES (GIT)

B.Tech (Honors) : CE					Scheme : 2020			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE09	PCC	4	-	-	4	40	60	100
Sessional Exam Duration : 1.5 Hrs.					End Exam Duration: 3 Hrs.			

Course Outcomes : At the end of the course the student will be able to

CO1: Select theeffective and economical ground improvement techniques

CO2: Understand the concept of deep compaction.

CO3: Gain the knowledge on stone columns and soil nailing.

CO4: Understand the concept of earth reinforcement in soil structures.

CO5: Analyze the different grouting techniques.

UNIT – I

Dewatering: Introduction – Scope and necessity of ground improvement in GeotechnicalEngineering –Basicconceptsandphilosophy –Drainage– Groundwaterloweringbywellpointsdeepwells,vacuumandelectro-osmoticmethods – Stabilizationbythermalandfreezingtechniques.

UNIT - II

Compaction and Sand Drains: In-situ compaction of granular and cohesive soils –Shallow anddeep compaction sand piles – Concept, design, factors influencing compaction –Blasting anddynamic consolidation – Preloading with sand drains, fabric drains, wick drains – Theories ofsanddrain– Designandrelativemerits.

UNIT – III

StoneColumn,LimePilesandSoilNailing: Stonecolumn,limepiles–Functions–Methodsof installation – Design, estimation of load carrying capacity and settlement – Slope stability – Stabilityoftrenches – Lime-sandcolumns –Rootpiles – Soilnailing–Applications.

UNIT – IV

Earth Reinforcement: Earth reinforcement – Principles and basis mechanism of reinforcedearth – Reinforced soil retaining structures – Simple design –Synthetic and natural fibre based Geo-textilesandtheirapplications –Filtration,drainage,separation,erosioncontrol–Casestudies.

UNIT - V

Grouting: Grouting techniques – Types of grout – Suspension and solution grouts – Basicrequirementsofgrout –Groutingequipment–Principleofinjection – Injectionmethods– Properties of treated ground – Application of jet grouting – Grout monitoring – Electro – chemicalstabilization–Stabilizationwithcement,lime–Stabilizationofexpansiveclays.

Text Books

1. Dr.P.PurushothamRaj,*GroundImprovementTechniques*,LakshmiPublicationsPvt.Ltd.
2. Das,B.M.,*PrinciplesofFoundationEngineering*,PWSPublishing.
3. Jones,J.E.P.,*EarthReinforcementandSoilStructure*,Butterworths.
4.Koerner,R.M.andWelsh,J.P.,*ConstructionandGeotechnicalEngineeringusingSyntheticFabrics*, JohnWiley.

Reference Books

1. Moseley,M.D.,*GroundTreatment*,BlackieAcademicandProfessional.
2. Hehn,R.W.,*PracticalGuidetoGroutingofUndergroundStructures*,ASCE.
3. Koerner,R.M.,*DesigningwithGeosynthetics*,PrenticeHall.

Question Paper Pattern:

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

ENVIRONMENTAL GEOTECHNOLOGY (EGT)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE10	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: UnderstandSoil-environmentinteraction

CO2: UnderstandSoilmineralogyandMechanismsofsoil-waterinteraction

CO3: Learngroundwaterflowandpredictcontaminanttransportphenomenon

CO4: Applyremediationtechniquesforcontaminatedsite

CO5: Understand the reuse of waste material

UNIT – I

Introduction: Industrialization and Urbanization – Pollution –Control and remediation.

Contamination: Surfacecontamination –Contaminationtransport –Soil-aGeotechnicaltrap – Effect of subsurface contamination – Detection of polluted zone – Monitoring and effectivenessofdesignedfacilities.

UNIT - II

Contaminants of Solid Waste in Landfills: Waste contaminants – Landfills – Types, shape andsize of landfills –Liner and liner system –Cover and cover system –Stability of landfills. Landfillconstruction&operation – Sustainablewastemanagement.

UNIT – III

ContaminantsofSlurrywastes: Slurrytransportedwastes – Slurryponds, operation – Embankmentconstructionandraising –Designaspects –Environmentalimpactandcontrol.

UNIT – IV

Vertical Barriers for Contaminant: Contaminated sites –Types of barriers –Soil-Bentonite slurrytrenchwalls –Cement-Bentoniteslurrytrenchwalls – Construction,materialanddesignaspects.

UNIT - V

Geotechnical Reuse of Waste materials: Waste reduction – Use in geotechnical construction – Waste characteristics – Transportation consideration – Engineering properties of wastes – Wastematerialinembankmentandfills.

Text Books

1. SharmaH.D&ReddyK.R, *Geo-environmentalEngineering*
2. Reddi, L.N&Inyang, H.I., *Geo-environmentalEngineering*
3. Daniel, D. E. Wentz,C.A.,*GeoTechnicalPracticeforWasteDisposalbyHazardousWasteManagement*,McGrawHill,

Singapore.

4. Fried,J.J.,*GroundWaterPollution*,Elsevier.

Reference Books

1. KerryRow, *GeotechnicalGeo–EnvironmentalEngineeringHandBook*.
2. Bedient,Refai&Newell, *GroundWaterContamination*.
3. Daniel,B.E.,*GeotechnicalPracticeforWasteDisposal*,ChapmanandHall,London.
4. Proceedingsofthe*InternationalsymposiumofEnvironmentalGeo-technology*(Vol.IandII),EnvironmentalPublishingCompany,1986and1989.
5. ASTMSpecialTechnicalPublication874,*HydraulicBarrierinSoilandRock*,1985.

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

URBAN TRANSPORTATION PLANNING (UTP)

B.Tech (Honors) : CE					Scheme : 2020			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE11	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.					End Exam Duration: 3 Hrs.			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the concepts of urbantransportation planning process.

CO2: Understand the surveys required for urban transportation planning.

CO3: Understand and apply the trip generation models for urban transportation planning.

CO4: Analyze the various methods of trip distribution models and suggest the suitable method.

CO5: Understand and apply the mode choice models and traffic assignment models.

UNIT – I

Urban Transportation Planning And Travel Demand: Urban issues, Travel characteristics, Evolution of planning process, Supply and demand – Systems approach. Overall planning process, long term vs short term planning. Travel demand function, independent variables, travel attributes, assumptions in travel demand estimation, sequential, and simultaneous approaches, aggregate and disaggregate techniques.

UNIT - II

Data Collection And Inventories: Collection of data – Organization of surveys and analysis, Study area-definition and guidelines – Zoning principles – Types and sources of data – Road side interviews, Home interview surveys, Commercial vehicle surveys – Sampling techniques – Expansion factors – Accuracy checks – Use of secondary sources.

UNIT – III

Trip Generation And Distribution: Definition of trip – Trip characteristics – Types of trips – Home based and non-home based trips – Factors affecting trip making behavior – Trip generation analysis: zonal models, category analysis, household models, trip attraction models.

UNIT – IV

Trip Distribution: Growth factor methods **–** Uniform growth factor – Average growth factor – Fratar method – Advantages and disadvantages of growth factors. Gravity model – Formulation and calibration.

UNIT - V

Mode Choice and Traffic Assignment:

Mode Choice:Factors affecting mode choice – Mode choice behaviour– Competing modes – Mode split curves – Models and probabilistic approaches – Use of diversion curves.

Traffic Assignment:Basic elements of transport networks – Coding – Route properties – Minimum path – Assignment techniques:All-or-nothing assignment – Capacity restraint technique – Multiple route assignment – Basic numerical examples.

Text Books

1. Kadiyali L.R., *Transport Planning*, KhannaPublishers
2. Khisty C.J., *Transportation Engineering - An Introduction*, Prentice Hall Publication.
3. PapacostasC.S. and Prevedouros P.D., *Transportation Engineering& Planning*,PHI

Reference Books

1. Hutchinson, B.G., *Principles of Urban Transport Systems Planning*, Scripta, McGraw Hill.
2. Black, Alan, *Urban Mass Transportation Planning*, McGraw Hill.
3. Vukan R. Vuchic, Urban Transit Systems and Technology, John Wiley & Sons.
4. National Urban Transport Policy.

Question Paper Pattern:

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

B.Tech (Honors) : CE					Scheme : 2020			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
		L	T	P	C	Continuous Internal Assessment	End Exam	Total
HCE12	PCC	4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.					End Exam Duration: 3 Hrs.			

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the data collection and data acquisition using ITS

CO2: Understands the requirements for telecommunications

CO3: Apply the various ITS methodologies

CO4: Design the transit system by considering all important parameters

CO5: Define the significance of ITS under Indian conditions

UNIT – I

Introduction to Intelligent Transportation Systems (ITS): Definition of ITS and identification of ITS objectives– Historical background –Benefits of ITS – ITS data collection techniques – Detectors –Automatic Vehicle Location (AVL) –Automatic Vehicle Identification (AVI) – Geographic Information Systems (GIS) – Video data collection.

UNIT - II

Telecommunications in ITS:Importance of telecommunications in the ITS system, Information management –Traffic Management Centres (TMC) – Vehicle–Road side communication – Vehicle positioning system

UNIT – III

ITS Functional Areas:Advanced Traffic Management Systems (ATMS) –Advanced Traveler Information Systems (ATIS) –Commercial Vehicle Operations (CVO) –Advanced Vehicle Control Systems (AVCS) –Advanced Public Transportation Systems (APTS) –Advanced Rural Transportation Systems (ARTS).

UNIT – IV

***ITS User Needs and Services*:**Travel and traffic management –Public transportation management –Electronic payment –Commercial vehicle operations –Emergency management – Advanced vehicle safety systems –Information management.

UNIT - V

Automated Highway Systems: Vehicles in platoons – Integration of automated highway systems –ITS Programs in the World – Overview of ITS implementations in developed countries –ITS in developing countries.

Text Books

1. *ITS Hand Book 2000:* Recommendations for World Road Association (PIARC) by Kan Paul Chen, John Miles.

2. Sussman, J. M., *Perspective on ITS*, Artech House Publishers, 2005.

3. Chowdhury, M. A. and Sadek, A, *Fundamentals of Intelligent Transportation SystemsPlanning*, Artech House, 2003.

Reference Books

1. *National ITS Architecture Documentation*, US Department of Transportation, 2007, (CD-ROM).

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End Exam: The question paper for end examination is for 60 marks. It shall consist of Five Units, each containing Two Questions (EITHER / OR type) from each unit of the syllabus, with a weightage of 12 marks. Each of these questions may contain sub-questions. The student shall answer one question from each unit.

PAVEMENT ANALYSIS AND DESIGN (PAD)

B.Tech (Honors) : CE					Scheme : 2020			
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE13	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.					End Exam Duration: 3 Hrs.			

Course Outcomes : At the end of the course the student will be able to

CO1: Understands the design factors, properties of pavement materials and material characterization.

CO2: Know the traffic loading, stresses, strains and deflections in rigid and flexible pavements.

CO3: Design and apply methodologies for flexible pavements

CO4: Design and apply methodologies for rigid pavements

CO5: Understand the structural and functions failure and the evaluation of pavements

UNIT – I

Types of Pavements Material properties: Factors affecting design and performance of pavements –Highway and airfield pavements –Requirements and desirable properties of aggregates, bitumen, emulsion and modified bitumen –Characterisation of different pavement materials.

UNIT - II

Pavement Design Factors: Design wheel load – Strength characteristics of pavement materials – Climatic variations – Traffic-load equivalence factors and equivalent wheel loads – Aircraft loading – Gear configuration and tyre pressure –Drainage – Estimation of flow – Surface drainage – Sub-surface drainage systems – Design of sub-surface drainage structures.

UNIT – III

Flexible Pavement Design: Empirical, semi-empirical and theoretical approaches – Design of highway and airport pavements by IRC, AASHTO Methods –Mechanistic – Empirical design – Applications of pavement design software.

UNIT – IV

Rigid Pavement Design: Types of joints and their functions –Joint spacing –Design of CC pavement for roads –Highways and airports as per IRC, AASHTO –Design of joints –Design of continuously reinforced concrete pavements –Reliability –Use of software for rigid pavement design.

UNIT - V

Pavement Management: Distresses in pavements – Maintenance of highways – Structural and functional condition evaluation of pavements – Performance prediction models – Ranking and

optimization in pavement management.

Text Books

1. Yoder and Witczak, *Priniciples of Pavement Design*, John Wiley and Sons.
2. Yang. H. Huang, *Pavement Analysis and Design*, Second Edition, Prentice Hall Inc.

Reference Books

1. Rajib B. Mallick and Tahar El-Korchi, *Pavement Engineering – Principles and Practice*, CRC Press (Taylor and Francis Group)
2. W.Ronald Hudson, Ralph Haas and Zeniswki , *Modern Pavement Management*, McGraw Hill and Co.

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TRANSPORTATION SYSTEM AND TRAFFIC MANAGEMENT (TSTM)

B.Tech (Honors) : CE						Scheme : 2020		
Course Code	Category	Hours/Week			Credits	Maximum Marks		
HCE14	PCC	L	T	P	C	Continuous Internal Assessment	End Exam	Total
		4	-	-	4	40	60	100
Sessional Exam Duration :1.5 Hrs.						End Exam Duration: 3 Hrs.		

Course Outcomes : At the end of the course the student will be able to

CO1: Understand the TSM objectives and philosophy for mixed traffic conditions.

CO2: Understand the importance of traffic management measures for improving vehicular flow

CO3: Measure the reducing peak hours, traffic and pricing for differential toll policies.

CO4: Measure the multi model co-ordination to promote transit and non-transit auto modes.

CO5: Understand and apply the bus route network planning, management and evaluation.

UNIT – I

TSM Philosophy: Systems approach to transportation planning – Long term strategies and short term measures – TSM actions – Objectives and philosophy – Relevance of TSM actions to Indian urban context – Broad spectrum of TSM actions.

UNIT - II

Traffic Management Measures-I: Measures for improving vehicular flow – One way streets-advantages and disadvantages – Guidelines for implementation – Signal improvements – Transit stop relocation – Parking management.

UNIT – III

Traffic Management Measures-II: Reversible lanes – Guidelines for applicability – Reducing peak period traffic – Staggering of working hours – Different methods – Congestion pricing – Methods – Differential toll policies – Differential parking fee policy.

UNIT – IV

Measures to Promote Transit and Non-Auto Modes: Preferential treatment to high occupancy vehicles – Carpooling – Transit service improvement measures – Transit management improvement measures – Transit and Para Transit integration – Para-Transit role in urban areas – Multi-modal coordination – Measures to promote Non-Auto modes –Pedestrianisation – Bicycle transportation – Advantages – Planning bicycle facilities – Class I, Class II And Class III Bikeways – Junction treatments for cycle tracks.

UNIT - V

Bus Route Network Planning, Management and Evaluation: Types of bus route networks – Suitability for a given urban area – Types of routes – Corridor routes, Activity routes and

Residential routes – Issues in route network evaluation – Number of routes – Length of routes – Route alignment methods – Service coverage and accessibility index.

Text Books

1. C.JotinKhisty& B. Kent Lall, *Transportation Engineering– An Introduction*, Prentice Hall.

2. Nicholas J.Garber and Lester A. Hoel, *Traffic and Highway Engineering*, Cengage Learning, USA.

Reference Books

1. S.R.Chari, *Transportation System Management Notes*, NIT, Warangal.

2. John W Dickey, *Metropolitan Transportation Planning*, Tata McGraw Hill.

3. Mike Hudson, *The Bicycle Planning*, Open Books, UK.

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