NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	0	2	3

Course Code	2CLDE51
Course Name	Advanced Concrete Technology

Course Outcomes:

At the end of the course, students will be able to –

1. recommend use of supplementary cementitious materials.
2. appraise applications of construction chemicals
3. choose appropriate concrete types and concreting techniques for practical applications.

Syllabus: Teaching Hours: 30

Unit 1: Supplementary Cementitious Materials Hours: 09

Significance, Classification, Mineral Admixtures, Fly ash, Ground granulated blast furnace slag, Silica fume, Metakaoilin, Rice husk ash, Alccofine, Physical and chemical properties, Proportioning of concrete, Effect on properties of fresh and hardened concrete and on durability.

Unit 2: Construction Chemicals Hours: 06

Significance, Classification, Rheology of concrete, Factors affecting rheological properties, Plasticizers, Superplasticizers, Retarders, Accelerators, Water proofing, Effect of incorporation of construction chemicals in concrete, New generation construction chemicals.

Unit 3: Special Concretes and Concrete Techniques Hours: 15

Special Concretes : Light weight concrete, High density concrete, High strength concrete, High performance concrete, Self-compacting concrete, Fiber reinforced concrete, Recycled aggregate concrete, Engineered cementitious composite, Polymer modified concrete, Mixture design of special concretes as per codal guidelines, Recent advancements.

Concrete Techniques: Hot weather concreting, Mass concrete, Roller compacted concrete, Ready mixed concrete, Recent advancements.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 05 experiments to be incorporated.

Suggested Readings:

1. Malhotra, V. M. & Ramezanianpour, A. A. *Fly Ash in Concrete*, CANMET.
2. Mehta, P. K. *Concrete: Microstructure, Properties and Materials*, McGraw Hill.
3. Neville, A. M. *Properties of Concrete*, Pearson Education.
4. Gambir, M. L *Concrete Technology Theory and Practice,* McGraw Hill.
5. Shetty, M. S. *Concrete Technology Theory and Practice,* S. Chand.
6. Codes: IS:10262, IS:456.

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Institute of Technology

School of Engineering

Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE01
Course Name	Advanced Solid Mechanics

Course Outcomes:

At the end of the course, students will be able to –

1. apply theory of elasticity for stress and strain analysis
2. determine torsional stresses in prismatic section
3. apply theory of failure for solid mechanics problems.

Syllabus: Teaching hours: 30

Unit 1: Introduction **Hours: 03**

Introduction to mechanics of deformable body, definition of stress and strain, Hooke's law for axial loads, constants of elasticity: Young's modulus, shear modulus and Poisson's ratio and their relation, Introduction to the general theory of elasticity, assumptions and applications of linear elasticity.

Unit 2: Analysis of Stress – Strain **Hours: 17**

Displacement, strain and stress field, Cauchy formula, Equation of equilibrium and compatibility conditions, Stress and strain transformation, Principal stress and strain, Stress and Strain invariants, Octahedral shear stress, hydrostatic and deviatoric stress and strain, Plane stress and plane strain problems, Mohr's circle, Generalized Hooke's law, measurement of strain, strain rosettes, stress under combined action of axial and torsional, axial and bending, axial, torsional and bending, Thin wall pressure vessels.

Unit 3: Torsion of Prismatic Cross Sections **Hours: 05**

General Solution of the torsion problem, Stress function, Torsion of Circular and Rectangular cross section. Prandtl's membrane analogy.

Unit 4: Failure Theories **Hours: 05**

Introduction to theory of failure, maximum normal stress theory, maximum shear stress theory, maximum strain energy theory, maximum distortion energy theory and comparison of theories of failure.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 tutorials to be incorporated.

Suggested Readings:

1. Fung, Y. C. & Tong P., *Classical and Computational Solid Mechanics*, World Scientific.
2. Schmidt, R.J. & Boresi, A.P., *Advanced Mechanics of Materials*, Wiley.
3. Srinath, L.N., *Advanced Mechanics of Solids*, Tata McGraw Hill
4. Ugural, A.C. & Fenster, S.K., *Advanced Mechanics of Materials and Applied Elasticity*, Prentice Hall
5. Cook, R. & Young, W., *Advanced Mechanics of Materials*, Pearson

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Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	0	2	3

Course Code	2CLDE52
Course Name	Advanced Structural Mechanics

Course Outcomes:

At the end of the course, students will be able to –

1. analyze skeletal structures using stiffness member approach
2. apply finite element method for bar and beam elements
3. develop spread sheets and computer programs for skeletal structures.

Syllabus: Teaching hours: 30

Unit 1: Analysis of Skeletal Structures Hours: 15

Stability and determinacy of structures, Formulation of stiffness matrix in local and global axis, Analysis of beam, truss, frame and grid using stiffness member approach, Composite structures, Concept of symmetry and anti-symmetry, Secondary effects: support settlement, temperature change, lack of fit.

Unit 2: Introduction to Finite Element Method Hours: 10

History and evolution, applications of finite element method for bar and beam elements, Calculation of joint displacements and stresses in members.

Unit 3: Computer Applications Hours: 05

Development of computer programs and spread sheets for analysis of skeletal structures using stiffness method, use of commercial software.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 05 exercises to be incorporated.

Suggested Readings:

1. Gere, J. M. & Weaver, W. *Matrix Analysis of Framed Structures*, C. B. S. Publishers.
2. Kassimali, A. *Matrix Analysis of Structures*, Cengage Learning
3. Ghali, A., Neville, A. M. & Brown, T. G. *Structural Analysis: A Unified Classical and Matrix Approach*, CRC Press.
4. Logan, D. L. A *First Course in Finite Element Method*, Cengage Learning
5. Desai, Y. M., Eldho, T. I. & Shah, A. H. *Finite Element Method with Applications in Engineering*, Pearson.

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Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE04
Course Name	Port and Harbour Engineering

Course Outcomes:

At the end of the course, students will be able to –

1. interpret requirements of harbour and port planning
2. plan and design various components of harbour and port
3. select appropriate aids and facilities for operation of port
4. justify dredging and protection requirement of harbour.

Syllabus: Teaching Hours: 30

Unit 1: Harbour Planning Hours: 05

Fundamentals of water transportation, classification, selection of site and planning, location, traffic estimation, ship characteristics, site investigations – hydrographic survey, topographic survey, soil investigations and tidal observations

Unit 2: Harbour Works Hours: 05

Design and construction of breakwaters, berthing structures - jetties, fenders, piers, wharves, dolphins, trestle, moles, mooring accessories

Unit 3: Docks and Repair Facilities Hours: 07

Harbour docks, use of wet docks, design of wet docks, repair docks, lift docks, dry docks, keel and bilge blocking, construction of dry docks, gates for dry docks, pumping plant, floating docks, slipways, locks, size of lock, lock gates, types of gates

Unit 4: Navigational Aids Hours: 04

Requirements of signals, fixed navigation structures, necessity of navigational aids, light houses, beacon lights, floating navigational aids, light ships, buoys, radar

Unit 5: Dredging and Coastal Protection Hours: 04

Classification, types of dredgers, choice of dredger, uses of dredged materials, coastal erosion and protection, sea wall, revetment, bulkhead

Unit 6: Port Facilities **Hours: 05**

Port development, port planning, port building facilities, transit sheds, warehouses, cargo handling facilities, container handling terminal facilities, shipping terminals, inland port facilities.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 04 tutorials to be incorporated.

Suggested Readings:

1. Oza, H.P. and Oza , *Docks and Harbour Engineering*, Charotar Publishing House
2. Srinivasan, R. *Harbour, Dock and Tunnel Engineering*, Charotar Publishing House
3. Bindra, S. P. *A course in Docks and Harbour Engineering*, Dhanpat Rai Publications
4. Gregory P. Tsinker, *Port Engineering: Planning, Construction, Maintenance, and Security*, John Wiley & Sons.
5. John W. Gaythwaite, *Design of Marine Facilities: Engineering for Port and Harbor Structures*, American Society of Civil Engineers.

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Semester – V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE05
Course Title	Airport Engineering

Course Outcomes:

At the end of the course, students will be able to -

1. interpret basic requirements for airport planning
2. plan and design various components of airport
3. select appropriate aids for operation of airport.

Syllabus: Teaching Hours: 30

Unit 1: Airport Planning **Hours: 06**

History of aviation, structure and organizations of Air Transport, authorities of airports, policy of air transport, aircraft characteristic, airport classification, airport master plan, regional planning, airport site selection and surveys, airport architecture.

Unit 2: Geometric Design of Airport Elements **Hours: 06**

Runway, taxiway & exit taxiways.

Unit 3: Terminal Area and Airport Layout **Hours: 08**

Terminal building requirements, vehicular circulation and parking area, apron, hanger, blast considerations, layouts.

Unit 4: Airport Pavement Design and Maintenance **Hours: 05**

Design factors, flexible pavement, rigid pavement, pavement failures, drainage, maintenance and evaluation.

Unit 5: Visual Aids and Air Traffic Control **Hours: 05**

Markings, lighting, air traffic control network, air traffic control aids.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 04 tutorials to be incorporated.

Suggested Readings:

1. Khanna, S.K., Arora, M.G. & Jain, S.S., *Airport Planning and Design*, Nem Chand and Bros.
2. Rangwala, S.C., *Airport Engineering*, Charotar Publishing House.
3. Saxena, S.C., *Airport Engineering: Planning & Design*, CBS Publishers.
4. G.V. Rao, *Airport Engineering*, Tata McGraw Hill.
5. Ashford, N.J., Mumayiz, S.A., Wright, P.H. *Airport Engineering: Planning, Design and Development of 21st Century Airports*, Wiley India.

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Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE06
Course Name	Traffic Engineering and Road Safety

Course Outcomes:

At the end of the course, students will be able to –

1. outline traffic characteristics and plan traffic studies
2. develop engineering solutions to ease traffic congestion and improve road safety
3. assess traffic stream characteristics, level of service and capacity of roadways and intersections.

Syllabus: Teaching hours: 30

Unit 1: Traffic Characteristics Hours: 03

Importance and scope of traffic engineering, traffic characteristics, human factors governing road user characteristics, vehicular characteristics.

Unit 2: Traffic Engineering Studies and Analysis Hours: 05

Data collection, analysis and interpretation of results of classified traffic volume, traffic forecasting, spot speed, speed and delay, origin and destination studies.

Unit 3: Fundamental Parameters and Relations of Traffic Flow Hours: 06

Traffic stream flow characteristics, Speed-Flow-Density relations, travel time, headway, spacing, time-space diagram, time mean speed, space mean speed and their relation, passenger car units, capacity and level of service.

Unit 4: Traffic Regulation and Control Hours: 08

Regulations and controls on driver, vehicle and flow, parking regulations, enforcement of regulations, traffic signs and design of two phase and three phase signals at intersections, IRC method of signal design, road markings, road intersections and design, design of rotary intersections, design of parking facilities.

Unit 5: Accident Analysis and Road Safety Hours: 04

Road accidents- Causes and prevention, analysis and investigation of individual accidents and statistical data.

Unit 6: Transportation Economics **Hours: 04**

Economic evaluation of transportation plans, vehicle operating costs, value of travel time savings.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 tutorials to be incorporated.

Suggested Readings:

1. Kadiyali L. R., *Traffic Engineering and Transport Planning*, Khanna Publishers.
2. Kumar S. R., *Introduction to Traffic Engineering*, The Orient Black Swan South Asian Edition
3. Papacoastas C. S., Prevedourous P. D., *Transportation Engineering and Planning*, Pearson Education India.
4. Khanna S. K., Justo C. E. J., Veeraraghavan A., *Highway Engineering*, Nem Chand and Brothers.
5. Garber N. J., Hoel L. A.., *Traffic and Highway Engineering*, Cengage Learning India.
6. Khisty J. B., Lall K. B., *Transportation Engineering: An Introduction*, PHI Learning, Eastern Economy Edition.

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Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code:	2CLDE07
Course Title:	Pavement Engineering

Course Outcomes (CO)

At the end of the course, students will be able to -

1. analyze the factors affecting design and performance of pavements
2. design flexible and rigid pavement systems
3. elaborate construction of flexible and rigid pavements with quality control
4. evaluate pavement distress and evolve maintenance management plan.

Syllabus: Teaching hours: 30

Unit 1: Stresses in Flexible and Rigid Pavements Hours: 04

Stress in Flexible Pavements: Stresses and deflections in homogeneous masses, Visco-Elastic Theory and Assumptions, Layered Systems Concepts, Stress Solutions for One, Two and Three Layered Systems, Fundamental Design Concepts.

Stresses in Rigid Pavements: Westergaard's Theory and Assumptions, Stresses due to warping, Stresses and Deflections due to Loading, Frictional Stresses, combined stresses and Stresses in Dowel Bars & Tie Bars.

Unit 2: Flexible and Rigid Pavement Design Hours: 10

Flexible Pavement Design Methods for Highways and Airports, Empirical, semi-empirical and theoretical approaches for pavement design, design of flexible pavements as per IRC 37 and AASHTO methods, use of software for flexible pavement design.

Types of joints in cement concrete pavements and their functions, joint spacing, design of CC pavement as per IRC 58 and AASHTO method, design of joint details for longitudinal joints, contraction joints and expansion joints, use of software for rigid pavement design.

Unit 3: Pavement Construction Hours: 08

Earthwork, construction of embankments, specifications of materials, construction methods and field quality control checks for various layers and types of flexible and rigid pavement, applications of geosynthetics.

Unit 4: Pavement Evaluation and Maintenance **Hours: 08**

Introduction, Pavement Roughness Measurement System, Pavement Distress Surveys and Evaluation, Pavement Condition Rating, Pavement Maintenance Management System.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 tutorials to be incorporated.

Suggested Readings:

1. Yoder E. J., and Witczak, *Principles of Pavement Design*, Wiley India.
2. Huang Y. H., *Pavement Analysis and Design*, Pearson Education.
3. Khanna S. K., Justo C. E. J., Veeraraghavan A., *Highway Engineering*, Nem Chand and Brothers.
4. Kumar S, Pavement *Design*, Universities Press, Orient Black Swan.
5. Chakraborty P., Das A., *Principles of Transportation Engineering*, Prentice Hall India Learning.
6. Srinivasa Kumar, R. *Pavement Evaluation and Maintenance Management System*, Universities Press
7. MoRTH, Specifications for Road and Bridge Works, Indian Road Congress.
8. Codes: IRC: 37, IRC: 58.

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L	T	P	C
2	1	0	3

Course Code:	2CLDE11
Course Title:	Advanced Construction Technologies

Course Outcomes (CO):

At the end of the course, students will be able to -

1. appraise formwork techniques for construction
2. make use of precast construction techniques
3. apply specialized technique for Civil construction
4. choose suitable construction techniques for bridge, tunnel and offshore structures.

Syllabus: Teaching hours: 30

Unit 1: Formwork Techniques Hours: 04

Need, classification, reasons for failure, material, formwork accessories, formwork types: conventional/traditional formwork, jump formwork, slip form work, table formwork, tunnel formwork, pre-fabricated formwork, ganged formwork, special form for shells.

Unit 2: Precast and Pre-fabrication Construction Techniques Hours: 03

Need, advantages & disadvantages, modular co-ordination & standardization, types, precast components & joints, planning & designing, fabrication, curing techniques, stacking, transportation, lifting, erection.

Unit 3: Specialized Construction Techniques Hours: 12

Construction aspects and procedures of specialized construction techniques like box pushing, diaphragm walls, reinforced earth wall, gabion wall, ground water control techniques, pipe lying, vacuum dewatering- finishing & curing methods, 3D printing, etc.

Unit 4: Bridge Construction Hours: 04

Types, bridge construction methods: in-situ and pre-cast construction methods, balanced cantilever methods, span-by-span method, incremental launching method.

Unit 5: Tunnel Construction Hours: 04

Site investigation and geological studies, drilling, pneumatic breakers, explosives, blasting, Tunnelling technology: mechanized, shield, micro, special methods; Hazards and safety, trenchless techniques.

Unit 6: Offshore Construction: **Hours: 03**

Equipment: Crane barges, derrick barges, drilling vessels; underwater construction; Stages of offshore structure, construction, facilities and methods of fabrication.

Self-Study:

The self study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 04 tutorials to be incorporated.

Suggested Readings:

1. Levitt, M., *Precast concrete - Materials, manufacture properties and usage*, Applied Science Publications
2. Jha, K.N. *Formwork for concrete structures*, McGraw Hill Education
3. Roy Chudley and Roger Greeno, *Advanced construction techniques*, Pearson
4. Beer, G., *Technology innovation in underground construction*. CRC Press
5. Gerwick, B., *Construction of marine and offshore structures*. CRC Press
6. Chew Yit Lin, Michael, *Construction Technology for Tall Buildings*, Singapore University Press, World Scientific

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Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code:	2CLDE12
Course Title:	Sustainable Building Technologies

Course Outcomes (CO)

At the end of the course, students will be able to -

1. appraise concepts of sustainable development and rating systems
2. recommend building materials and technologies for sustainable construction.
3. formulate strategies for resource conservation and waste management.

Syllabus: Teaching hours: 30

Unit 1: Introduction to Sustainability **Hours: 05**

Concept, need and life cycle analysis for sustainability, Meteorological and climatic considerations, Sustainable site selection and planning, carbon footprint.

Unit 2: Green Building Rating Systems **Hours: 03**

Introduction to Leadership in Energy and Environment Design (LEED), Indian Green Building Council (IGBC), Green Rating for Integrated Habitat Assessment (TERI-GRIHA).

Unit 3: Energy Conservation **Hours: 06**

Embodied energy of materials, energy efficient lighting, building automation, ventilation and air quality requirement passive cooling and thermal comfort. renewable energy harvesting and usage in buildings.

Unit 4: Building Materials and Technologies **Hours: 07**

Features and characteristics of alternative and natural materials like bamboo, timber, rammed earth, stabilized mud blocks, agro and industrial wastes; Alternative technologies like filler slab, ferrocement, rat trap bond for sustainable construction

Unit 5: Water Conservation and Wastewater Management **Hours: 04**

Water usage minimization, planning and systems for water conservation, sustainable wastewater treatment techniques.

Unit 6: Solid Waste Management **Hours: 05**

Need, objectives and scope, type of solid wastes, vermi-composting and other methods of domestic solid waste management, construction and demolition waste utilization, E-waste management.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 tutorials to be incorporated.

Suggested Readings:

1. Jagadish K.S. *Sustainable Building Technologies*, IK International Publishing House
2. Jagadish K.S. Venkatarama Reddy B.V. and Nanjunda Rao K.S.. *Alternative building Materials and Technologies*, New Age International.
3. Rai G.D. *Non-conventional energy resources*, Khanna Publishers.
4. Bhatia, S.C. *Wealth from Waste, Volume I-II.* Atlantic Publication.
5. Wright, R.T. & Boorse, D.F. *Environmental Science towards a sustainable development*, Pearson.
6. Pandel, U. & Poonia, M.P. *Environmental Technologies for Sustainable Development*, Prime Publishing.

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Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE13
Course Name	Building Systems, Safety and Services

Course Outcomes:

At the end of the course, students will be able to –

1. design and implement water and drainage system
2. apply electrical and lighting system in building
3. select appropriate systems for vertical transportation and HVAC
4. identify appropriate safety and security systems in building.

Syllabus: Teaching hours: 30

Unit 1: Introduction and Overview **Hours: 02**

Importance, problems of maintenance and repairs.

Unit 2: Plumbing Systems and Maintenance **Hours: 04**

Water storage and distribution, heating methods, dual plumbing, pipe fittings, maintenance of plumbing system. Drainage system: components, types and design.

Unit 3: Electrical Systems **Hours: 04**

Electrical system installations, electrical control and safety devices: fuse, circuit breakers, lightning arresters, etc.; Electrical wiring systems: material and specifications.

Unit 4: Lighting and Illumination **Hours: 04**

Factors affecting illumination in building, modern theory of light and colour, synthesis of light, Luminous flux, utilization factor, artificial light sources, types of energy efficient lamps.

Unit 5: Heating, Ventilation and Air Conditioning (HVAC) **Hours: 04**

Concept, importance, components, planning of HVAC systems.

Unit 6: Vertical Transportation **Hours: 04**

Types, sizes and capacity, speed, mechanical safety method, installation requirements.

Unit 7: Fire Safety System **Hours: 04**

Causes of fire, fire resistance materials, safety regulations, heat and smoke detectors, fire fighting devices and systems, fire escapes.

Unit 8: Building Security and Automation **Hours: 04**

Need, types and concept of smart building automations.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 04 tutorials to be incorporated.

Suggested Readings:

1. Hassan G., *Building Services*, Macmillan.
2. Greeno R. *Building Services, Technology and Design*, Routledge publication
3. Hall, F. & Greeno, R. *Building Services Handbook*, Butterworth-Heinmann.
4. Philips D., *Lighting Modern buildings*, Architectural Press
5. Hall, F., *Building services and equipment*, Routledge
6. Rao, S., Jain R.K. & Saluja, S., *Electrical Safety, fire safety Engineering and Safety Management*, Khanna Publishers.

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Semester- V/VI/VII

L	T	P	C
2	0	2	3

Course Code	2CLDE55
Course Name	Geomatics

Course Outcomes:

At the end of the course, students will be able to –

1. apply remote sensing techniques for Civil Engineering applications
2. demonstrate applications of Geographical Information System (GIS) in Civil Engineering
3. illustrate concept of geodesy and global navigation satellite system.

Syllabus: Teaching hours: 30

Unit 1: Remote Sensing Hours: 10

Basics, electromagnetic radiation, types, limitations of methods, concept of signatures, sensors and satellites, spatial, spectral and radiometric resolution, digital image format, visual image analysis, histogram, image enhancement, Remote sensing based indices, digital image classification, applications of remote sensing

Unit 2: Geographical Information System (GIS) Hours: 08

Concept, functions, advantages. data: type, model, input, geometric transformation, editing, display, exploration, data analysis, database management system, terrain mapping and analysis, GIS models & modelling, applications

Unit 3: Geodesy and Global Navigation Satellite System Hours: 10

Concept of geodetic survey, adjustment, geodetic reference system, concept of terrestrial reference system, types of datum, datum transformation, coordinate system, concept of mapping system, map projection system. Navigational satellite systems: GPS, GLONASS, GALILEO, COMPASS, IRNNS. GPS: signals and pseudo range and carrier phase observable, data collection, errors and bias, corrections of errors, survey types, data processing, applications

Unit 4: Advances in Geomatics Hours: 02

LIDAR and Drone survey: need, principle, applications and limitations.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 06 exercises to be incorporated.

Suggested Reading

1. Chang, K.T. I*ntroduction to Geographic Information Systems*, McGraw Hill.
2. Kiefer, L. *Remote sensing and image interpretation*, John Wiley & Sons.
3. El-Rabbany, A. *Introduction to Global Positioning System*, Artech house.
4. Bhatt, *Global Navigational Satellite System*, BS Publication.
5. Bhatt, B. *Remote Sensing and GIS,* Oxford University Press.
6. Reddy, M.A. *Remote Sensing and Geographical Information System*, B S Publication.

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Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE15
Course Name	Advanced Soil Mechanics

Course Outcomes:

At the end of the course, students will be able to –

1. infer flow through soils
2. analyze the stresses in soil under various conditions
3. assess shear strength of soils.

Syllabus:

Teaching hours: 30

Unit 1: Introduction **Hours: 02**

Composition, nature and characteristics of soil, soil-air-water interaction.

Unit 2: Flow through Soil **Hours: 06**

Permeability, seepage force, effective stress, Laplace equations of fluid flow, flow net, piping.

Unit 3: Stresses and Displacements in Soil **Hours: 07**

Soil as elastic body, principal stresses and strains, problems of plane stresses and strains; stress distribution: Boussenesq, Westerdgards theory, Newmark's chart.

Unit 4: Shear Strength of Cohesionless Soil **Hours: 08**

Stress strain relationship, Mohr's circle analysis, stress path, friction between solid surfaces, dilatancy, critical void ratio, quick sand condition; Triaxial test: types, soil behaviour, stress state, analysis.

Unit 5: Shear Strength of Cohesive Soil **Hours: 07**

Effective stress: water content relationship, stress history, structure, strain rate, sensitivity, elastic and plastic analysis of soil

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 05 tutorials to be incorporated.

Suggested Readings:

1. Prakash, S. *Fundamentals of Soil Mechanics*, S.P. Foundation
2. Terzaghi, K.V., Peck, R.B & Mesri, G., *Soil Mechanics in Engineering Practice*, John Wiley.
3. Lambe, T.W. & Whitman, R.V., *Soil Mechanics*, Wiley.
4. Knappett, J., Craig R.F., *Craig's Soil Mechanics*, Van Nostrand Reinhold Company.
5. Das, B.M., *Advanced Soil Mechanics*, Taylor & Francis.

L= Lecture, T= Tutorial, P= Practical, C= Credit

w.e.f. academic year 2020-21 and onwards

NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	1	0	3

Course Code	2CLDE16
Course Name	Applied and Engineering Geology

Course Outcomes:

At the end of the course, students will be able to –

1. appraise the importance of geological investigation for civil engineering project
2. classify rocks and assess their engineering properties
3. summarize structural features of rock and fundamentals of seismology.

Syllabus: Teaching hours: 30

Unit 1: Engineering Geology **Hours: 08**

Scope, geological studies for engineers, stress-strain behaviour of rocks; brittle and ductile deformation; engineering properties of rocks. Ground water geology: exploration, well hydraulics and water quality.

Unit 2: Petrology **Hours: 05**

Weathering of rocks, geological works of natural agencies, rock forming minerals, classification of rocks including composition, texture & structure.

Unit 3: Mineralogy **Hours: 03**

Rock and soil minerals: chemical analysis, physical properties, susceptibility of minerals to alteration.

Unit 4: Structural Geology **Hours: 05**

Folds, joints, faults, unconformities, overlap stratification, outcrop, dip and strike.

Unit 5: Geological Investigation **Hours: 03**

Site selection for civil engineering structures, methods of geological investigations, interpretation of reports and maps.

Unit 6: Engineering Seismology **Hours: 04**

Basic of seismology, plate tectonics, geological hazards: seismicity, shoreline process, landslide and mass movement.

Unit 7: Application in Civil Engineering **Hours: 02**

Role of geology in construction of civil engineering structures.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Tutorial Work:

Tutorial work will be based on above syllabus with minimum 04 tutorials to be incorporated.

Suggested Readings:

1. Singh, P. *Engineering & General Geology*, S. K. Kataria & Sons.
2. Bell, F.G. ,*Engineering Geology*, Elsevier.
3. Waltham, T., *Foundations of Engineering Geology*, Taylor and Francis.
4. Kehew, A.E., *Geology for Engineers and Environmental Scientists*, Prentice Hall

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w.e.f. academic year 2020-21 and onwards

NIRMA UNIVERSITY

Institute of Technology

School of Engineering

Bachelor of Technology - Civil Engineering

Semester- V/VI/VII

L	T	P	C
2	0	2	3

Course Code	2CLDE59
Course Name	Advanced Fluid Mechanics

Course Outcomes:

At the end of the course, students will be able to -

1. apply the knowledge of model analysis and boundary layer theories to solve fluid flow problems
2. solve problems of non-uniform, gradually and rapidly varied flows in steady state conditions
3. estimate flow through pipes for analysis of pipe networks.

Syllabus

Teaching hours: 30

Unit 1: Dimensional and Model Analysis **Hours: 06**

Physical quantities and dimensions, dimensional homogeneity, Rayleigh's and Buckingham's-theorem, model laws and utility analysis, distorted models.

Unit 2: Submerged Bodies and Boundary Layer Theories **Hours: 08**

Viscous drag, pressure drag, lift, boundary layer theory and equation, laminar and turbulent flow, displacement and momentum thickness; momentum equation for a flat plate, boundary layer separation and control; stream lined bodies, free fall of body through a fluid.

Unit 3: Steady Non-Uniform Flow and Gradually Varied Flow **Hours: 07**

Differential equation, free surface profiles, backwater and draw-down curves. Types and discharge through open channels, empirical formula and estimations of most economical channel sections.

Unit 4: Rapidly Varied Flow **Hours: 04**

Hydraulic jump and surges in open channel; surge tanks, sequential depths, loss of energy, transient flow.

Unit 5: Pipe Flow **Hours: 05**

Introduction to pumps and turbines, water hammer and effects, rigid water column theory, elastic water column theory: sequence of events, pressure water and velocity.

Self-Study:

The self-study contents will be declared at the commencement of semester. Around 10% of the questions will be asked from self-study contents.

Laboratory Work:

Laboratory work will be based on above syllabus with minimum 04 exercises to be incorporated.

Suggested Readings:

1. Bansal R. K., *Fluid Mechanics*, Laxmi Publication.
2. Graebel W. P., *Advanced Fluid Mechanics*; Elsevier.
3. Subramanya K., *Fluid Mechanics and Hydraulic Structure*, Tata McGraw-Hill.
4. Modi P. N., Seth S. M., *Hydraulics and Fluid Mechanics*, Standard Book House.
5. Sengal & Simbala, *Fluid Mechanics; Fundamentals and Applications,* Tata McGraw-Hill.

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w.e.f. academic year 2020-21 and onwards