GURU GHASIDAS VISHWAVIDYALAYA
BILASPUR (C.G.)

(A Central University)

Koni, Bilaspur-495009, C.G (India)

OUTCOME BASED EDUCATION
WITH
CHOICE BASED CREDIT SYSTEM (CBCS)

MASTER OF TECHNOLOGY
IN
GEOTECHNICAL ENGINEERING

COURSE STRUCTURE AND SYLLABI

M. Tech. Regular Two Year Degree Program
(Effective from the Academic Year 2025-26)

DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY
GGV, BILASPUR, C.G. (INDIA)

DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF STUDIES OF ENGINEERING & TECHNOLOGY, GGV, BILASPUR, C.G. (INDIA)

SCHEME OF EXAMINATION

M.TECH. GEOTECHNICAL ENGINEERING

M.Tech. I-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CGPATT1	Advanced Soil Mechanics	3	0	0	40	60	100	3
2.	CGPATT2	Geotechnical Investigation for construction projects	3	0	0	40	60	100	3
3.	CGPATP1 CGPATP2 CGPATP3	Elective – I 1. Highway Soil Mechanics 2. Environmental Geotechnology 3. Constitutive Modelling and Granular Mechanics	3	0	0	40	60	100	3
4.	CGPATP4 CGPATP5 CGPATP6	Elective – II 1. Soil Dynamics 2. Geosynthetic Reinforced Soil Structure 3. Remote Sensing and GIS for Civil and Geotechnical Engineering Applications	3	0	0	40	60	100	3
5.	CGPATP7 CGPATP8 CGPATP9	Elective – III 1. Stability Analysis of Slopes, Dams, and Embankments 2. Rock Mechanics 3. Pavement Analysis and Design	3	0	0	40	60	100	3
6.	CGPALT1	Geotechnical Engineering Laboratory	0	0	3	30	20	50	2
7.	IPPATC1	Research Methodology and IPR	2	0	0	-	50	50	2
Total			17	0	3	230	370	600	19

M.Tech. II-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CGPBTT1	Advanced Foundation Engineering	3	0	0	40	60	100	3
2.	CGPBTT2	Principles of Ground Modification	3	0	0	40	60	100	3
3.	CGPBTP1 CGPBTP2 CGPBTP3	Elective – IV 1. Bio Geotechnics 2. Computational Fluid Dynamics 3. Subsurface Geomechanics and Applications	3	0	0	40	60	100	3
4.	CGPBTP4 CGPBTP5 CGPBTP6	Elective – V 1. Pavement Evaluation, Rehabilitation, and Maintenance 2. Optimization Methods in Civil Engineering 3. Groundwater and Flow Through Porous Media	3	0	0	40	60	100	3
5.	MSPBTO1 IPPBTO2 IPPBTO3 CEPBTO4 MEPBTO5 CHPBTO6	Open Elective 1. Business Analytics 2. Industrial Safety 3. Cost Management of Engineering Projects 4. Composite Materials 5. IoT 6. MOOCs	3	0	0	40	60	100	3
6.	CGPBLT1	Geotechnical Software Lab	0	0	3	30	20	50	2
7.	CGPBPT1	Mini Project	0	0	4	30	20	50	2
8.	ELPBTX1 PEPBTX2 LAPBTX4	Audit Course/Value Added Course 1. English for Research Paper Writing 2. Stress Management by Yoga 3. Constitution of India	2	0	0	40	60	100	2
Total			17	0	07	300	400	700	21

Note: Under MOOCs the students have to opt any subject other than Civil Engineering from NPTEL/UGC SWAYAM

M.Tech. III-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CWPCPT1	Dissertation Stage–I	0	0	28	100	100	200	14
Total			0	0	28	100	100	200	14

M.Tech. IV-Semester

Sl.	Course Type/ Code	Subjects	Periods/Week			Evaluation			Credits
			L	T	P	IA	ESE	Total	
1.	CWPDPT1	Dissertation Stage–II	0	0	32	100	200	300	16
Total			0	0	32	100	200	300	16

Total Credits for the Program = 19 + 21 +14 +16 = 70

M. Tech. Geotechnical Engineering

SEMESTER-I								
Syllabus	**Semester -I**	**Teaching Hours/ Week**			**Continuous Internal Assessment**	**Semester Examination Assessment**	**Total Marks**	**Credits**	**Pre-requisite Course (s)**
Course Code	CGPATT1	L	T	P	CIA	SEA	100	3	
Course Name	Advanced Soil Mechanics	3	0	0	40	60			

Course Objectives:

- To understand soil composition, properties, and behaviors, including dry and saturated conditions, for practical civil engineering applications.
- To analyze soil mechanics, including shear strength, stress-strain relationships, permeability, and stability, to support geotechnical design decisions.

Unit	**Content**	**Teaching/Lecture Hours**
I	Introduction: Soil Problems in Civil Engineering, A Preview of Soil Behaviour, Conduct of the Subject.	3
II	Nature of Soil: Soil Composition, Index Properties, Soil Classification, Soil Structure: Clay-Water Forces, Interparticle Forces, Soil Formation.	10
III	Dry Soil: Stresses Within a Soil Mass, Tests to Measure Stress-Strain Properties, General Aspects of Stress-Strain Behaviour, Shear Strength of Cohesionless Soil, Stress-Strain Relationships, Rankine Earth Pressures, Infinite Slopes, Retaining Walls.	10
IV	Saturated Soil (No or Steady State Flow): Effective Stress Principle, Capillarity, Soil Suction, One- and Two-Dimensional Flow, Coefficient of Permeability (Theory and Practice), Stress-Strain and Strength Behaviour of Clays, 1-D Behaviour (Theory and Practice), Drained Shear Behaviour, Strength Principles, Lateral Earth Pressures, and Slope Stability.	10
V	Saturated Soil (Transient Flow): Pore Pressure Parameters, Undrained Shear Behaviour of Clays, and Strength Principles, Consolidation of Cohesive Soils, Evaluation of Stability (Loading vs. Unloading and Undrained vs. Drained Conditions), Estimation of Undrained Strength for Design.	10
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To understand and apply soil engineering concepts, including soil composition, properties, stress-strain behavior, shear strength, and stability for effective civil engineering problem-solving.

CO2 To analyze and assess soil behavior under dry, saturated, and transient flow conditions, incorporating effective stress, permeability, pore pressure, undrained shear behavior, and consolidation for stability and design decisions

Text Books: -

1 Lambe, T. W., & Whitman, R. V. (1991). Soil mechanics (Vol. 10). John Wiley & Sons.

2 Das, B. M. (2019). Advanced soil mechanics. CRC Press.

3 Terzaghi, K., & Peck, R. B. (1948). Soil mechanics in engineering practice. John Wiley & Sons.

Reference Books: -

1 Holtz, R. D., Kovacs, W. D., & Sheahan, T. C. (2011). An Introduction to Geotechnical Engineering (2nd ed.). Pearson.

2 Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil Mechanics in Engineering Practice (3rd ed.). Wiley.

3 Mitchell, J. K., & Soga, K. (2005). Fundamentals of soil behavior (3rd ed.). John Wiley & Sons.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATT2	L	T	P	CIA	SEA	100	3	
Course Name	Geotechnical Investigation for Construction Projects	3	0	0	40	60			

Course Objectives:

To equip students with the skills and knowledge required to solve practical geotechnical engineering problems encountered in industry.

To understand and analyze advanced methodologies, techniques, and tools used in geotechnical investigations and emphasize their application through real-world examples and case studies.

Unit	Content	Teaching/Lecture Hours
I	Introduction, Planning of sub-surface programs, Stages in sub-surface exploration, Reconnaissance, Lateral extent and depth of exploration, Methods of exploration – trial pits, open excavation, boring, etc., Types of boring and drilling, Methods for stabilization of borehole, Types of soil samples, Sample disturbance, storage, labeling, and transportation of samples, Types of soil samplers.	7
II	Field Tests – Standard Penetration Test, Cone Penetration Test, Vane Shear Test, Plate Load Test, Pressure Meter Test, etc..	9
III	Determination of groundwater table, Geophysical methods, Seismic methods, Electrical resistivity methods. Soil investigation report – Borelog, soil profile, and contents of the report, Field records, Safety measures, and Geotechnical risks	7
IV	Field Instrumentation: Rollers, Pressure meters, Piezometers, Pressure cells, Sensors, Inclinometers, Strain gauges, etc. Site investigation in view of ground improvement.	9
V	Geotechnical Engineering Case Histories and Forensic studies: Earthen dam and reservoir, Industrial Structures, Ground Liquefaction, opencast coal mining, landslides, failure of geotechnical structures under critical natural hazards, debris flow, forensic geotechnical investigation, karst topography, Land reclamation, expansive soils, sports field engineering.	11
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To analyze and solve real-world geotechnical problems by applying theoretical concepts and advanced investigation techniques.

CO2 To utilize case histories and modern tools to evaluate geotechnical challenges and provide practical engineering solutions.

Text Books: -

1 Hunt, R. E. (2006). Geotechnical engineering investigation handbook (2nd ed.). CRC Press.

2 Clayton, C. R. I., Matthews, M. C., & Simons, N. E. (1995). Site investigation (2nd ed.). Blackwell Science.

3 Day, R. W. (2006). Geotechnical engineering investigation and testing: Planning, design, and reporting. McGraw-Hill.

Reference Books: -

1 Dunnicliff, J. (1993). Geotechnical instrumentation for monitoring field performance. Wiley.

2 Das, B. M. (2011). *Soil mechanics laboratory manual* (8th ed.). Oxford University Press.

3 Bowels, J. E. (1996). Foundation analysis and design (5th ed.). McGraw-Hill.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP1	L	T	P	CIA	SEA	100	3	
Course Name	Highway Soil Mechanics	3	0	0	40	60			

Course Objectives:

To understand soil classification, compaction, and geotechnical properties relevant to pavement and buried structure design.

To analyze stress responses and time-dependent behavior in pavements and buried infrastructure systems.

Unit	Content	Teaching/Lecture Hours
I	Classification of Soil. HRB classification. Group Index Method. Compaction: Mechanics of compaction. Field-compaction equipment: their suitability and choice. Compaction quality control and measurement. Characterization of geo-materials and pavement materials.	7
II	Beams and slabs on elastic foundations: Soil response models, Infinite beam, two parameters, Isotropic elastic half space, Analysis of beams of finite length, Classification of finite beams in relation to their stiffness. Winkler, Elastic continuum, two-parameter elastic models, Elastic plastic behavior, Time-dependent behavior	9
III	Mechanical modeling of pavement materials, bound and unbound materials, stress-dependent and time-dependent response (with reference to modeling of bituminous mix, aggregates, and soil). Analysis of concrete pavement - load stress and thermal stress; Elastic half-space; Analysis of bituminous pavement - load stress and thermal stress	11
IV	Buried Structures: Load on Pipes, Marston's load theory for rigid and flexible pipes, Trench and Projection conditions, minimum cover, Pipe flotation.	7
V	Subsoil drainage in Highway Engineering, Design of filters, perforated pipe drainage, Methods of subsoil drainage for roads, permeable blankets, longitudinal and transverse under drains, horizontal drains, stabilizing trenches. Sub-soil drainage in highways, runways, and railways.	9
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To classify soils and evaluate compaction quality for field applications in highway subgrade design.

CO2 To apply mechanical models to analyze stress in pavements and buried pipe systems under load.

Text Books: -

1 Huang, Y. H. (2004). Pavement analysis and design (2nd ed.). Pearson Prentice Hall.

2 Rodríguez, A. R., Castillo del H. & Sowers, G.F. (1988). Soil mechanics in highway engineering. Trans Tech Publications.

3 Moser, A. P., & Folkman, S. (2008). Buried pipe design (3rd ed.). McGraw-Hill.

Reference Books: -

1 Khanna, S. K., Justo, C. E. G., & Veeraragavan, A. (2014). Highway engineering (10th ed.). Nem Chand & Bros.

2 Das, B. M. (2011). *Soil mechanics laboratory manual* (8th ed.). Oxford University Press.

3 Cedergren, H. R. (1977). Seepage, drainage, and flow nets (3rd ed.). Wiley.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP2	L	T	P	CIA	SEA	100	3	
Course Name	Environmental Geotechnology	3	0	0	40	60			

Course Objectives:

To understand soil behavior in geoenvironmental conditions and its role in contaminant migration and retention.

To learn to design, assess, and apply containment and remediation techniques for contaminated geo-sites.

Unit	Content	Teaching/Lecture Hours
I	Fundamentals of Environmental Geotechnics: Scope of geoenvironmental engineering- multiphase behavior of soil – role of soil in geoenvironmental applications – importance of soil physics, soil chemistry, hydrogeology, biological process – sources and type of ground contamination – impact of ground contamination on geoenvironmental - case histories on geoenvironmental problems.	7
II	Soil-Water-Contaminant Interaction: Soil mineralogy characterization and its significance in determining soil behavior – soil-water interaction and concepts of double layer – forces of interaction between soil particles. Concepts of unsaturated soil – the importance of unsaturated soil in geoenvironmental problems - measurement of soil suction - water retention curves - water flow in the saturated and unsaturated zone. Soil-water-contaminant interactions and their implications – Factors affecting retention and transport of contaminants.	9
III	Waste Containment System: Evolution of waste containment facilities and disposal practices – Site selection based on environmental impact assessment –different role of soil in waste containment – different components of waste containment system and its stability issues – property evaluation for checking soil suitability for waste containment – design of waste containment facilities.	11
IV	Contaminant Site Remediation: Site characterization – risk assessment of contaminated site - remediation methods for soil and groundwater – selection and planning of remediation methods – some examples of in-situ remediation.	7
V	Advanced Soil Characterization: Contaminant analysis - water content and permeability measurements – electrical and thermal property evaluation – use of GPR for site evaluation - introduction to geotechnical centrifuge modeling.	9
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To analyze multiphase soil behavior and geoenvironmental impacts from contamination using case histories.

CO2 To evaluate containment and remediation strategies for contaminated soil and groundwater sites.

Text Books: -

1 Yong, R. N. (2000). Geoenvironmental engineering: Contaminated soils, pollutant fate, and mitigation. CRC Press.

2 Sharma, H. D., & Reddy, K. R. (2004). Geoenvironmental engineering: site remediation, waste containment, and emerging waste management technologies. John Wiley & Sons.

3 Daniel, D. E. (1993). Geotechnical practice for waste disposal. Chapman & Hall.

Reference Books: -

1 Rowe, R. K. (2012). Geotechnical and geoenvironmental engineering handbook. Springer Science & Business Media.

2 Reddi, L., & Inyang, H. I. (2000). Geoenvironmental engineering: principles and applications. CRC Press

3 Mitchell, J. K., & Soga, K. (2005). Fundamentals of soil behavior (3rd ed.). John Wiley & Sons.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP3	L	T	P	CIA	SEA	100	3	
Course Name	Constitutive Modelling and Granular Mechanics	3	0	0	40	60			

Course Objectives:

To understand and apply constitutive models to predict soil and rock behavior under various conditions.

To develop modeling skills using advanced theories and numerical methods for geotechnical materials.

Unit	Content	Teaching/Lecture Hours
I	Constitutive Models Overview: Introduction to the role of modelling in geotechnical engineering. Stress-Strain Relationships: Fundamentals of constitutive laws in geomaterials. Elasticity and Plasticity: Basic concepts for soils and rocks. Yield Criteria: Understanding yield points in geotechnical materials.	8
II	Critical State Mechanics: Fundamental principles in soil mechanics. Cam-Clay Models: Introduction and application in soils. Modified Cam-Clay Model: Extended concepts and usage. Cap Plasticity Models: Application in Geotechnical Contexts.	9
III	Advanced Models: Exploration of sophisticated soil and rock models. Anisotropic Models: Understanding and calibrating anisotropic behavior. Numerical Implementation: Finite Element Analysis Applications. Introduction to Hypo-plasticity: Exploring hypo-plasticity in geomechanics.	7
IV	Rock Mechanics: Constitutive modelling in rock mechanics. Elasto-Plastic Models: Application for rocks and jointed rock masses. Damage Mechanics: Mechanics and applications in rock materials. Dynamic Loading Models: Constitutive models under dynamic conditions.	9
V	Behaviour of Granular Materials: Introduction to Granular Mechanics Micro-Macro-Mechanics: Examining discrete-continuum duality in granular material behaviours. Modelling schemes: Comparisons with continuum methods. Soft and hard particle models Time driven and event-driven collisions Numerical Applications: Usage in various geotechnical problems using FEM and DEM.	10
Total Lecture Hours		43

Text Books: -

1 Desai, C. S., & Siriwardane, H. J. (1984). Constitutive laws for engineering materials with emphasis on geologic materials. Prentice-Hall.

2 O'Sullivan, C. (2011). Particulate Discrete Element Modelling: A Geomechanics Perspective. CRC Press.

3 Puzrin, A. M. (2012). Constitutive modelling in geomechanics: Introduction. Springer.

Reference Books: -

1 Wood, D. M. (1990). Soil behaviour and critical state soil mechanics. Cambridge University Press.

2 Nakai, T. (2013). Constitutive modeling of geomaterials: Principles and applications. CRC Press

3 Pande, G. N., & Zienkiewicz, O. C. (1990). Soil mechanics through project-based learning: Constitutive modelling. Thomas Telford.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP4	L	T	P	CIA	SEA	100	3	
Course Name	Soil Dynamics	3	0	0	40	60			

Course Objectives:

- To understand and apply the principles of earthquake engineering, vibration theory, and wave propagation to analyze soil behavior under dynamic loads.
- To evaluate dynamic soil properties, ground motion effects, and seismic response using laboratory methods, codes, and geotechnical design principles

Unit	Content	Teaching/Lecture Hours
I	Earthquake seismology – Causes of earthquake, Plate tectonics, Earthquake fault sources, Seismic waves, Elastic rebound theory, Quantification of earthquake, Intensity and magnitudes, Earthquake source models.	10
II	Engineering problems involving soil dynamics; Role of inertia; Theory of Vibrations: Single and two-degree freedom systems; Wave propagation in elastic media	9
III	Dynamic moduli, Dynamic elastic constants. Poisson's Ratio, Damping ratio, Liquefaction parameters, Laboratory techniques. Factors affecting shear modulus, Elastic modulus, and Elastic Constants. Propagation of seismic waves in soil deposits - Attenuation of stress waves	8
IV	Elastic homogeneous half space and lumped parameter solutions; Vibration isolation; Codal provisions; Strong Ground Motion: Measurement, characterization, and estimation; Amplification theory and ground response analysis.	9
V	Liquefaction of soil and its remediation; Seismic slope stability; Seismic bearing capacity and earth pressures.	8
Total Lecture Hours		44

Course Outcomes: At the end of the course, a student is able

CO1 To design foundations and retaining structures for seismic loads using soil-structure interaction principles.

CO2	To interpret seismic site response and recommend mitigation strategies using geotechnical earthquake engineering tools.

Text Books: -

1 Kramer, S. L. (1996). Geotechnical earthquake engineering. Upper Saddle River, NJ: Prentice Hall.

2 Das, B. M., & Ramana, G. V. (2011). Principles of soil dynamics (2nd ed.). Cengage Learning.

Reference Books: -

1 Idriss, I. M., & Boulanger, R. W. (2008). Soil liquefaction during earthquakes. Oakland, CA: Earthquake Engineering Research Institute.

2 Prakash, S. (1981). Soil dynamics. McGraw-Hill Book Company.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP5	L	T	P	CIA	SEA	100	3	
Course Name	Geosynthetic Reinforced Soil Structure	3	0	0	40	60			

Course Objectives:

- To understand the types, properties, and functional applications of geosynthetics in civil engineering systems.
- To evaluate geosynthetic performance and innovation in geotechnical and sustainable infrastructure design

Unit	Content	Teaching/Lecture Hours
I	Introduction to Geosynthetics: Definition, history, and importance; Types and Classification of Geosynthetics; Geosynthetic Functions and Properties: Quality Control of Geosynthetics: Production processes, Standards & Importance of quality control in Geosynthetic Applications.	10
II	Role of geosynthetics in sustainable development. Geosynthetic Testing and Characterization: Laboratory and field testing methods, Interpretation of test results; Geosynthetic Reinforcement in Geotechnical Engineering: Introduction to soil reinforcement, Design principles and applications in slope stabilization and retaining walls.	9
III	Geosynthetics in Geoenvironmental Engineering: Applications in landfill liners and caps, Environmental benefits and regulations; Geosynthetics in Transportation Geotechnics: Use in pavement design and construction, Geosynthetic-reinforced foundations and subgrades.	8
IV	Geosynthetics in Hydraulic Applications: Riverbank protection and erosion control, Dams and reservoir applications; Case Studies in Sustainable Geosynthetic Applications: Real-world projects showcasing geosynthetics, Lessons learned, and best practices	9
V	Emerging Trends and Innovations in Geosynthetics: Sustainable materials and technologies, Research and development in the field, Integrating geosynthetics into sustainable engineering practices, Opportunities and challenges in the evolving field	8
Total Lecture Hours		44

Course Outcomes: At the end of the course, a student is able

CO1 To apply knowledge of geosynthetic types, properties, and testing to design sustainable geotechnical structures.

CO2	To evaluate geosynthetic applications across environmental, hydraulic, and infrastructure systems using case-based and emerging practices.

Text Books: -

1 Koerner, R. M. (2012). *Designing with geosynthetics* (6th ed.). Xlibris Corporation

2 Shukla, S. K. (2017). *An introduction to geosynthetic engineering* (2nd ed.). CRC Press.

Reference Books: -

1 Rao, G. V. (2007). *Geosynthetics: Engineering applications*. Chennai, India: Alpha Science International.

2 Mandal, J. N. (2021). *Geosynthetics: Expanding horizons*. CRC Press.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP6	L	T	P	CIA	SEA	100	3	
Course Name	Remote Sensing and GIS for Civil and Geotechnical Engineering Applications	3	0	0	40	60			

Course Objectives:

- To understand principles and tools of remote sensing and GIS for spatial analysis in engineering.
- To apply RS-GIS techniques to solve real-world civil and geotechnical engineering problems.

Unit	Content	Teaching/Lecture Hours
I	Fundamentals of Remote Sensing: Basic principles: EMR, sensors, platforms, Types of remote sensing: active vs. passive, Resolution (spatial, spectral, radiometric, temporal), Data products and acquisition.	8
II	GIS Concepts and Data Models: GIS definitions and applications, Spatial data types: raster and vector, Coordinate systems, georeferencing, Spatial data input, storage, and database management, Map projections and scale	9
III	Image Processing and Analysis: Image enhancement, classification (supervised/unsupervised), Feature extraction, change detection, Image fusion and filtering, Accuracy assessment and ground truthing	8
IV	Application of Remote Sensing and GIS in Civil Engineering: Urban planning, land use/land cover (LULC) analysis, Infrastructure development and monitoring, Watershed and hydrological modeling, Flood and disaster mapping	9
V	Application in Geotechnical Engineering: Site characterization and terrain evaluation, Landslide mapping and susceptibility analysis, Soil and rock classification using RS data, Monitoring ground deformation, land subsidence, Case studies on slope stability and liquefaction using GIS/RS	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To analyze and process remote sensing and GIS data for geospatial and geotechnical applications.

CO2 To design spatial solutions to engineering problems using appropriate RS-GIS methods and tools.

Text Books: -	
1	Lillesand, T., Kiefer, R. W., & Chipman, J. (2015). Remote Sensing and Image Interpretation (7th ed.). Wiley
2	Burrough, P. A., & McDonnell, R. A. (1998). Principles of Geographical Information Systems. Oxford University Press
3	Choudhury, D. G., & Panigrahi, B. K. (2019). Remote Sensing and GIS Applications in Civil and Environmental Engineering. IK International.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP7	L	T	P	CIA	SEA	100	3	
Course Name	Stability Analysis of Slopes, Dams, and Embankments	3	0	0	40	60			

Course Objectives:

- To understand the types, causes, and stability analysis methods for slopes, including infinite and finite slope stability.
- To gain knowledge of various design techniques for slopes in cuttings, embankments, and earth dams, including the influence of seepage.

Unit	Content	Teaching/Lecture Hours
I	Landslide phenomenon: Types and causes of slope failures, Practical applications, Stability analysis of infinite slopes with or without water pressures, Stability analysis of finite and Infinite slopes: concept of factor of safety, pore pressure coefficients, Mass analysis, Wedge methods, friction circle method, Method of slices, Bishop's method, Janbu's method.	15
II	Effect of seepage, steady state seepage, submerged and sudden drawdown conditions, Pseudo-static analysis of slopes.	6
III	Design of slopes in cutting, Embankments and Earth dams, Use of stability charts.	7
IV	Site Investigation: Reconnaissance, Preliminary and detailed investigation, Investigation for foundations.	7
V	Advances in stability analysis of slopes. Waste Disposal Systems. Design of Ash Pond, Upstream method, Downstream method, Centerline method	8
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To analyze the stability of slopes under different conditions, including effects of seepage and drawdown.

CO2 To design stable slopes for cutting, embankments, and earth dams using appropriate methods and charts.

Text Books: -

1 Terzaghi, K., Peck, R. B., & Mesri, G. (1996). Soil mechanics in engineering practice (3rd ed.). John Wiley & Sons.
2 Jumi, L. & Lee, C. (2013). Geotechnical engineering: Principles and practices (3rd ed.). Pearson

Reference Books: -

1 Das, B. M. (2019). Advanced soil mechanics (5th ed.). CRC Press.
2 Bowles, J. E. (1996). Foundation analysis and design (5th ed.). McGraw-Hill.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP8	L	T	P	CIA	SEA	100	3	
Course Name	Rock Mechanics	3	0	0	40	60			

Course Objectives:

- To understand the classification, properties, and behavior of rocks and discontinuities in engineering contexts.
- To apply rock mechanics principles to analyze underground openings, slopes, and tunnel stability.

Unit	Content	Teaching/Lecture Hours
I	Rock: Formation of rocks, Physical properties, Classification of rocks and rock masses, Static and Dynamic Elastic constants of rock. Rock Testing: Laboratory and Field tests.	10
II	Discontinuities in Rock Masses: Discontinuity orientation, Effect of discontinuities on the strength of rock. Strength Behaviour: Compression, Tension, and Shear, Stress-Strain relationship, Rheological behavior.	8
III	Strength/Failure Criterion: Coulomb, Mohr, Griffith's theory of brittle strength, and other strength criteria. Stresses in the rock near underground openings.	7
IV	Applications of rock mechanics: slopes, underground excavations, foundations, and rock support systems. Basic features of tunneling: shapes, usages, methods of construction, problems associated with tunnels, tunneling in various subsoil conditions and rocks	8
V	Analysis of stresses: methods to determine stresses around openings, Kirsch equation, Greenspan's method. Basic concepts for lined, unlined, and pressure tunnels. Improvement of rock mass response: rock bolts, rock anchors, steel mats, precast concrete segments, shotcrete, grouting, etc.	10
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To identify rock types, test their properties, and interpret lab and field test results.

CO2 To analyze rock mass behavior and stress distribution around tunnels and underground structures.

Text Books: -

1 Jaeger, J. C., Cook, N. G. W., & Zimmerman, R. W. (2007). Fundamentals of rock mechanics (4th ed.). Blackwell Publishing.

2 Bieniawski, Z. T. (1984). Rock mechanics design in mining and tunneling. A.A. Balkema

3 Goodman, R. E. (1989). Introduction to rock mechanics (2nd ed.). John Wiley & Sons

Reference Books: -

1 Hoek, E., & Bray, J. W. (1981). Rock slope engineering (3rd ed.). CRC Press.

2 Ramamurthy, T. (Ed.). (2007). Engineering in rocks for slopes, foundations, and tunnels. Prentice Hall India.

3 Obert, L., & Duvall, W. I. (1967). Rock mechanics and the design of structures in rock. John Wiley & Sons.

4 Hudson, J. A., & Harrison, J. P. (1997). Engineering rock mechanics: An introduction to the principles. Pergamon.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPATP9	L	T	P	CIA	SEA	100	3	
Course Name	Pavement Analysis and Design	3	0	0	40	60			

Course Objectives:

- To understand the fundamental principles governing the design of flexible and rigid pavements.
- To analyze and compare different pavement design approaches, inputs, and performance criteria.

Unit	Content	Teaching/Lecture Hours
I	Philosophy of Design of Flexible and Rigid Pavements.	7
II	Analysis of Pavements using Different Analytical Methods.	8
III	Selection of Pavement Design Input Parameters – Traffic Loading and Volume.	8
IV	Material Characterization, Drainage, Failure Criteria, Reliability.	8
V	Design of Flexible and Rigid Pavements Using Different Methods. Comparison of Different Pavement Design Approaches, Design of Overlays, and Drainage System	9
Total Lecture Hours		40

Course Outcomes: At the end of the course, a student is able

CO1 To apply analytical methods to evaluate pavement behavior under various loading conditions

CO2 To design flexible and rigid pavements considering traffic, materials, reliability, and drainage.

Text Books: -

1 Huang, Y. H. (2004). Pavement analysis and design (2nd ed.). Pearson Prentice Hall.
2 Yoder, E. J., & Witczak, M. W. (1982). Principles of pavement design (2nd ed.). McGraw-Hill.
3 Teng, W. C. (1980). Functional design of pavements. McGraw-Hill.

Reference Books: -

1 Indian Roads Congress (IRC). (2018). IRC:37–2018: Guidelines for the design of flexible pavements. New Delhi: IRC.
2 Indian Roads Congress (IRC). (2015). IRC:58–2015: Guidelines for the design of plain jointed rigid pavements for highways. New Delhi: IRC.
3 AASHTO. (1993). AASHTO guide for design of pavement structures. American Association of State Highway and Transportation Officials.
4 Sharma, S. C., & Sharma, M. G. (1980). Principles and practice of highway engineering. Asia Publishing House.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPALT1	L	T	P	CIA	SEA	50	2	
Course Name	Geotechnical Engineering Laboratory	0	0	2	30	20			

Course Objectives:

- To understand and apply standard laboratory procedures for evaluating engineering properties of soil.
- To develop hands-on skills in determining soil behavior for geotechnical design and analysis.

List of Experiments	
• Visual identification and water content determination • To determine the specific gravity of soil solids. • To determine the particle size of the soil by the dry and wet methods. • To determine the particle size of the soil by the hydrometer analysis • To determine the Atterberg limit of the soil. • To determine the compaction characteristics of soil. • To determine the maximum and minimum density of sand • To determine in situ density by sand replacement and the core cutter method • To determine the permeability of the soil by constant head and falling head tests. • To determine the shear strength of the parameter of coarse-grained soil by the direct shear test. • To determine the unconfined compressive strength test • To determine strength properties using the triaxial shear test. • To determine consolidation parameters	
Total Lecture Hours	30

Course Outcomes: At the end of the course, a student is able

CO1 To determine the physical and engineering properties of soils through standardized laboratory tests

CO2 To interpret test results to evaluate soil strength, permeability, and compressibility for geotechnical applications.

Text Books: -

1 Das, B. M. (2011). Soil mechanics laboratory manual (8th ed.). Oxford University Press.

2 Lambe, T. W. (1951). Soil testing for engineers. Wiley.

Reference Books: -

1 IS 2720 Series. (Various years). Methods of Test for Soils. Bureau of Indian Standards.

2 Bowles, J. E. (1992). Engineering properties of soils and their measurement (4th ed.). McGraw-Hill.

Syllabus	Semester -I	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	IPPATC1	L	T	P	CIA	SEA	50	2	
Course Name	Research Methodology and IPR	2	0	0	-	50			

Course Objectives:

- To understand fundamental principles, designs, and methodologies of academic research.
- To learn data collection, analysis techniques, and intellectual property frameworks in research contexts.

Unit	Content	Teaching/Lecture Hours
I	Introduction and Design of research: Meaning, objectives and significance of research, types and parameters of research, research process, identification and definition of the research problem, definition of construct and variables, pure and applied research design, exploratory and descriptive design methodology, qualitative vs. quantitative research methodology, field studies, field experiments vs. laboratory experiments, research design in social and physical sciences	7
II	Data and Methods of Data Collection: Survey, assessment, and analysis: data collection, primary and secondary sources of data, Collection of primary data through questionnaires and schedules. Collection of secondary data, processing, and analysis of data. Sample survey, simple random sampling, stratified random sampling, systematic sampling, cluster sampling, area sampling, and multistage sampling. Pilot survey, scaling techniques, validity & reliability.	8
III	Data Analysis: Procedure for testing of hypothesis, the null hypothesis, determining levels of significance, type i and ii errors, grouped data distribution, measures of central tendency, measures of spread/dispersion, normal distribution, analysis of variance: one way, two-way, chi square test and its application, student's 'T' distribution, non-parametric statistical techniques, binomial test. Correlation and regression analysis – discriminant analysis – factor analysis – cluster analysis, measures of relationship.	8
IV	Research report preparation and presentation: Review of literature: historical survey and its necessity, layout of research plan, meaning, techniques and precautions of interpretation, types of report: technical report, popular report, report writing – layout of research report, mechanics of writing a research report. Writing a bibliography and references.	8
V	Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, and development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT	9
Total Lecture Hours		40

Course Outcomes: At the end of the course, a student is able

CO1	To identify research problems and formulate designs using qualitative and quantitative methods.
CO2	To analyze data using statistical tools and effectively present research findings and reports.

Text Books: -

1 Kothari, C. R., & Garg, G. (2019). Research methodology: Methods and techniques (4th ed.). New Age International Publishers.

2 Creswell, J. W., & Creswell, J. D. (2018). Research design: Qualitative, quantitative, and mixed methods approaches (5th ed.). SAGE Publications.

3 Cooper, D. R., & Schindler, P. S. (2014). Business research methods (12th ed.). McGraw-Hill Education.

Reference Books: -

1 Bryman, A. (2016). Social research methods (5th ed.). Oxford University Press.

2 Flick, U. (2014). An introduction to qualitative research (5th ed.). SAGE Publications

3 Ranjit, K. (2020). Research methodology: A step-by-step guide for beginners (5th ed.). SAGE Publications.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTT1	L	T	P	CIA	SEA	100	3	
Course Name	Advanced Foundation Engineering	3	0	0	40	60			

Course Objectives:

- To understand the planning and execution of soil exploration for effective foundation design.
- To apply design principles for various foundation systems, including deep, shallow, and special conditions.

Unit	Content	Teaching/Lecture Hours
I	Planning of soil exploration for different projects, methods of subsurface exploration, methods of borings along with various penetration tests	7
II	Shallow foundations, requirements for satisfactory performance of foundations, methods of estimating bearing capacity, settlements of footings and rafts, proportioning of foundations using field test data, IS codes.	8
III	Pile foundations, methods of estimating load transfer of piles, settlements of pile foundations, pile group capacity and settlement, negative skin friction of piles, laterally loaded piles, pile load tests, analytical estimation of load-settlement behavior of piles, proportioning of pile foundations, lateral and uplift capacity of piles.	8
IV	Well foundation, IS and IRC codal provisions, elastic theory, and ultimate resistance methods, Coffer dams, various types, analysis, and design, Foundations under uplifting loads.	8
V	Foundations on problematic soils: Foundations for collapsible and expansive soil	9
Total Lecture Hours		40

Course Outcomes: At the end of the course, a student is able

CO1 To analyze field data to select the appropriate foundation type and evaluate its performance.

CO2 To design shallow and deep foundations based on bearing capacity, settlement, and IS code guidelines.

Text Books: -

1 Bowels, J. E. (1996). Foundation analysis and design (5th ed.). McGraw-Hill.

2 Tomlinson, M. J., & Woodward, J. (2015). Foundation design and construction (7th ed.). Pearson Education.

Reference Books: -

1 IS 6403:1981 – Determination of bearing capacity of shallow foundations. Bureau of Indian Standards

2 IS 2911 (Part 1 to 4):2010 – Design and construction of pile foundations. Bureau of Indian Standards.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTT2	L	T	P	CIA	SEA	100	3	
Course Name	Principles of Ground Modification	3	0	0	40	60			

Course Objectives:

- To understand traditional and modern ground modification techniques for improving weak and problematic soils.
- To apply principles of mechanical, hydraulic, chemical, and inclusion-based soil modification methods.

Unit	Content	Teaching/Lecture Hours
I	Introduction to Engineering Ground Modification: The ground modification option for dealing with difficult soil, recent forums, traditional objectives, emerging trends, and current and future developments	7
II	Mechanical modification: Introduction to Mechanical Modification, Principles of Soil Densification, Properties of Compacted Soil, Compaction Control Tests, Specifications of Compaction Requirements.	8
III	Hydraulic Modifications: Introduction to Hydraulic Modification; Design of Dewatering System; Filtration, Drainage, and Seepage Control with Geosynthetics; Preloading and Use of Vertical Drain; Electrokinetic Dewatering and Stabilization.	8
IV	Physical and Chemical Modification: Modifications by Admixtures; Modification at Depth by Grouting; Thermal Modifications.	8
V	Modification by Inclusion and Confinement: Evolution of Soil Reinforcement; Mechanical Models of Soil Reinforcement, Flexible Geosynthetics Sheet reinforcement, Stone Columns; Encased Stone Columns; Soil Confinement by Formwork	9
Total Lecture Hours		40

Course Outcomes: At the end of the course, a student is able

CO1 To identify and explain suitable ground improvement techniques for various geotechnical problems.

CO2 To analyze and design ground modification solutions using mechanical, hydraulic, and reinforcement methods.

Text Books: -

1 Hausmann, M. R. (1990). Engineering principles of ground modification. McGraw-Hill
2 Han, J. (2015). Principles and practice of ground improvement. John Wiley & Sons.

Reference Books: -

1 Moseley, M. P., & Kirsch, K. (Eds.). (2004). Ground improvement. CRC Press
2 Chu, J. J., & Rujikiatkamjorn, C. (2005). Ground Improvement: Case Histories. Elsevier.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP1	L	T	P	CIA	SEA	100	3	
Course Name	Bio Geotechnics	3	0	0	40	60			

Course Objectives:

- To understand natural and biological processes influencing soil formation and behavior.
- To apply bio-based methods to improve soil properties and develop sustainable geotechnical techniques.

Unit	Content	Teaching/Lecture Hours
I	Natural origins of soils, biological processes in soils, the geologic origin of a soil, its depositional mode and environment, thixotropic processes	10
II	Use of biological process for changes in physical properties (density, gradation, porosity, saturation), conduction properties (hydraulic, electrical, thermal), mechanical properties (stiffness, dilation, compressibility, swell/shrink, cohesion, cementation, friction angle, erodibility, and soil-water characteristic curve), and chemical composition (buffering, reactivity, cation exchange capacity) of soils.	12
III	Development of a biomediated soil improvement technique, bioaugmentation (where the required microbes are injected into the soil), and biostimulation (where natural microbes are stimulated). Biogeochemical and geotechnical models, management of treatment of by-products.	10
IV	Durability and longevity/reversibility of the process, and education of engineers and researchers.	8
Total Lecture Hours		40

Course Outcomes: At the end of the course, a student is able

CO1 To explain how biological processes affect geotechnical, hydraulic, and chemical properties of soils.

CO2 To design and assess biomediated soil improvement techniques like bioaugmentation and biostimulation.

Text Books: -

1 DeJong, J. T., Martinez, B. C., & Nelson, D. C. (2013). Bio-mediated and bio-inspired geotechnics. Springer.

2 Ivanov, V., & Chu, J. (2008). Applications of microorganisms to geotechnical engineering for bioclogging and biocementation of soil in situ. Springer.

Reference Books: -

1 Jensen, C. (2014). Bio- and chemo-mechanical processes in geotechnical engineering. Institution of Civil Engineers.

2 Mitchell, J. K., & Soga, K. (2005). Fundamentals of soil behavior (3rd ed.). Wiley.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP2	L	T	P	CIA	SEA	100	3	
Course Name	Computational Fluid Dynamics	3	0	0	40	60			

Course Objectives:

- To understand fluid flow governing equations and numerical methods for solving partial differential equations.
- To analyze fluid flow behavior using discretization techniques, stability criteria, and finite difference methods.

Unit	Content	Teaching/Lecture Hours
I	Three approaches: world, CFD, and applications to different branches of Science and Engineering. Governing equations for fluid flow: Continuity equation, momentum equation, and energy equation	10
II	Classification of partial differential equations, Parabolic, Hyperbolic, and elliptic equations, Discretisations of the 1-Dimensional, 2-Dimensional partial differential equations, and their solutions. Finite difference formulations	8
III	Introduction, discretization methods, consistency, error and stability analysis, fundamentals of fluid flow modeling, Finite difference solutions, and applications.	8
IV	Navier-Stokes equation, continuity equations for incompressible flows. Explicit finite difference schemes, implicit finite difference schemes, Initial and Boundary conditions, significance of model boundary conditions.	8
V	Grid generation techniques and Von Neumann Stability analysis, Solution of governing equations, and Application to different fluid flow problems with stability analysis	9
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To apply conservation laws to derive governing equations for computational fluid dynamics problems.

CO2 To solve discretized PDEs using finite difference methods and assess stability and consistency.

Text Books: -

1 Hoffmann, K. A. (2000). Computational fluid dynamics (Vol. 1–4). Engineering Education System.
2 Anderson, J. D. (1995). Computational fluid dynamics: The basics with applications. McGraw-Hill.

Reference Books: -

1 Abbott, M. B., & Basco, D. R. (1989). Computational fluid dynamics: An introduction for engineers (1st ed.). Cambridge University Press
2 Vreugdenhil, C. B. (1994). Computational hydraulics: An introduction (2nd ed.). Springer

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP3	L	T	P	CIA	SEA	100	3	
Course Name	Subsurface Geomechanics and Applications	3	0	0	40	60			

Course Objectives:

- To understand the geomechanical behavior of subsurface formations under varying stress and pore pressure conditions.
- To apply geomechanical principles to energy systems, including hydraulic fracturing, CCS, and geothermal reservoirs.

Unit	Content	Teaching/Lecture Hours
I	Introduction: Overview of subsurface geomechanics. Stress and Strain: Basics of subsurface stress and strain. Rock Mechanics: Elasticity, plasticity, and anisotropy in rocks.	10
II	Pore Pressure Dynamics: Understanding pore pressure behaviour. Wellbore Stability: Stability analysis and design aspects. Mud Weight and Failure: Mud weight impact on wellbore failure	8
III	Hydraulic Fracturing: Principles and Techniques. Shale Gas and Tight Oil: Geomechanics of Unconventional Reservoirs. Coalbed Methane: Exploration and Production Strategies.	8
IV	Geothermal Systems: Exploration of geothermal and EGS. Carbon Capture and Storage: Techniques and challenges in CCS. CCS Monitoring: Geomechanical aspects and monitoring strategies.	8
V	Induced Seismicity: Causes, effects, and mitigation strategies. Advanced Modeling: Modern modeling techniques in geomechanics. Future Trends: Upcoming trends and integrated subsurface models.	9
Total Lecture Hours		43

Course Outcomes: At the end of the course, a student is able

CO1 To analyze stress, strain, and pore pressure conditions affecting rock stability in subsurface environments.

CO2 To evaluate geomechanical implications in unconventional reservoirs, geothermal systems, and carbon storage operations.

Text Books: -

1 Zoback, M. D., & Kohli, A. H. (2019). Unconventional reservoir geomechanics. Cambridge University Press.

2 Anderson, J. D. (1995). Computational fluid dynamics: The basics with applications. McGraw-Hill.

3 Amadei, B., & Stephansson, O. (1997). Rock stress and its measurement. Springer.

Reference Books: -

1 Zoback, M. D. (2010). Reservoir geomechanics. Cambridge University Press

2 Fjær, E., Holt, R. M., Horsrud, P., Raaen, A. M., & Risnes, R. (2008). Petroleum-related rock mechanics (2nd ed.). Elsevier

3 Fossen, H. (2016). Structural geology (2nd ed.). Cambridge University Press

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP4	L	T	P	CIA	SEA	100	3	
Course Name	Pavement Evaluation, Rehabilitation, and Maintenance	3	0	0	40	60			

Course Objectives:

- To understand pavement performance factors, distress mechanisms, and evaluation techniques for flexible and rigid pavements.
- To apply design methods and economic analysis to develop suitable overlay strategies for pavement rehabilitation.

Unit	Content	Teaching/Lecture Hours
I	Factors affecting pavement performance: Failure and distress- their nature.	8
II	Evaluation Techniques for monitoring the nature and magnitude of distress in flexible and rigid pavements- devices adopted	9
III	Assessing the structural strength of highway pavements	8
IV	Overlays- their types- general construction features.	7
V	Design of overlays- IRC, AASHTO and other methods- their comparison, Economics of overlays.	10
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To identify and evaluate pavement distress and structural condition using standard monitoring and testing methods.

CO2 To design and compare overlays using IRC, AASHTO, and other standards, considering cost-effectiveness.

Text Books: -

1 Yoder, E. J., & Witczak, M. W. (1975). Principles of pavement design (2nd ed.). John Wiley & Sons.
2 Yang, N. C. (1972). Design of functional pavement. McGraw-Hill.
3 Croney, D., & Croney, P. (1998). The design and performance of road pavements (3rd ed.). McGraw-Hill Professional.

Reference Books: -

1 Indian Roads Congress. (Various years). IRC codes and guidelines related to pavement design and overlays. New Delhi: IRC
2 Haas, R., Hudson, W. R., & Zaniewski, J. (1994). Modern pavement management. Krieger Publishing
3 Huang, Y. H. (2004). Pavement analysis and design (2nd ed.). Pearson Education

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP5	L	T	P	CIA	SEA	100	3	
Course Name	Optimization Methods in Civil Engineering	3	0	0	40	60			

Course Objectives:

- To introduce classical and non-classical optimization methods relevant to civil engineering
- To enable students to apply optimization techniques using MATLAB and MS Excel to solve real-world problems.

Unit	Content	Teaching/Lecture Hours
I	Introduction to Optimization: Importance and role of optimization in civil engineering, Optimization problem formulation: Objective functions, constraints, variables, Classification: Linear vs Non-linear, Deterministic vs Stochastic, Case examples in design, construction, and planning.	8
II	Classical Optimization Techniques: Linear Programming: Simplex Method, Duality, Non-linear Optimization: Unconstrained and Constrained Optimization, Lagrange Multipliers and Kuhn-Tucker Conditions, Applications using MATLAB and Excel Solver	9
III	Non-Classical and Evolutionary Methods: Genetic Algorithms, Particle Swarm Optimization, Simulated Annealing, Ant Colony Optimization, Multi-objective Optimization and Pareto Front, Application to Civil Engineering problems	8
IV	Optimization in Geotechnical Engineering: Slope stability optimization, Bearing capacity enhancement using reinforcement optimization, Soil improvement method selection via optimization, Application of GA/PSO in retaining wall and foundation design problems	9
V	Optimization Tools and Real-World Applications: MATLAB toolbox for optimization, Excel Solver for linear/nonlinear models, Real-world case studies: Water resource planning, structural layout optimization etc., scheduling, Research trends and future scope	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To Formulate and solve civil engineering optimization problems using appropriate classical and modern techniques.

CO2 To analyze engineering systems to optimize performance with computational tools and ethical considerations.

Text Books: -

1 Deb, K. (2012). Optimization for engineering design: Algorithms and examples. PHI Learning
2 Rao, S. S. (2019). Engineering optimization: Theory and practice (5th ed.). Wiley
3 Arora, J. S. (2011). Introduction to optimum design (3rd ed.). Academic Press.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBTP6	L	T	P	CIA	SEA	100	3	
Course Name	Groundwater and Flow Through Porous Media	3	0	0	40	60			

Course Objectives:

- To understand the physical behavior of water in soils and its influence on engineering properties.
- To analyze groundwater flow and consolidation using mathematical models and geotechnical testing methods.

Unit	Content	Teaching/Lecture Hours
I	Modes of occurrence of water in soils. Adsorbed water, capillary water, Capillary potential, Capillary tension, and soil suction.	8
II	Effective and Neutral pressures in soil Flow through porous Media: Darcy's law and measurement of permeability in laboratory and field.	9
III	Steady State flow solutions of Laplace's equation, Plane problems, 3-dimensional problems, Partial cut-offs, uplift pressure, consolidation theory –one- and three-dimensional consolidation. Secondary consolidation	12
IV	Groundwater Hydraulics: Water table in regular materials, Geophysical exploration for locating the water table. Confined water, Equilibrium conditions, Non-equilibrium conditions, Water withdrawal from streams, Method of groundwater imaging.	13
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To explain the types of soil water and assess capillarity, suction, and potential in various soils.

CO2 To apply Darcy's law to determine permeability and calculate effective stresses in soil.

Text Books: -

1 Todd, D. K., & Mays, L. W. (2005). Groundwater hydrology (3rd ed.). Wiley

2 Raghunath, H. M. (2007). Groundwater (3rd ed.). New Age International

3 Fitts, C. R. (2013). Groundwater science (2nd ed.). Academic Press.

Reference Books: -

1 Raj, P. P. (2005). Geotechnical engineering. Tata McGraw-Hill Education

2 Lambe, T. W., & Whitman, R. V. (1991). Soil mechanics. Wiley

3 Craig, R. F. (2012). Craig's soil mechanics (8th ed.). CRC Press

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	MSPBTO1	L	T	P	CIA	SEA	100	3	
Course Name	Business Analytics	3	0	0	40	60			

Course Objectives:

- To introduce the aspects and importance of data analytics
- To study the ability to think critically in making decisions based on data and deep analytics.
- To learn the technical skills in predictive and prescriptive modeling to support business decision-making and to demonstrate the ability to translate data into clear, actionable insights

Unit	Content	Teaching/Lecture Hours
I	Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview	7
II	Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, Simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology.	8
III	Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring Contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predictive Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its steps in the business analytics Process, Prescriptive Modelling, Nonlinear Optimization	9
IV	Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Causal Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte Carlo Simulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.	10
V	Decision Analysis: Formulating Decision Problems, Decision Strategies without Outcome Probabilities, Decision Trees, the Value of Information, Utility, and Decision Making	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To demonstrate knowledge of data analytics.

CO2	To demonstrate the ability to think critically in making decisions based on data and deep analytics.
CO3	To demonstrate the ability to use technical skills in predictive and prescriptive modeling to support business decision-making.
CO4	To demonstrate the ability to translate data into clear, actionable insights.

Reference Books: -

1 Schniederjans, M. J., Schniederjans, D. G., & Starkey, C. M. (2014). Business analytics: Principles, concepts, and applications. Pearson FT Press

2 Evans, J. R. (2016). Business analytics (2nd ed.). Pearson Education.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	IPPBTO2	L	T	P	CIA	SEA	100	3	
Course Name	Industrial Safety	3	0	0	40	60			

Course Objectives:

- To study the Safety Measures and the plans for Engineering maintenance.
- To learn the determination of wear & Corrosion and apply methods for their prevention.
- To introduce the method for tracing the Fault and equipment, and preventive maintenance

Unit	Content	Teaching/Lecture Hours
I	Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting	7
II	Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of the maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.	8
III	Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle, and factors affecting the corrosion. Types of corrosion, corrosion prevention methods	9
IV	Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes..	10
V	Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning, and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and their use, definition, need, steps, and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, and advantages of preventive maintenance. Repair cycle concept and importance	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1	To apply the knowledge of Safety Measures
CO2	To plan for Engineering maintenance.
CO3	To determine the wear & Corrosion and apply methods for their prevention.
CO4	To trace the Fault of machine tools and equipment.
CO5	To plan and implement the periodic and preventive maintenance for machines/equipment.

Reference Books: -

1 Dhillon, B. S. (2002). Engineering maintenance: A modern approach. CRC Press.

2 H. Phadke, H. (2018). Industrial safety and maintenance management. Everest Publishing House.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	IPPBTO3	L	T	P	CIA	SEA	100	3	
Course Name	Cost Management of Engineering Projects (Other than Civil Engg.)	3	0	0	40	60			

Course Objectives:

- To learn the cost concepts in the cost management process.
- study the application of project cost control methods and determine costing, and carry out the analysis of pricing for profitability
- To implement the application of PERT/CPM for cost management

Unit	Content	Teaching/Lecture Hours
I	Introduction and Overview of the Strategic Cost Management Process	7
II	Cost concepts in decision-making: relevant cost, Differential cost, Incremental cost, and Opportunity cost. Objectives of a Costing System: Inventory valuation, Creation of a Database for operational control, Provision of data for Decision-Making.	8
III	Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution is a conglomeration of technical and non-technical activities. Detailed Engineering activities. Pre-project execution: main clearances and documents. Project team: Role of each member. Importance Project site: Data required with significance. Project contracts. Types and contents. Project execution: Project cost control. Bar charts and Network diagrams. Project commissioning: mechanical and process	9
IV	Cost Behavior and Profit Planning: Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard Costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of the service sector. Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management, and Theory of constraints. Activity-Based Cost Management, Bench Marking, Balanced Score, and Value-Chain Analysis. Budgetary Control, Flexible Budgets, Performance budgets, Zero-based budgets. Measurement of Divisional profitability, pricing decisions including transfer pricing	10
V	Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1	To discuss the cost concepts in the cost management process
CO2	To handle the projects by the application of project cost control methods.
CO3	To determine all types of costing and carry out the analysis of pricing for profitability.
CO4	To apply the PERT/CPM for cost management.

Reference Books: -

1 Horngren, C. T., & Foster, G. (2003). Advanced management accounting (9th ed.). Prentice Hall.

2 Kaplan, R. S., & Atkinson, A. A. (1998). Management and cost accounting (3rd ed.). Prentice Hall.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	IPPBTO4	L	T	P	CIA	SEA	100	3	
Course Name	Composite Materials	3	0	0	40	60			

Course Objectives:

- To study the implementation of composite materials for the required performance and to adopt composite materials as reinforcements.
- To study the methods of manufacturing metal matrix composites
- To study the strength of laminates

Unit	Content	Teaching/Lecture Hours
I	INTRODUCTION: Definition, Classification, and characteristics of Composite materials. Advantages and applications of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance	7
II	REINFORCEMENTS: Preparation-layup, curing, properties, and applications of glass fibers, carbon fibers, Kevlar fibers, and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.	8
III	Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon–Carbon composites: Knitting, Braiding, Weaving. Properties and applications	9
IV	Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications	10
V	Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations	8
Total Lecture Hours		42

Course Outcomes: At the end of the course, a student is able

CO1 To explain and implement the composite materials for the required performance based on the characteristics

CO2 To adopt composite materials as reinforcements.

CO3 To implement the methods of manufacturing metal matrix composites.

CO4 To adopt the methods of manufacturing polymer matrix composites and evaluate the strength of laminates

Reference Books: -

1 Cahn, R. W. (Ed.). (1993). Material science and technology: Vol. 13 – Composites. VCH Publishers.

2 Lubin, G. (Ed.). (1982). Handbook of composite materials. Springer US.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	IPPBTO5	L	T	P	CIA	SEA	100	3	
Course Name	IoT	3	0	0	40	60			

Course Objectives:

- To introduce the concepts of the Internet of Things.
- To study the analysis of the basic protocols in a wireless sensor network
- To learn the design of IoT applications in different domains and be able to analyze their performance and security

Unit	Content	Teaching/Lecture Hours
I	Review of computer communication concepts (OSI layers, components, packet communication, Networks, TCP-IP, subnetting, IPV4 addressing and challenges). IPV6 addressing. IoT architecture reference layer. Characteristics IoT sensor nodes, Edge computer, cloud and peripheral cloud, single board computers, open-source hardware, Examples of IoT infrastructure	7
II	Software defined networks, network function virtualization, difference between SDN and NFV for IoT, Basics of IoT System Management with NETCOZF, YANG-NETCONF, YANG, SNMP NETOPEER	8
III	MQTT, UDP, MQTT brokers, publish subscribe modes, HTTP, COAP,XMPP and gateway protocols, IoT Communication Pattern, IoT Protocol Architecture, Selection of Wireless technologies (6LoWPAN, Zigbee, WIFI, BT, BLE,SIG,NFC, LORA, Lifi, Widi).	9
IV	An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, A Brief History of IOT Security, Common Challenges in IOT Security, How IT and OT Security Practices and Systems Vary, Formal Risk Analysis Structures: OCTAVE and FAIR, The Phased Application of Security in an Operational Environment	9
V	IoT Physical Devices and Endpoints: Introduction to Arduino and Raspberry Pi-Installation, Interfaces (serial, SPI, I2C), Programming – Python program with Raspberry PI with focus on interfacing external gadgets, controlling output, reading input from pins. IoT Physical Servers and Cloud Offerings: Introduction to Cloud Storage models and communication APIs WebServer: Web server for IoT, Cloud for IoT, Python web application framework. Designing a RESTful web API. IoT application and its Variants: Case studies: IoT for smart cities, smart grid, health care, agriculture, smart meters.M2M, Web of things, Cellular IoT, Industrial IoT, Industry 4.0,IoT standards.	12
Total Lecture Hours		45

Course Outcomes: At the end of the course, a student is able

CO1	To understand the concepts of the Internet of Things
CO2	To analyze basic protocols in a wireless sensor network.
CO3	To design IoT applications in different domains and be able to analyze their performance.
CO4	To elaborate on the need for Data Analytics and Security in IoT

Reference Books: -

1 Bahga, A., & Madisetti, V. (2015). Internet of Things: A hands-on approach. Universities Press.

2 Srinivasa, K. G. (2017). Internet of Things. Cengage Learning India.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBLT1	L	T	P	CIA	SEA	50	2	
Course Name	Geotechnical Software Lab	0	0	3	30	20			

Course Objectives:

- To develop the ability to model and analyze geotechnical problems using FEM-based software
- To apply numerical methods to solve real-world foundation, slope, and excavation design problems

Contents

The Geotechnical Software Laboratory course introduces students to advanced numerical modeling techniques using PLAXIS 2D/3D, a finite element-based software for geotechnical analysis. The course begins with the fundamentals of FEM and PLAXIS interface, focusing on soil model selection, mesh generation, and boundary conditions. Students will simulate shallow and deep foundations, analyzing load-settlement behavior and soil-structure interaction. They will also model retaining structures and braced excavations, emphasizing construction stages and earth pressure distribution.

Further, the course covers slope stability analysis using strength reduction methods under static and seismic conditions. Applications of seepage and rainfall-induced failures are also explored. Advanced topics include ground improvement techniques like stone columns and geosynthetics, along with basic dynamic simulations using PLAXIS Dynamics. Each module includes practical lab exercises with interpretation of results, enhancing understanding of deformation, stress distribution, and safety assessments in geotechnical systems. The course strengthens students' ability to apply computational tools to real-world geotechnical design problems

Course Outcomes: At the end of the course, a student is able

CO1 To simulate and analyze geotechnical systems using PLAXIS for effective engineering design

CO2 To interpret FEM results to assess safety, deformation, and construction stages of soil-structure systems.

Reference Books: -

1 Brinkgreve, R. B. J., Kumarswamy, S., & Swolfs, W. M. (2020). PLAXIS 2D 2020 Manual. Bentley Systems.

2 Bentley Systems. (2022). PLAXIS Knowledge Base and Tutorials.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPBPT1	L	T	P	CIA	SEA	50	2	
Course Name	Mini Project	0	0	4	30	20			

Course Objectives:

- To develop the ability to identify and define engineering problems through a comprehensive literature review
- To apply scientific research methodology to propose and present effective, data-driven solutions

Contents
• The Mini Project will have a mid-semester presentation and an end-of-semester presentation. The mid-semester presentation will include identification of the problem based on the literature review on the topic, referring to the latest literature available. • End semester presentation should be done along with the report on identification of the topic for the work and the methodology adopted, involving scientific research, collection and analysis of data, determining solutions, highlighting individuals' contribution. • Continuous assessment of the Mini Project at Mid Sem and End Sem will be monitored by the departmental committee

Course Outcomes: At the end of the course, a student is able

CO1 To identify research problems from the literature and formulate relevant project objectives and scope

CO2 To present project findings using appropriate methodology, data analysis, and individual contributions.

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	ELPBTX1	L	T	P	CIA	SEA	100	2	
Course Name	English for Research Paper Writing	2	0	0	40	60			

Course Objectives:

- To study how to improve writing skills and the level of readability.
- To learn about what to write in each section and the skills needed when writing a Title
- To learn how to write a good quality of paper for the very first time submission

Unit	Content	Teaching/Lecture Hours
I	Planning and Preparation, Word Order, breaking up long sentences, and Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness	5
II	Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts, Introduction	6
III	Review of the Literature, Methods, Results, Discussion, Conclusions, and The Final Check. Key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, and skills needed when writing a Review of the Literature.	8
IV	Skills are needed when writing the Methods, skills are needed when writing the Results, skills are needed when writing the Discussion, and skills are needed when writing the Conclusions	6
V	Useful phrases, how to ensure the paper is as good as it could possibly be, the first-time submission	6
Total Lecture Hours		31

Course Outcomes: At the end of the course, a student is able

CO1 To improve your writing skills and level of readability

CO2 To learn about what to write in each section.

CO3 To understand the skills needed when writing a Title.

Reference Books: -

1 Goldbort, R. (2006). Writing for science. Yale University Press.

2 Day, R. A. (2006). How to write and publish a scientific paper (6th ed.). Cambridge University Press

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	PEPBTX2	L	T	P	CIA	SEA	100	2	
Course Name	Stress Management by Yoga	2	0	0	40	60			

Course Objectives:

- To introduce the practices for developing a healthy mind in a healthy body.
- To practice the methods for improving human efficiency at work

Unit	Content	Teaching/Lecture Hours
I	Definitions of Eight parts of yog. (Ashtanga).	10
II	Yam and Niyam, Do`s and Don't's in life, i) Ahinsa, satya, astheya, bramhacharya and aparigraha, ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan.	10
III	Asan and Pranayam, i) Various yog poses and their benefits for the mind & body, ii) Regularization of breathing techniques and their effects- Types of pranayam.	10
Total Lecture Hours		30

Course Outcomes: At the end of the course, a student is able

CO1 To develop healthy mind in a healthy body, thus improving social health also

CO2 To improve efficiency.

Reference Books: -

1 Janardan Swami Yogabhyasi Mandal. (2000). Yogic asanas for group training – Part I. Janardan Swami Yogabhyasi Mandal

2 Vivekananda, S. (2003). Raja Yoga or conquering the internal nature. Advaita Ashrama, Publication Department

Syllabus	Semester -II	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	LAPBTX4	L	T	P	CIA	SEA	100	2	
Course Name	Constitution of India	2	0	0	40	60			

Course Objectives:

- To understand the historical evolution and philosophy behind the making of the Indian Constitution.
- To analyze the structure, powers, and functions of government institutions and local self-governance bodies

Unit	Content	Teaching/Lecture Hours
I	History of Making of the Indian Constitution: History Drafting Committee, (Composition & Working). Philosophy of the Indian Constitution: Preamble, Salient Features, Contours of Constitutional Rights & Duties: Fundamental Rights, Right to Equality, Right to Freedom, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights, Right to Constitutional Remedies, Directive Principles of State Policy, Fundamental Duties	7
II	Organs of Governance: Parliament, Composition, Qualifications and Disqualifications, Powers and Functions, Executive, President, Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications, Powers and Functions. Local Administration: District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CEO of Municipal Corporation. Pachayati raj: Introduction, PRI: ZilaPachayat. Elected officials and their roles, CEO ZilaPachayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy.	15
III	Election Commission: Election Commission: Role and Functioning, Chief Election Commissioner and Election Commissioners, State Election Commission: Role and Functioning, Institute and Bodies for the welfare of SC/ST/OBC and women	8
Total Lecture Hours		30

Course Outcomes: At the end of the course, a student is able

CO1 To explain the significance of the Constitution and its foundational principles and rights

CO2 To identify the roles of key constitutional institutions and their impact on democratic governance.

Reference Books: -

1 Basu, D. D. (2021). Introduction to the Constitution of India (25th ed.). LexisNexis.

2 Bakshi, P. M. (2023). The Constitution of India (15th ed.). Universal Law Publishing

Semester III

Syllabus	Semester -III	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPCPT1	L	T	P	CIA	SEA	200	14	
Course Name	Dissertation Stage–I	0	0	28	100	100			

Course Objectives:

- To inculcate the reviewing of available research literature for identifying the complex Civil Engineering problems
- To practice the applications of appropriate techniques to analyze complex Civil Engineering problems
- To adopt the engineering and management principles through the efficient handling of the projects

Contents

- Dissertation- I will have a mid-semester presentation and an end-of-semester presentation. The mid-semester presentation will include identification of the problem based on the literature review on the topic, referring to the latest literature available.
- End semester presentation should be done along with the report on identification of topic for the work and the methodology adopted involving scientific research, collection and analysis of data, determining solutions, and must bring out the individual's contribution.
- Continuous assessment of Dissertation – I and Dissertation – II at Mid Sem. and End Sem. will be monitored by the departmental committee.

Course Outcomes: At the end of the course, a student is able

CO1 To identify complex Civil Engineering problems, reviewing available literature

CO2 To identify appropriate techniques to analyze complex Civil Engineering problems and apply engineering and management principles through efficient handling of project

Semester IV

Syllabus	Semester -IV	Teaching Hours/ Week			Continuous Internal Assessment	Semester Examination Assessment	Total Marks	Credits	Pre-requisite Course(s)
Course Code	CGPDPT1	L	T	P	CIA	SEA	300	16	
Course Name	Dissertation Stage–II	0	0	32	100	200			

Course Objectives:

- To introduce the problem-solving skills related to the complex Civil Engineering problems by applying appropriate techniques and tools
- To necessitate the exhibition of good communication skills to the engineering community and society
- To crop out and demonstrate the promotion of professional ethics and work culture.

Contents
• Dissertation – II will be an extension of the work on the topic identified in Dissertation – I. • Continuous assessment should be done of the work done by adopting the methodology decided, involving numerical analysis/conducting experiments, collection and analysis of data, etc. There will be a pre-submission seminar at the end of the academic term. After the approval, the student has to submit the detailed report, and an external examiner is called for the viva-voce to assess, along with a guide.

Course Outcomes: At the end of the course, a student is able

CO1 To apply appropriate techniques and tools to solve complex Civil Engineering problems effectively

CO2 To communicate effectively with the engineering community and society while demonstrating ethics and professionalism