JABALPUR ENGINEERING COLLEGE, JABALPUR (MP)
(An Autonomous Institute of Govt. of M.P.)
Affiliated to Rajiv Gandhi Technological University, Bhopal (MP)
Scheme of Study and Examination (w.e.f. July 2010)

M.E. II Sem. Branch : Civil Engg. Specialization : Geotechnical Engineering

Course Code	Subject	Periods			EVALUATION SCHEME					Credits
					SESSIONAL EXAM			ESE	SUB TOTAL	
		L	T	P	TA	CT	TOT			
CE-119	Soil Structure Interaction	3	1	-	10	20	30	70	100	4
CE-120	Geo technic of Dams	3	1	-	10	20	30	70	100	4
CE-121	Geodynamics & Machine Foundation	3	1	-	10	20	30	70	100	4
CE-122A	**Elective – I (Any One)**									
	Rock Mechanics									
CE-122B	Advances in Geotechnical Engineering	3	1	-	10	20	30	70	100	4
CE-122C	Tunnel Engineering									
CE-122D	Geosynthetics and Reinforced Earth									
	Elective - II (Any One)									
CE-123A	Advanced Foundation Engineering									
CE-123B	Geotechnical Processes	3	1	-	10	20	30	70	100	4
CE-123C	Remote Sensing GIS & Geointerpretation									
CE-123D	Environmental Geotechnology									
(PRACTICAL/DRAWING/DESIGN)										
CE-124L	Advanced Geotech. Lab	-	-	2	60	-	60	90	150	6
CE-125L	Geotech Field Testing Lab - II	-	-	2	60	-	60	90	150	6
	Total	**15**	**5**	**4**	**170**	**100**	**270**	**530**	**800**	**32**

T.A. Teachers Assessment, CT- Class Test, ESE - End Semester Examination, Total Marks 800
Total Periods : 24 Total Credits : 32

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COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	SOIL STRUCTURE INTERACTION	CE-119	Min "D"	Min "D"	5.0

SOIL STRUCTURE INTERACTION

UNIT – I : Review of conventional methods of foundation design, Nature and complexity of soil structure interaction, selection and use of field and lab data for foundation design. Selection and suitability of foundation type .

UNIT- II: Design of isolated and combined footing foundation. Proportioning of footing for equal settlements. Study of code of practice for design of isolated and combined footing. Numericals related to field data for design practice.

UNIT- III : Design of raft foundation, General considerations and various methods of design of raft foundations. Floating foundations . Analysis and design of floating foundations. Suitability of floating foundations .

UNIT- IV : Deep foundation and its selection criteria based on soil properties. Design of pile foundation. Group pile design and its suitability. Instrumental set up and data analysis of pile load test.

UNIT- V : Foundation in expansive soil. Typical terrain and selection criteria based on various soil parameters. Study of settlement behavior of foundation in black-cotton soil. Case studies to learn through real examples.

Reference Books :

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	GEOTECHNIC OF DAMS	CE-120	Min "D"	Min "D"	5.0

GEOTECHNIC OF DAMS

Unit – I : Types of dams. Site selection for major/minor dams, regional map preparation using satellite imagery. Design criteria. Types and selection of earth dam and its suitability on various soil parameters. Components of earth dam. Analysis of different geologic conditions influencing the design of an earthen dam/embankment.

Unit – II : Suitability of earth dam over other types. Components of earthen dam and their design criteria. Soil and hydraulic factors affecting the design. Types and selection of earth dam.

Unit – III : Seepage analysis of an earthen dam, flow net, its applications, phreatic line, seepage below Hydraulic structure, pore water pressure and its control. Method of foundation treatment. Critical review of stability analysis.

Unit – IV : Embankment construction procedures & equipment, methods and quality control. Various methods of embankment improvement by geosynthetics and other available procedures.

Unit – V : Critical study of earth dam failures. Lesson from failure cases, maintenance of earthen dam. Critical review of earthen dam construction over other types.

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	GEODYNAMICS AND MACHINE FOUNDATIONS	CE-121	Min "D"	Min "D"	5.0

GEODYNAMICS AND MACHINE FOUNDATIONS

Unit – I THEORY OF VIBRATIONS : Definitions; degree of freedom, damping, amplitude, period, natural frequency. Harmonic motion, free & forced vibrations of a single degree of freedom system, undamped and damped system. Logarithmic decrement, transmissibility. Vibrations of multiple degree of freedom systems.

Unit – II WAVE PROPAGATION & DYNAMIC SOIL PROPERTIES : Wave propagation in elastic infinite medium, wave propagation in elastic half space. Soil spring constants. Dynamic moduli, poission's ratio, field & laboratory techniques, cyclic shear test, cyclic plate load test, block vibration test, seismic refraction tests, high strain tests.

Unit – III MACHINE FOUNDATIONS : General Principles : Type of machine and foundations, modes of vibration of a rigid foundation block, general requirements. Permissible amplitude and allowable soil pressure General design criteria , I S codes .

Unit – IV : DESIGN OF MACHINE FOUNDATIONS : Foundations for impact type machine, design procedure for hammer foundations. Foundations for reciprocating & rotary type machines.

Unit – V : VIBRATION ISOLATION AND SCREENING :

Force and motion isolation, screening of vibrations, materials for base isolation.

Reference Books :

1. Soil Dynamics and Machine Foundations by Swamisaran; Galgotia publications Pvt. Ltd. New Delhi
2. Dynamics of Bases and Foundations : Barken DD, Mc Graw Hill NewYork
3. Soil Dynamics : by Shamsher Prakash Mc Graw Hill Book co.
4. I S 2974 (part I to V) ISI New Delhi
5. Soil Dynamics and Earthquake Engineering by Bharat Bhusan Prasad, PHI Learning Pvt. Ltd. New Delhi

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ROCK MECHANICS	CE-122A	Min "D"	Min "D"	5.0

ROCK MECHANICS

Introduction to rock mechanics, geology, rock mechanics and foundation, engineering properties of intact rock, mechanical behavior of joints in rock mass. FEM approach, seismic considerations, measurement of stress and stress in rocks, rock fracturing in compression. Stress distribution in rocks and soils, selection of suitable foundation, spread foundation, pile cassion foundation. Machine foundations.

Reference Books :

Structural Geology, by Billings, PHI
Rock Slope Engineering by E Hock J Bray,
Soil Mechanics by T Schebotarioti, TMH
Foundations of structure by W Dunham, TMH

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ADVANCES IN GEOTECHNICAL ENGINEERING	CE-122B	Min "D"	Min "D"	5.0

ADVANCES IN GEOTECHNICAL ENGINEERING

Foundation classification; Choice of foundations; Bearing capacity and settlement analysis of shallow foundations like footings and rafts and rafts, Deep foundations like piles, piers and Caissons, Foundations on expansive soils, Laterites, fills and rock; Construction aspects of foundations. Shoring and underpinning; Groundwater lowering and drainage; Legal aspects of foundation engineering; Field tests in foundation engineering including instrumentation for monitoring of foundation.

Reference Books :

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	TUNNEL ENGINEERING	CE-122C	Min "D"	Min "D"	5.0

TUNNEL ENGINEERING

Unit – I : Definitions, different types of tunnels for different purposes, brief history of tunnels of world. Shapes and sizes of tunnels for their purposes.

Unit – II : Tunnel alignment – Transfer of center line on ground, various modern methods.

Unit – III : Study of various geotechnical parameters for deciding feasibility of tunnels, Various ground improvement measures for tunnel construction like grouting, strengthening of rock, rock bolting etc.

Unit – IV : Tunnel construction – construction in hard rock and soft ground. Drilling, blasting, quarrying, subsidence and caving. Percolation and dewatering during construction. Handling of unexpected source of water, muck hauling, lighting and ventilation in tunnel.

Unit – V : Computer based design of tunnels, Economy in design of tunnels, tunnel lining, routine and regular maintenance of tunnels for smooth running.

Reference Books :

The art of Tunnelling by K Szechy, Tesa 1960.

Rock Mechanics & Design of structures on Rock by L. Obert & WI Duvall wiley, 1967.

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	GEOSYNTHETICS AND REINFORCED EARTH	CE-122D	Min "D"	Min "D"	5.0

GEOSYNTHETICS AND REINFORCED EARTH

Unit – I : Rainforced Earth : Histroy, field of applications, natural fibres, overview of Geotexiles, Geomembranes, Geogrids, Geonets, Geowebs Geomats and Geo-composites, economic aspects of their applications.

Unit – II : Production of Geotextiles, comoposites, physical-mechanical, hydraulic and chemical properties. Functions of Geosynthetics, fluid transmission, filtration, separation, protection.

Unit – III : Soil reinforcement : Basic principle of soil reinforcement, shear strength of reinforced soil, theoretical strength models, factors affecting requirements on synthetic reinforcement, installation techniques.

Unit – IV Calculation methods : Basic concepts, embankment on soft soils, internal stability, overall stability, foundation stability and bearing capacity. Failures. Construction of the steep slope, retaining walls-external stability, internal stability.

Unit – V : Use of Geo-synthetics in Roads and railways, drainage systems- Control of groundwater level, dewatering and reclamation of land, use of Geo-membranes for lining applications, management and maintenance.

Reference Books :

1. Geo-textiles and Geo-membranes in Civil Engg. Gerard P.T.M. Van Santvrot A.A. Balkema, Oxford and IBH publishing company, New Delhi.
2. Reinforced Soil and Geo-textiles – J.N. Mandal, proceedings FIGC-1988, Oxford and IBH publishing company provate Ltd, New Delhi
3. Geosynthetics : Applications, Design and construction – R.J. Tarmat, Proceedings First European Geo-synthetics Conference, Netherland A.A. Balkema, Publisher-Brookfield U.S.A.

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COURSE CONTENT & GRADE (w.e.f. July 2010)

Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ADVANCED FOUNDATION ENGINEERING	CE-123A	Min "D"	Min "D"	5.0

ADVANCED FOUNDATION ENGINEERING

- Unit – I : RAFT FOUNDATIONS : Rectangular, Circular and Angular Raft Foundation. Design considerations. Current design and construction practices.

Unit – II : FOUNDATIONS FOR TALL STRUCTURES : Radar, Antenna Microwave and T.V. Tower, power transmission line, Tower and pile foundation for chimney.

Unit – III : CAISSONS AND FOFFERDAMS : CAISSON : Types, Design consideration, construction of drilled, open and pneumatic caissons. COFFERDAMS – Type, design and consideration.

Unit – IV : SPECIAL FOUNDATIONS : Stone column, sandulick foundation. Reinforced Earth Structure. Conical, hyperbolic and parabolic types of shell foundation.

Unit – V : FOUNDATION : Foundation in distress and remedial measures : case study of foundation under distress and foundation failure.

Unit – VI : BURIED STRUCTURE : Design of structure buried in semi-Rigid and flexible conducts.

- **Reference Books :**

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	GEOTECHNICAL PROCESSES	CE-123B	Min "D"	Min "D"	5.0

GEOTECHNICAL PROCESSES

Introduction : Classification of geotechnical processes. Fundamental principles of geotechnical processes. Scope and limitations of geotechnical processes.

Drainage : Function of drainage in geotechnical Engineering Structures. Methods of drainage deep drainage, shallow drainage and displacement.

Compaction : Classification, methods of compaction, theories of compaction, superficial or shallow compaction.

Soil stabilization : various methods their scope and limitations. Artificial cementing. Injection of grouting processes, theory of injections. Single field injections. Multi flow injection, freezing. Base exchange Electro- chemical hardening of clay and with concentrated solutions. Reinforced earth concepts : materials applications design. Other methods of improving engineering properties of rock and soils preloading. Stone columns sand piles and columns, Rock anchoring. Study of case histories.

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	REMOTE SENSING GIS & GEOINTERPRETATION	CE-123C	Min "D"	Min "D"	5.0

REMOTE SENSING GIS & GEOINTERPRETATION

Unit - I : Remote sensing, its terminology, Electro magnetic signatures , Atmospheric window . Active and Passive systems for remote sensing. Remote sensing applications.

Unit -II : Principle of Aerial Photograph, Flight planning, Relief displacement of vertical photographs. Stereoscope, Parallax bar , methods of aerial photo visual interpretation keys by this instrument.

Unit – III : Principle of Satellite image procurement, spectral reflectance curves, spatial, spectral, temporal, radiometric resolution, characteristics of images. Errors of satellite images & their rectification. Methods of visual interpretation of satellite images.

Unit - IV :Projection, different types of projections, Use of projections for image correction. projection used in India. Measure of shortest distance between two points on Earth.

Unit - V : Remote Sensing , Technique used in Resource management of soil and water, Data Base Management system for Urban & Rural Planning and Civil Engineering Projects. Global positioning system.

Reference Books :

Principle of Remote Sensing by Sabins
Manual of Remote Sensing by (A.S.R.S.) U.S.A.

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ENVIRONMENTAL GEOTECHNOLOGY	CE-123D	Min "D"	Min "D"	5.0

ENVIRONMENTAL GEOTECHNOLOGY

Soil Formation, Solids composition and characterization, Mineral composition, Role of Composition and soil structure in the Engineering. Behaviour of soils. Flow of water in soils; Energy states of water in soil. Principles of flow in saturated soils, Governing equation for saturated flow, Principle of flow in unsaturated soils, Governing equation for unsaturated flow. Mass Transport, mass transport mechanisms, mass transfer mechanisms. Site characterization and contaminant release mechanism, site contamination, Characterization of site, Geo statically applications, contaminant release mechanisms : vaporization, dusting , leaching. Principles of site and geo-material treatment techniques : Treatment approaches, basis for treatment, Technology selection, in situ soil flushing, in situ vitrification principles, natural attenuation principles, and bioremediation principles, ex-situ stabilization and chemical treatment principles. Waste containment system, Implementation – Essentials of waste containment, hydraulic and physical containment, containment effects on source. Terms, site selection techniques for containment, containment site improvement. Introduction to Landifills, Environmental impact assessment and management – Initial environmental evaluation, Elements of EIA, preparation of environmental base map, classifications of environmental parameters. Identification of hazardous waste; Introduction to exposure assessment, Risk-based estimation of required cleanup levels. Non aqueous – phase liquids in soils; introduction, Principles of NAPL entrapment in soils, conceptualization of field scale transport of NAPLs, phase diagram for soil – water.

LNAPL – Air systems, mobilization of residual NAPLs,

Reference Books :

Lakshmi N.Reddy, Hilary. I Inyang – Geo-Environmental Engineering – Principles and Applications Markcel Dekker ink, 2000

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	ADVANCED GEOTECH LAB	CE-124L	Min "D"	Min "D"	5.0

ADVANCED GEOTECH LAB

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)

1. Cyclic tri-axial shear test
2. Pneumatic box – shear test
3. Centrifugal modeling of Geotechnical problems.
4. Determination of swelling pressure of cohesive soils
5. Brazilian tensile strength of rock samples.
6. Determination of point load index of rock samples.
7. To determine safe bearing capacity of rocks.
8. Determination of rock porosity

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Branch	Subject Title	Subject Code	Grade for End Sem		CGPA at the end of every even semester
			T	P	
	GEOTECH FIELD TESTING LAB - II	CE-125L	Min "D"	Min "D"	5.0

GEOTECH FIELD TESTING LAB – II

The exercises in this component shall be designed to demonstrate the basic principles outlined in different units of the theory paper. After completing the exercises the student should have developed a good grasp of the practical utilities of the theory content.

(Suggested Exercise)

1. Determination of coefficient of elastic uniform compression using cyclic plate load test.
2. Geophysical Examination – Electrical resistivity test.
3. Geo physical examination – seismic refraction test.
4. Rock sampling techniques
5. Determination of RQD & RMR
6. Determination of pile load carrying capacity in clayey and sandy strata.
7. Study of ground penetration radar
8. Bankelman beam test

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