INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

CIVIL ENGINEERING

COURSE DESCRIPTION FORM

Course Title	**Engineering Geology**			
Course Code	A50188			
Regulation	**R15- JNTUH**			
Course Structure	Lectures	Tutorials	Practicals	Credits
	4	1	-	4
Course Coordinator	Y. Ravi Kumar, Assistant Professor , Civil Engineering Department			
Team of Instructors	Ch. Bala Krishna , Assistant Professor , Civil Engineering Department			

I. COURSE OVERVIEW:

This course covers the study of physical geology, structural geology and petrology also the importance of geology from civil engineering point of view. It deals weathering of common rocks like granite and with reference to dams and reservoirs.
This course also covers study of minerals, properties, role of properties in their identification. This course also deals with study of rocks, classification and their identification, study of common geological structures like folds, faults and unconformities. This course also deals the methods of investigating subsurface features by geophysical methods such as gravity methods, electrical methods, seismic methods and geothermal methods. Finally this course addresses study and selection of site for dams and reservoirs, improvement of competence of the site by grouting, water tightness, and design considerations of constructing tunnels and lining of tunnels.

II. PREREQUISITE(S):

Level	Credits	Periods/ Week	Prerequisites
UG	4	5	Structure Analysis-I Geotechnical Engineering-I Geotechnical Engineering-II

III. MARKS DISTRIBUTION:

Sessional Marks	University End Exam marks	Total marks
Midterm Test There shall be two midterm examinations. Each midterm examination consists of essay paper, objective paper and assignment. The essay paper is for 10 marks of 60 minutes duration and shall contain 4 questions. The student has to answer 2 questions, each carrying 5 marks. The objective paper is for 10 marks of 20 minutes duration. It consists of 10 multiple choice and 10 fill-in-the blank questions, the student has to answer all the questions and each carries half mark. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in every theory course. Assignments are usually issued at the time of commencement	75	100

Sessional Marks	University End Exam marks	Total marks
of the semester. These are of problem solving in nature with course. critical thinking. Marks shall be awarded considering the average of two midterm tests in each		

IV. EVALUATION SCHEME:

S. No	Component	Duration	Marks
1.	I Mid Examination	80 minutes	20
2.	I Assignment	-	5
3.	II Mid Examination	80 minutes	20
4.	II Assignment	-	5
5.	External Examination	3 hours	75

V. COURSE OBJECTIVES:

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

I. Know case histories of failures of civil engineering constructions due to geological drawbacks and importance of geology from civil engineering point of view.
II. Learn about structural geology, mineralogy and petrology.
III. Learn about minerals their physical properties and chemical composition.
IV. Learn how geological structures like folds, faults, joints and unconformities are formed their advantages and disadvantages.
V. Know suitable site considerations for construction of dams and reservoirs.

VI. COURSE OUTCOMES:

After completing this course the student must demonstrate the knowledge and ability to:

1. Identify the minerals based on their physical properties
2. Know the importance of geology in civil engineering.
3. Distinguish weathered rocks from fresh rocks
4. Understand the effects of weathering on dams, reservoirs and tunnels
5. Study the rocks by their physical properties, chemical composition, optical properties and X- ray properties
6. Understand the geological classification of rocks into Igneous, Sedimentary and metamorphic rocks, their identification based on structure and texture.
7. Understand the importance of various associated geological structures like folds, faults, joints and unconformities present at site for foundations.
8. Select a suitable site for dams and reservoirs to avoid seepage, silting and tilting.
9. Locate various subsurface mines and rock bodies by applying geophysical investigations such as Gravity methods, magnetic methods, Electrical methods, seismic methods, radio metric methods and geothermal methods.

10. Understand the structural and lithological considerations for tunnel construction to avoid leakage and falling of rock parts.
11. Understanding of impact of engineering solutions on the society and also will be aware of contemporary issues.
12. Develop confidence for self-education and ability for life-long learning.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED:

Program Outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineeringfundamentals, and an engineering specialization to the solution of complex engineering problems.	H	Assignments, Exams
PO2	**Problem analysis**: Identify, formulate, review research literature, and analyze complexengineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.	H	Assignments, Exams
PO3	**Design/development of solutions**: Design solutions for complex engineering problems anddesign system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.	S	Assignments
PO4	**Conduct investigations of complex problems**: Use research-based knowledge and researchmethods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.	S	Assignments
PO5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modernengineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.		-
PO6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assesssocietal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.	H	Exams
PO7	**Environment and sustainability**: Understand the impact of the professional engineering solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.	S	Exams, Assignments
PO8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms ofthe engineering practice.	S	Quizzes, Discussions
PO9	**Individual and team work**: Function effectively as an individual, and as a member or leader indiverse teams, and in multidisciplinary settings.	S	Lectures, Discussions
PO10	**Communication**: Communicate effectively on complex engineering activities with the engineeringcommunity and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.	S	Lectures, Discussions

PO11	**Project management and finance**: Demonstrate knowledge and understanding of theengineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.	S	Possible Projects
PO12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage inindependent and life-long learning in the broadest context of technological change.	S	Discussions

S – Supportive **H - Highly Related**

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED:

Program Specific Outcomes		Level	Proficiency assessed by
PSO1	**ENGINEERING KNOWLEDGE:**Graduates shall demonstrate sound knowledge in analysis, design, laboratory investigations and construction aspects of civil engineering infrastructure, along with good foundation in mathematics, basic sciences and technical communication.	H	Lectures, Assignments, Exams
PSO2	**BROADNESS AND DIVERSITY:**Graduates will have a broad understanding of economical, environmental, societal, health and safety factors involved in infrastructural development, and shall demonstrate ability to function within multidisciplinary teams with competence in modern tool usage.	H	Lectures, Assignments, Exams
PSO3	**SELF-LEARNING AND SERVICE:**Graduates will be motivated for continuous self-learning in engineering practice and/ or pursue research in advanced areas of civil engineering in order to offer engineering services to the society, ethically and responsibly	S	Guest Lectures, Possible Group Projects, Industrial Internship

S - Supportive **H - Highly Related**

IX. SYLLABUS:

UNIT - I

INTRODUCTION: Importance of geology from Civil Engineering point of view. Brief study of casehistories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.
WEATHERING OF ROCKS: Its effect over the properties of rocks importance of weathering with reference to dams, reservoirs and tunnels weathering of common rock like "Granite".

UNIT – II

MINERALOGY: Definition of mineral, Importance of study of minerals, Different methods of study ofminerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldsper, Quartz, Flint, Jasper, Olivine, Augite, Hornblende, Muscovite, Biotite, Asbestos,Chlorite, Kyanite, Garnet, Talc,Calcite. Study of other common economics minerals such as Pyrite, Hematite, Magnetite, Chrorite, Galena, Pyrolusite, Graphite, Magnesite and Bauxite.

PETROLOGY: Definition of rock, Geological classification of rocks into igneous, Sedimentary andmetamorphic rocks. Dykes and sills, common structures and textures of igneous, sedimentary and metamorphic rocks. Their distinguishing features, Megascopic and microscopic study of Granite, Dolerite,

Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate. Rock excavation, stone aggregates

UNIT - III

STRUCTURAL GEOLOGY: Indian stratigraphy, paleontology and geological time scale, out crop, strikeand dip study of common geological structures associating with the rocks such as fold, faults unconformities and joints– their important types. Ground water: Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration. Earth quakes, their causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, Landslides hazards, water in landslides their causes and effects, measures to be taken to prevent their occurrence. Importance of study of ground water, Earthquake and landslides.

UNIT - IV

GEOLOGY OF DAMS AND RESERVOIRS: Types of dams and bearing of Geology of site in theirselection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factors contributing to the success of a reservoir. Geological factors influencing water tightness and life of reservoirs, Geo hazards, ground subsidence. Geophysical studies: Importance of geophysical studies Principles of geophysical study by Gravity methods, Magnetic methods, Electrical methods, Seismic methods, Radio metric methods and geothermal method. Special importance of Electrical resistivity methods and seismic refraction methods. Improvement of competence of sites by grouting etc. Fundamental aspects of Rock mechanics and Environmental Geology.

UNIT - V

TUNNELS: Purposes of tunnelling, Effects of Tunnelling on the ground, Role of Geological Considerations(i.e. Lithological, structural and ground water) in tunnelling over break and lining in tunnels, Tunnels in rock, subsidence over old mines, mining substances.

Textbooks:

1. N. Chennkesavulu (2005), Engineering Geology, Mc Milan India Ltd., New Delhi, India.
2. Venkat Reddy (2011), Engineering geology, Vikas Publications, New Delhi, India.

Reference Books:

1. K. V. G. K. Gokhale (2005), Principles of engineering Geology, BS Publications, New Delhi, India.
2. F.G. Bell, Fundamental of Engineering geology butterwoths, Publications, New Delhi, 1992.

X. COURSE PLAN:

At the end of the course, the students are able to achieve the following course learning outcomes:

Lecture Number	Topics Planned to cover	Learning Objectives	References
1	To introduce the subject and importance	**Introduction to Engineering Geology**: Definition and branches of Geology	**T2:24.6** **T2:24.8**
1	To know the importance of geology	Importance of engineering geology from civil engineering point of view	**T7:12.14**
2-3	To know various case histories of failures of some major constructions due to geological drawbacks	Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs.	**T4:3.10** **T2:24.7**

Lecture Number	Topics Planned to cover	Learning Objectives	References
4-5	Able to understand various branches of geology	Importance of Physical geology, Petrology and Structural Geology	**T4:3.11 T4:3.12**
6	To know the process of weathering	**weathering of rocks:** Definition and Process of weathering	**T1:16.2**
7	to avoid dam and reservoir failures due to weathering	importance of weathering with Reference to dams, reservoirs and tunnels	**T1:16.5**
8-9	To know how the granite respond to weathering	Weathering effect over the properties of rocks and weathering of common rock like "Granite"	**T1:16.6.2**
10	To understand the importance of minerals and study	**Mineralogy:** Definition and importance of study of minerals	**T2:26.9**
11-12	To understand the different methods of study of minerals	Different methods of study of minerals, Advantages of study of minerals by physical properties	**T2:26.11**
13	Ability to identify the minerals based on their physical properties	Role of study of physical properties of minerals in the identification of minerals.	**T1:16.7**
14	Ability to study on different physical properties of minerals such as feldspar, quartz, Flint minerals	Study of physical properties of Feldspar, Quartz and Flint	**T2:26**
15	Ability to identify Jasper, olivine, Horneblende and Augiteminerals	Study of physical properties of Jasper, olivine, Horneblende, Augite	**T2:20.4**
16	Ability to identify Muscovite,Biotite Asbestos, Chlorite and Kyanite minerals.	Study of physical properties of Muscovite,Biotite Asbestos, Chlorite and Kyanite	**T2:23.4**
17	Ability to identify Garnet, Talc, calcite minerals	Study of physical properties of Garnet, Talc, calcite	**T2:20.9**
18	Ability to study on common economic minerals such as Pyrite, Hematite, Magnetite, Chrorite, Galina	Study of physical properties of Pyrite, Hematite, Magnetite, Chrorite, Galina	**T4:5.13**
19	Ability to study on common economic minerals such as Pyrolusite, Graphite, magnesite, Bauxite	Study of physical properties of Pyrolusite, Graphite, magnesite, Bauxite	**T2:21.1-21.2**
20	To know about petrology ,definition of rock, classification of rocks	**PETROLOGY:** Definition of rock, Geological classification of rocks	**T:21.3- T:21.4 T2:21.5-21.6**
21	Ability to study about distinguishing features of granite ,dolerite ,basalt ,pegmatite, laterite ,conglomerate	Study of physical features of rocks such as granite, dolerite, basalt, pegmatite, laterite, conglomerate	**T4:7.1-7.3**
22	Ability to study about distinguishing features of sand stone ,shale, limestone, gneiss, schist	study about distinguishing features of sand stone ,shale, limestone, gneiss, schist	**T3:27.2**
23-25	Ability to study about distinguishing features quartzite, marble , slate	study about distinguishing features quartzite, marble , slate	**T3:27.9**
26-27	Study of rock excavation and stone aggregates	Study of rock excavation and stone aggregates	**T3:27.9**

Lecture Number	Topics Planned to cover	Learning Objectives	References
28-29	To understand the concept of structural geology	**structural geology:** Indian stratigraphy, paleontology and geological time scale, out crop	**T3:27.10**
30	To know the importance of strike and dip	Strike and Dip	**T3:27.11**
31-32	To know the importance of geological structures associating with the rocks such as folds, faults ,unconformities and joints-their types	Folds , faults and unconformities	
33	Ability to understand the importance of ground water :water table ,types of ground water	Ground water table ,and their types	**T4:10.7**
34-36	Ability to understand the importance of springs ,cone of depression , geological controls of ground water movement ,exploration	Springs , cone of depression , controls of ground water movement , exploration	**T2:20.10**
37	Ability to understand the importance earth quakes ,their causes and effects	Earth quakes	**T2:34.2**
38	Ability to understand the importance shield areas and seismic belts, seismic waves	Seismic belts ,seismic waves	**T4:44.2**
39-40	Ability to understand the importance of Richter scale , precautions to be taken for building construction in seismic areas	Study of Richter scale and precautions to be taken for building construction in seismic areas.	**T4:46.9**
41	Ability to understand the importance of landslides , hazards , water in landslides their causes and effects and measures to be taken to prevent their occurrence	Landslides and their effects and precautionary measures	**T4:46.11**
42-43	Ability to understand the importance of ground water , earth quakes and land slides	Importance of landslides , earth quakes	**T4:46.7**
44	Ability to understand the importance of geology of dams and reservoirs and types of dams	Geology of dams and their types	**T4:46**
45	Ability to understand the importance bearing capacity of geology of site in teir selection	Bearing capacity of geology of site in dam selection	**T4:40.4**
46	Ability to understand the importance of geological considerations in the selection of a dam site and the analysis dam failure in the past	Geological considerations in selection of a dam site and analysis of dam failure in the past	**T5:50.4**
47	Ability to understand the importance of factors contributing to the success of a reservoir	Factors contributing to the success of a reservoir	**T5:54.9**
48	Ability to understand the importance of geological factors influencing water tightness and life	Factors influencing water tightness and life of reservoirs , geo hazards and ground subsidence	**T5:27.2**

Lecture Number	Topics Planned to cover	Learning Objectives	References
	of reservoirs, geo hazards and ground subsidence.		
49	Ability to understand the importance of geophysical studies, principles of geophysical study in gravity methods, magnetic and electric methods	Geophysical studies, principle of geophysical study in gravity, magnetic and electric methods.	**T5:27.9**
50-51	Ability to understand the importance of seismic, radiometric and geothermal methods	Seismic, radiometric and geothermal methods.	**T5:27.9**
52-54	Ability to understand the importance of electrical resistivity methods ,seismic refraction methods	Electric resistivity, seismic refraction methods.	**T5:27.10**
55-58	Ability to understand the importance of improvement of competence of sites by grouting etc…, fundamental aspects of rock mechanics and environmental geology	Improvement of competence of sites by grouting , fundamental aspects of rock mechanics and environmental geology	**T5:20.11**
59-61	Ability to understand the importance of tunnels , purposes of tunneling ,effects of tunneling ongeo logical considerations (lithological , structural and ground water) in tunneling	Importance of tunneling , effects of tunneling on geological considerations	**T5:23.22**
62-63	Ability to understand the importance of over break and lining in tunnels	Over break and lining	**T5:25.15**
64-73	Ability to understand the importance of tunnels in rock, subsidence over old mines, mining substances.	Tunnels in rock, subsidence over old mines, mining substances.	**T5:32.17**

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
I	S	H											H		S
II	H	S											H	S	
III				H			S						H	S	
IV											S		S	H	
V			H	S						S			S	H	S

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XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
1	H	S						S					H		S
2		H	S										H		
3		H							S	S	S		H		
4				S	H							S	H	S	
5					H							S	S	H	
6			H				S						S		
7				H						S			H	H	
8						H		S				S	H	H	S
9					S		H						H	H	S
10	H	S											H	H	S
11	H				S								H	H	S
12	H							S	S				H		S

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