# GEOTECHNICAL ENGINEERING (GR18A3002)

III- B.Tech – I Semester

(AY  2021-22)

**Dr. C. Lavanya**

**Professor**



**Department of Civil Engineering**

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Bachupally, Kukatpally, Hyderabad – 500 090.**

# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

## Geotechnical Engineering

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# Gokaraju Rangaraju Institute of Engineering and Technology
## (Autonomous)
**Bachupally, Kukatpally, Hyderabad – 500 090.**
### Department of Civil Engineering
### GEOTECHNICAL ENGINEERING

**Course Code: GR18A3002**　　　　　**III Year I Sem**　　　　　**L:3 T:0 P:0 C:3**

**UNIIT I Introduction** - Types of soils, their formation, Scope of soil mechanics, Basic Definitions and Relationships, Soil as three-phase system. Determination of moisture content by oven dry method, pycnometer and sand bath method. Specific gravity by pycnometer method. Unit weight of soil by Core-cutter method and Sand-replacement method. Consistency limits, Consistency indices, Grain size analysis, Indian standard soil classification system. Plasticity of soil

**UNIIT II Permeability of Soil** - Darcy's law, validity of Darcy's law. Determination of coefficient of permeability by constant-head method and falling-head method. Field method by pumping- out test. Permeability of stratified soils and factors affecting permeability of soil.
**Seepage Analysis** - Introduction, characteristics of flow nets, effective stress principle, nature of effective stress, effect of water table, fluctuations of effective stress, effective stress in soils saturated by capillary action, quick sand condition.

**UNIIT III Compaction of Soil** - Introduction, theory of compaction, laboratory determination of optimum moisture content and maximum dry density. Factors affecting compaction. Compaction in field and compaction control. Stresses in soils – Introduction, stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area. Pressure bulb and Isobars, Boussinesq's equation, Theory of Newmark's Influence Chart. Appropriate stress distribution methods - equivalent point load method and two to one method.

**UNIIT IV Consolidation of Soil** - Introduction, comparison between compaction and consolidation, initial, primary & secondary consolidation, spring analogy for primary consolidation, Terzaghi's theory of consolidation, interpretation of consolidation test results, computation of consolidation settlement and secondary consolidation.

**UNIT V Shear Strength** - Mohr circle and its characteristics, principal planes, relation between major and minor principal stresses, Mohr-Coulomb theory. Types of shear tests – direct shear test and it merits, tri-axial compression test and its behaviour of UU, CU and CD, Unconfined compression test and vane shear test. Computation of effective shear strength parameters.

**TEXT BOOKS**
1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, New Delhi, 2nd edition (2000), Reprint (2014).
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5 th edition (2000), Reprint (2009).

**REFERENCES BOOKS**
1. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundations,Laxmi publications Pvt. Ltd., New Delhi, 16th edition, Reprint (2012).
2. C. Venkataramiah, Geotechnical Engineering, New age International publishers (2002),4 th edition (2012).
3. Dr. P. Purushotham Raj, Soil Mechanics and Foundation Engineering, Pearson Education India (2008).
4. S. K.Gulhati& Manoj Datta, Geotechnical Engineering, Mc.Graw Hill Education Pvt Ltd., New Delhi (2005), 16th Reprint (2013).
5. Braja M. Das, Advanced Soil Mechanics, Taylor and Francis, 3 rd edition (2008).
6. Soil Mechanics by Craig R.F., Chapman & Hall
7. Soil Mechanics in Engineering Practice by Karl Terzaghi, Ralph B. Peck, andGholamrezaMesri.
8. Geotechnical Engineering: Principles and Practices of SoilMechanics and FoundationEngineering (Civil and Environmental Engineering) by V.N.S.Murthy

# Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)
**Bachupally, Kukatpally, Hyderabad – 500 090.**

## Time Table

**III YEAR I Sem A & B SECTION**

**III BTech ( GR18) - I Semester        AY:  2020-21   Sec A & B**

| DAY/ HOUR | 9:00- 9:55 | 9:55- 10:50 | 10:50- 11:45 | 11:45- 12:25 | 12:25- 1:15 | 1:15- 2:05 | 2:05- 2:55 |
|---|---|---|---|---|---|---|---|
| Monday | GTE (B) | GTE (B) | | | | | |
| Tuesday | | | | | GTE (B) | GTE (B) | |
| Wednesday | | | | LUNCH BREAK | | | |
| Thursday | GTE (A) | GTE (A) | | | | | |
| Friday | | GTE (A) | GTE (A) | | | | |
| Saturday | | | | | | | |

**Program Educational Objectives**

1. Graduates of the programme will be successful in technical and professional career.

2. Graduates of the programme will have proficiency in solving real time Civil Engineering projects.

3. Graduates of the programme will continue to engage in life-long learning with ethical and social responsibility.

**Program Outcomes**

Graduates of the Civil Engineering programme will be able to

a. apply knowledge of mathematics, science and fundamentals of Civil Engineering.

b. analyse problem and interpret the data.

c. design a system component, or process to meet desired needs in Civil Engineering within realistic constraints.

d. identify, formulate, analyse and interpret data to solve Civil Engineering problems.

e. use modern engineering tools such as CAD and GIS for the Civil Engineering practice.

f. understand the impact of engineering solutions in a global, economic and societal context.

g. understand the effect of Civil Engineering solutions on environment and to demonstrate the need for sustainable development.

h. understanding of professional and ethical responsibility.

i. work effectively as an individual or in a team and to function on multi-disciplinary context.

j. communicate effectively with engineering community and society.

k. demonstrate the management principles in Civil Engineering projects.

l. recognize the need for and an ability to engage in life-long learning.

**PSOs**

1. Recognize the need for a sustainable environment and design smart infrastructure considering the global challenges.

2. Create and develop innovative designs with new era materials through research and development.

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Bachupally, Kukatpally, Hyderabad – 500 090.**

# COURSE OBJECTIVES

Academic Year                    : 2021-22

Semester                             :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A & B

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                              Dept.: Civil Engineering

Designation:  Professor

On completion of this Subject/Course the student shall be able to:

| S.No | Objectives |
|------|------------|
| 1 | Educate basic Engineering properties of soil. |
| 2 | Provide a strong background in geotechnical engineering in various aspects like permeability and effective stresses. |
| 3 | Provide details about properties of compaction and stress distribution. |
| 4 | Identify the nature and behaviour of soil during consolidation process. |
| 5 | Excel in information about shear strength of soil mass. |

Signature of HOD                                                             Signature of faculty

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Bachupally, Kukatpally, Hyderabad – 500 090.**

# COURSE OUTCOMES

**A**cademic **Y**ear           : 2021-22

Semester                :  I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A & B

Course/Subject:  Geotechnical Engineering            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

The expected outcomes of the Course/Subject are: At the end of the course, the student will be able to

| S.No | Outcomes |
|------|----------|
| 1 | Identify basic Engineering properties of soil and classify the soil. |
| 2 | Perform and evaluate the experiments to determine the permeability and effective stresses of soil. |
| 3 | Identify, formulate and solve various problems in compaction and stresses in soils. |
| 4 | Analyse the mechanism and behaviour of soil under consolidation process. |
| 5 | Evaluate the behaviour of shear strength of soil mass. |

Signature of HOD                                  Signature of faculty

# Gokaraju Rangaraju Institute of Engineering and Technology
## (Autonomous)
### Bachupally, Kukatpally, Hyderabad – 500 090.

## STUDENT ROLL LIST

**B.Tech CIVIL Engg. III yr-I Sem- Section A  (GR18)**  2021-22

| S.No | Reg No | Student Name |
|------|--------|--------------|
| 1 | 18241A0151 | SOHEB PATEL |
| 2 | 18241A0152 | SRIAM SHIVA ADITYA |
| 3 | 19241A0101 | RUHAIL AHMAD LONE |
| 4 | 19241A0102 | AITHA SAI TEJA |
| 5 | 19241A0103 | BARISETTY SHIVA KARTHIK |
| 6 | 19241A0104 | BENDHI VARUN THEJA GOUD |
| 7 | 19241A0105 | BHUKYA VAMSHI |
| 8 | 19241A0106 | BOGE VENKAT ROHITH |
| 9 | 19241A0107 | BONTHA PRANEETHKUMAR |
| 10 | 19241A0108 | CHILUKA RAHUL |
| 11 | 19241A0109 | DANDI KIRAN |
| 12 | 19241A0110 | DAYYA RAGNESH |
| 13 | 19241A0111 | E MANISH GOUD |
| 14 | 19241A0112 | ERRAM SAI PRIYA |
| 15 | 19241A0113 | G DEEPIKA |
| 16 | 19241A0114 | GORANTALA SAI |
| 17 | 19241A0115 | GUGULOTHU SANTHOSH |
| 18 | 19241A0116 | GURIJALA SAI KUMAR |
| 19 | 19241A0117 | GURUJALA SRIDHAR |
| 20 | 19241A0118 | IRUVANTI HEMANTH KUMAR |
| 21 | 19241A0119 | JANGITI VYSHNAVI |
| 22 | 19241A0120 | JARUPLA CHERAN |
| 23 | 19241A0122 | JETTI SREEVANI |
| 24 | 19241A0123 | K SOWMYA |
| 25 | 19241A0124 | KADALI KRISHNASRI SAI |
| 26 | 19241A0125 | KAMAREDDY AKSHAY |
| 27 | 19241A0126 | KATTA SAI KUMAR |
| 28 | 19241A0127 | KOLLURI.TEJASWI |
| 29 | 19241A0128 | KONDAPURAM SRIJA |
| 30 | 19241A0129 | KOTTE VIVEK |
| 31 | 19241A0130 | KRUTHIKA VIJAY PALANGE |
| 32 | 19241A0131 | MADA AKHIL REDDY |
| 33 | 19241A0132 | MADARAM SHRAVAN KUMAR REDDY |
| 34 | 19241A0133 | MADDIGATLA AJAY SAGAR |
| 35 | 19241A0134 | CHANDANA MALPATEL |
| 36 | 19241A0135 | MANDALA CHINNI |

| | | |
|---|---|---|
| 37 | 19241A0136 | MIREGILLA VIJAYAKUMAR |
| 38 | 19241A0137 | MOHD OBAID KASHIF |
| 39 | 19241A0138 | NARAPAKA MADHAV KUMAR |
| 40 | 19241A0139 | NIMMALA ARSHITHA |
| 41 | 19241A0141 | P SIDDARTHA |
| 42 | 19241A0142 | PAGIDIPALLY AJAY KUMAR |
| 43 | 19241A0143 | PALLAPU NAVEEN |
| 44 | 19241A0144 | PALLE SANATH KUMAR |
| 45 | 19241A0145 | PANTANGI PRANAY |
| 46 | 19241A0146 | PATIL SWAPNIL |
| 47 | 19241A0147 | POLISETTY SAAHAS |
| 48 | 19241A0148 | S.SAITEJA |
| 49 | 19241A0149 | SAI NEERAJ M |
| 50 | 19241A0150 | SATYA SAI PRASANNA REDDY SOLIPETA |
| 51 | 19241A0151 | SHAIK BILAL |
| 52 | 19241A0152 | SHAIK FIRDOUS AYESHA |
| 53 | 19241A0153 | SOORA VIKAS |
| 54 | 19241A0154 | TELLAM SRI SAI PAVANA ROSHINI |
| 55 | 19241A0155 | THALLAPALLY SWARANYA |
| 56 | 19241A0156 | THUMATI VENKATA VAYUNANDHAN |
| 57 | 19241A0157 | UDUMULA NIKHIL REDDY |
| 58 | 19241A0158 | VELISHALA  GAYATHRI |
| 59 | 19241A0159 | VENKATA SIDDHARTHA RAJU VEGESNA |
| 60 | 19241A0160 | YASWANTH KURUVA |

# Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

**Bachupally, Kukatpally, Hyderabad – 500 090.**

## STUDENT ROLL LIST

**B.Tech CIVIL Engg. III yr-I Sem- Section B  (GR18)**  2021-22

| S.No | Reg No | Student Name |
|------|--------|--------------|
| 1 | 19241A0161 | ABDUL RAHEEM |
| 2 | 19241A0162 | ANEMONI MURALI MANOHAR |
| 3 | 19241A0163 | ASKANY HARISH SAGAR |
| 4 | 19241A0164 | BODLA AKSHITH |
| 5 | 19241A0165 | BURRA VAMSHI KRISHNA |
| 6 | 19241A0166 | CHERLAKOLA AKHILA |
| 7 | 19241A0167 |  CHINTAPALLI VIKRAM |
| 8 | 19241A0168 | CHIRRIBOYINA DHANYA |
| 9 | 19241A0169 | D SREE MADHURI |
| 10 | 19241A0170 | GADDAM SAHITHI |
| 11 | 19241A0171 | GAJJALA SUKENDHAR REDDY |
| 12 | 19241A0172 | YASHASWI GANGAVARAM |
| 13 | 19241A0173 | GINDHAM ADITYA KUMAR |
| 14 | 19241A0174 | GUDHETI NARENDAR REDDY |
| 15 | 19241A0175 | GUMMADI SAI PRATEEK REDDY |
| 16 | 19241A0176 | HANMAPUR DHEERAJ GOUD |
| 17 | 19241A0177 | JAVVAJI AISHWARYA |
| 18 | 19241A0178 | JULAPALLY NITHIN RAO |
| 19 | 19241A0179 | K NAVEEN |
| 20 | 19241A0180 | K RAJESHWARI |
| 21 | 19241A0181 | KACHAVA SURENDAR |
| 22 | 19241A0182 | KODATHALA INDU |
| 23 | 19241A0183 | KOTARU SRINIVASA VARAPRASAD |
| 24 | 19241A0184 | MALOTH RAHUL |
| 25 | 19241A0185 | MATURI SATHVIK |
| 26 | 19241A0186 | MD ABDUL MAAJID |
| 27 | 19241A0187 | MEDARI DAYANA |
| 28 | 19241A0188 | NARSINGA SANDEEP |
| 29 | 19241A0189 | PALANATI ROHITH |
| 30 | 19241A0190 | PURALASETTY BHAVANA |
| 31 | 19241A0191 | RODDA MALAVIKA REDDY |
| 32 | 19241A0192 | SAPRAM NAGA SRILOWKYA MUKTHA |
| 33 | 19241A0193 | SHAIK PARVEZ ANSARI |

| | | |
|---|---|---|
| 34 | 19241A0194 | SIDDELA THARUN KUMAR |
| 35 | 19241A0195 | TALARI CHANDANA SREE |
| 36 | 19241A0196 | VALLEPU KALYAN |
| 37 | 19241A0197 | VRASHAB PATEL |
| 38 | 19241A0198 | YELLAVULA NARENDER |
| 39 | 19241A0199 | BADDELA SAI THARUN |
| 40 | 20245A0101 | AAMANCHI BOWMI |
| 41 | 20245A0102 | AVIRABOINA SAI CHAITHANYA |
| 42 | 20245A0103 | BAIRY B S ANIRUDH |
| 43 | 20245A0104 | DADDU TEJASREE |
| 44 | 20245A0105 | DOPATHI RAVITEJA |
| 45 | 20245A0106 | ERUVENTI NIHARIKA |
| 46 | 20245A0107 | GADDAMIDI AANIL |
| 47 | 20245A0108 | GANDLA RISHIK RAJ |
| 48 | 20245A0109 | GONE NAVEEN KUMAR |
| 49 | 20245A0110 | KOTA VISHAL |
| 50 | 20245A0111 | KUMMARI MAHESH |
| 51 | 20245A0112 | LAKAVATH ANIL |
| 52 | 20245A0113 | MADAVARAM ROHITH |
| 53 | 20245A0114 | MANDALA AKSHITHA |
| 54 | 20245A0115 | M MANJUNATH |
| 55 | 20245A0116 | PORANDLA NAGABHUSHANAM |
| 56 | 20245A0117 | PULISHETTY BHAVANI |
| 57 | 20245A0118 | RACHA KRANTHI RANADEER |
| 58 | 20245A0119 | S MANOJ KUMAR |
| 59 | 20245A0120 | SAMUDRALA MANIDEEP |
| 60 | 20245A0121 | SANGEPAGA GOUTHAM |
| 61 | 20245A0122 | SODADASI RAHUL |
| 62 | 20245A0123 | VANGA HARSHITH |
| 63 | 20245A0124 | CHOLETI VINEETHA |
| 64 | 20245A0125 | GANGULA GRISHMA |
| 65 | 20245A0126 | BOLLAMPALLI SAI POOJITH |
| 66 | 20245A0127 | PAMULAPATI SUMANTH |
| 67 | 20245A0128 | T SANGHAMITHRA |
| 68 | 20245A0129 | ABEDA AKANKSHA |
| 69 | 20245A0130 | DOPPALAPUDI RAMVINEETH SAI |
| 70 | 20245A0131 | PILLY UDAY KIRAN |

# GUIDELINES TO STUDY THE COURSE/SUBJECT

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A & B

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

## Guidelines to students

Guidelines to study the Course: Geotechnical Engineering

The course helps the students to learn and understand the importance of geotechnical engineering in different phases of construction. One can learn to determine the various engineering properties of soils. This course makes the students to understand about index properties, consistency of clays, permeability, compaction, consolidation, shear strength, etc of various types of soils.

So the students should have the prerequisites
- knowledge of various building materials
- knowledge of  formation of soils

To become expertise in this course, students need to be perfect with the basic concepts of soil mechanics to understand and analyse the behaviour of soils.

## Where will this subject help?
- Useful in foundation engineering, analyzing type of foundation, estimating bearing capacity of various soils.
- This course let the students to work with various types of soils.
- This course let the students to determine the engineering properties of soils.
- This course let the students to calculate bearing capacity of soils.

## Books / Material

TEXT BOOKS
1. Gopal Ranjan and ASR Rao, Basic and Applied Soil Mechanics, New Age International Pvt. Ltd, New Delhi, 2$^{nd}$ edition (2000), Reprint (2014).
2. K.R. Arora, Soil Mechanics and Foundation Engineering, Standard Publishers Distributors, Delhi, 5$^{th}$ edition (2000), Reprint (2009).

3. B.C.Punmia, Ashok Kumar Jain and Arun Kumar Jain, Soil Mechanics and Foundations, Laxmi publications Pvt. Ltd., New Delhi, 16th edition, Reprint (2012).
4. C. Venkataramiah, Geotechnical Engineering, New age International publishers (2002), 4th edition (2012).

REFERENCES
1. Dr. P. Purushotham Raj, Soil Mechanics and Foundation Engineering, Pearson Education India (2008).
2. S. K.Gulhati & Manoj Datta, Geotechnical Engineering, Mc.Graw Hill Education Pvt Ltd., New Delhi (2005), 16th Reprint (2013).
3. Braja M. Das, Advanced Soil Mechanics, Taylor and Francis, 3rd edition (2008).

**Websites:**

www.nptel.ac.in/courses/civilengineering/soilmechcnais/105103097/
www.google.co.in

**Course Design and Delivery System (CDD):**

- The Course syllabus is written into number of learning objectives and outcomes.
- These learning objectives and outcomes will be achieved through lectures, assessments, assignments, experiments in the laboratory, projects, seminars, presentations, etc.
- Every student will be given an assessment plan, criteria for assessment, scheme of evaluation and grading method.
- The Learning Process will be carried out through assessments of Knowledge, Skills and Attitude by various methods and the students will be given guidance to refer to the text books, reference books, journals, etc.

The faculty be able to –
- Understand the principles of learning
- Understand the psychology of students
- Develop instructional objectives for a given topic
- Prepare course, unit and lesson plans
- Understand different methods of teaching and learning
- Use appropriate teaching and learning aids
- Plan and deliver lectures effectively
- Provide feedback to students using various methods of Assessments and tools of Evaluation
- Act as a guide, advisor, counselor, facilitator, motivator and not just as a teacher alone

Signature of HOD                                                                                    Signature of faculty

# COURSE SCHEDULE

**A**cademic **Y**ear                    : 2021-22

Semester                         :   I

Name of the Program: B.Tech Civil Engineering      Year: III             Section: A

Course/Subject:  Geotechnical Engineering                          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

The Schedule for the whole Course / Subject is:

| S. No. | Description | Duration (Date) | | Total No. Of Periods |
| --- | --- | --- | --- | --- |
| | | From | To | |
| 1. | **UNIT I:** Introduction & Index Properties of Soils | 16-08-2021 | 09-09-2021 | 12 |
| 2. | **UNIT II:** Permeability &  Seepage through soils | 13-09-2021 | 04-10-2021 | 10 |
| 3. | **UNIT III:** Stress distribution in soils | 07-10-2021 | 01-11-2021 | 11 |
| 4. | **UNIT IV:** Compaction & Consolidation | 03-11-2021 | 22-11-2021 | 9 |
| 5. | **UNIT V:** Shear strength of soils | 24-11-2021 | 08-12-2021 | 9 |

Total No. of Instructional periods available for the course: 51 Hours / Periods

# COURSE SCHEDULE

**A**cademic **Y**ear            : 2021-22

Semester                     :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section:  B

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

The Schedule for the whole Course / Subject is:

| S. No. | Description | Duration (Date) | | Total No. Of Periods |
|--------|-------------|------|------|------|
| | | From | To | |
| 1. | **UNIT I:** Introduction & Index Properties of Soils | 16-08-2021 | 14-09-2021 | 12 |
| 2. | **UNIT II:** Permeability &  Seepage through soils | 17-09-2021 | 08-10-2021 | 10 |
| 3. | **UNIT III:** Stress distribution in soils | 11-10-2021 | 05-11-2021 | 11 |
| 4. | **UNIT IV:** Compaction & Consolidation | 08-11-2021 | 19-11-2021 | 9 |
| 5. | **UNIT V:** Shear strength of soils | 22-11-2021 | 07-12-2021 | 9 |

Total No. of Instructional periods available for the course: 51 Hours / Periods

# Gokaraju Rangaraju Institute of Engineering and Technology
## (Autonomous)
### Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

## SCHEDULE OF INSTRUCTIONS
## COURSE PLAN

**A**cademic **Y**ear            : 2021-22

Semester                   :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                      Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 | | 16-08-2021 | 1 | Scope of soil mechanics | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.1-2 |
| 2 | | 18-08-2021 | 1 | Types of soils | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.4-6 |
| 3 | | 19-08-2021 | 1 | Soil formation | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.94-98 |
| 4 | | 23-08-2021 | 1 | Basic Definitions and Relationships | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.98, 10 |
| 5 | I | 25-08-2021 | 1 | Soil as three-phase system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.10-14 |
| 6 | | 26-08-2021 | 1 | Determination of moisture content by oven dry method, pycnometer and sand bath method | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.15-20 |
| 7 | | 30-08-2021 | 1 | Specific gravity by pycnometer method, Unit | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.45-46 |

| | | | | weight of soil by Core-cutter and Sand-replacement method | | |
|---|---|---|---|---|---|---|
| 8 | | 01-09-2021 | 1 | Consistency limits, Consistency indices | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25 |
| 9 | | 02-09-2021 | 1 | Grain size analysis, Indian standard soil classification system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25-26 |
| 10 | | 06-09-2021 | 1 | Plasticity of soil | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.27-32 |
| 11 | | 08-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.34-39 |
| 12 | | 09-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.40-42 |
| 13 | | 13-09-2021 | 1 | Darcy's law, validity of Darcy's law | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.137 |
| 14 | | 15-09-2021 | 1 | Determination of permeability by constant-head method and falling-head method | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.133-134 |
| 15 | | 16-09-2021 | 1 | Field method by pumping- out test | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.138-139 |
| 16 | II | 20-09-2021 | 1 | Permeability of stratified soils | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.145-146 |
| 17 | | 22-09-2021 | 1 | Factors affecting permeability of soil | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.140-141 |
| 18 | | 23-09-2021 | 1 | Seepage Analysis, Characteristics of flow nets | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.147-148 |
| 19 | | 27-09-2021 | 1 | Effective stress principle and effect of water table | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.142-144 |
| 20 | | 29-09-2021 | 1 | Soils saturated by capillary action, quick sand condition | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.173-174 |

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| 21 | | 30-09-2021 | 1 | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.149-152 |
| 22 | | 04-10-2021 | 1 | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.148 |
| 23 | | 07-10-2021 | 1 | Theory of compaction, laboratory determination of OMC & MDD | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200 |
| 24 | | 11-10-2021 | 1 | Factors affecting compaction | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200-202 |
| 25 | | 13-10-2021 | 1 | Compaction in field and compaction control | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202-208 |
| 26 | | 14-10-2021 | 1 | Stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202, 203 |
| 27 | III | 21-10-2021 | 1 | Pressure bulb and Isobars | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.212, 213 |
| 28 | | 25-10-2021 | 1 | Boussinesq's equation | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.210-211 |
| 29 | | 27-10-2021 | 1 | Theory of Newmark's Influence Chart | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |
| 30 | | 27-10-2021 | 1 | Equivalent point load method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |
| 31 | | 28-10-2021 | 1 | Two to one method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.208-210 |
| 32 | | 01-11-2021 | 1 | Problems | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.220 |
| 33 | | 01-11-2021 | 1 | Problems | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.220 |
| 34 | IV | 03-11-2021 | 1 | Consolidation of Soil - Introduction | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.106 |

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| 35 | | 08-11-2021 | 1 | Comparison between compaction and consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.106-107 |
| 36 | | 08-11-2021 | 1 | Initial, primary & secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.109-113 |
| 37 | | 10-11-2021 | 1 | Spring analogy for primary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.113-119 |
| 38 | | 11-11-2021 | 1 | Terzaghi's theory of consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.119-120 |
| 39 | | 15-11-2021 | 1 | Interpretation of consolidation test results | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.221-222 |
| 40 | | 17-11-2021 | 1 | Consolidation settlement and secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.224-227&237 |
| 41 | | 18-11-2021 | 1 | Problems | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.240-241 |
| 42 | | 22-11-2021 | 1 | Problems | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.226,230-233 |
| 43 | | 24-11-2021 | 1 | Shear Strength - Mohr circle and its characteristics | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.287 |
| 44 | | 25-11-2021 | 1 | principal planes, relation between major and minor principal stresses | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.287-289 |
| 45 | V | 25-11-2021 | 1 | Mohr-Coulomb theory | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.290-296 |
| 46 | | 29-11-2021 | 1 | Direct shear test and it merits | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.296-302 |
| 47 | | 29-11-2021 | 1 | Tri-axial compression test and its behaviour of UU, CU and CD | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.311-313 |
| 48 | | 01-12-2021 | 1 | Unconfined compression test and vane shear test | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.303-308 |

| 49 | | 02-12-2021 | 1 | Computation of effective shear strength parameters | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.314 |
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| 50 | | 06-12-2021 | 1 | Problems | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.314 |
| 51 | | 08-12-2021 | 1 | Problems | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp. |

Signature of HOD                                                    Signature of faculty


Note:    1. Ensure that all topics specified in the course are mentioned.
         2. Additional topics covered, if any, may also be specified in bold
         3. Mention the corresponding course objective and outcome numbers against each topic.

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

# SCHEDULE OF INSTRUCTIONS
# COURSE PLAN

**A**cademic **Y**ear        : 2021-22

Semester             :  I

Name of the Program: B.Tech Civil Engineering    Year: III       Section:  B

Course/Subject:  Geotechnical Engineering         Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya         Dept.: Civil Engineering

Designation:  Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 |  | 16-08-2021 | 1 | Scope of soil mechanics | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.1-2 |
| 2 |  | 17-08-2021 | 1 | Types of soils | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.4-6 |
| 3 |  | 20-08-2021 | 1 | Soil formation | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.94-98 |
| 4 | I | 23-08-2021 | 1 | Basic Definitions and Relationships | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.98, 10 |
| 5 |  | 24-08-2021 | 1 | Soil as three-phase system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.10-14 |
| 6 |  | 27-08-2021 | 1 | Determination of moisture content by oven dry method, pycnometer and sand bath method | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.15-20 |

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| 7 | | 30-08-2021 | 1 | Specific gravity by pycnometer method, Unit weight of soil by Core-cutter and Sand-replacement method | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.45-46 |
| 8 | | 03-09-2021 | 1 | Consistency limits, Consistency indices | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25 |
| 9 | | 06-09-2021 | 1 | Grain size analysis, Indian standard soil classification system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25-26 |
| 10 | | 07-09-2021 | 1 | Plasticity of soil | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.27-32 |
| 11 | | 13-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.34-39&40-42 |
| 12 | | 14-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.79-83 |
| 13 | | 17-09-2021 | 1 | Darcy's law, validity of Darcy's law | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.137 |
| 14 | | 20-09-2021 | 1 | Determination of permeability by constant-head method and falling-head method | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.133-134 |
| 15 | II | 21-09-2021 | 1 | Field method by pumping- out test | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.138-139 |
| 16 | | 24-09-2021 | 1 | Permeability of stratified soils | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.145-146 |
| 17 | | 27-09-2021 | 1 | Factors affecting permeability of soil | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.140-141 |

| 18 | | 28-09-2021 | 1 | Seepage Analysis, Characteristics of flow nets | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.147-148 |
|----|----|------------|---|-------------------------------------------------|------------|-------------------------------------|
| 19 | | 01-10-2021 | 1 | Effective stress principle and effect of water table | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.142-144 |
| 20 | | 04-10-2021 | 1 | Soils saturated by capillary action, quick sand condition | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.173-174 |
| 21 | | 05-10-2021 | 1 | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.149-152 |
| 22 | | 08-10-2021 | 1 | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.175-178 |
| 23 | III | 11-10-2021 | 1 | Theory of compaction, laboratory determination of OMC & MDD | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200 |
| 24 | | 12-10-2021 | 1 | Factors affecting compaction | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200-202 |
| 25 | | 22-10-2021 | 1 | Compaction in field and compaction control | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202-208 |
| 26 | | 25-10-2021 | 1 | Stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202, 203 |
| 27 | | 26-10-2021 | 1 | Pressure bulb and Isobars | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.212, 213 |
| 28 | | 26-10-2021 | 1 | Boussinesq's equation | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.210-211 |
| 29 | | 29-10-2021 | 1 | Theory of Newmark's | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |

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| | | | | | Influence Chart | | |
| 30 | | 01-11-2021 | 1 | Equivalent point load method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |
| 31 | | 01-11-2021 | 1 | Two to one method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.208-210 |
| 32 | | 02-11-2021 | 1 | Problems | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.220 |
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| 36 | | 12-11-2021 | 1 | Initial, primary & secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.113-116 |
| 37 | | 12-11-2021 | 1 | Spring analogy for primary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.117-119&119-120 |
| 38 | | 15-11-2021 | 1 | Terzaghi's theory of consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.221 |
| 39 | | 16-11-2021 | 1 | Interpretation of consolidation test results | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.221-222&224-227 |
| 40 | | 16-11-2021 | 1 | Consolidation settlement and secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.237 |
| 41 | | 19-11-2021 | 1 | Problems | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.240-241 |
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| 43 | | 22-11-2021 | 1 | Shear Strength - Mohr circle and its characteristics | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.287 |
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| 47 | V | 30-11-2021 | 1 | Tri-axial compression test and its behaviour of UU, CU and CD | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.311-313 |
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| 51 | | 07-12-2021 | 1 | Problems | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp. |

Signature of HOD                                         Signature of faculty

Note:   1. Ensure that all topics specified in the course are mentioned.
            2. Additional topics covered, if any, may also be specified in bold
            3. Mention the corresponding course objective and outcome numbers against each topic.

# SCHEDULE OF INSTRUCTIONS
# UNIT PLAN

**A**cademic **Y**ear         : 2021-22

Semester             :  I

Name of the Program: B.Tech Civil Engineering     Year: III       Section: A

Course/Subject: Geotechnical Engineering           Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation: Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
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| 1 | I | 16-08-2021 | 1 | Scope of soil mechanics | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.1-2 |
| 2 | | 18-08-2021 | 1 | Types of soils | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.4-6 |
| 3 | | 19-08-2021 | 1 | Soil formation | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.94-98 |
| 4 | | 23-08-2021 | 1 | Basic Definitions and Relationships | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.98, 10 |
| 5 | | 25-08-2021 | 1 | Soil as three-phase system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.10-14 |
| 6 | | 26-08-2021 | 1 | Determination of moisture content by oven dry method, pycnometer and sand bath method | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.15-20 |
| 7 | | 30-08-2021 | 1 | Specific gravity by pycnometer method, Unit weight of soil by Core-cutter and Sand- | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.45-46 |

| | | | | replacement method | | |
|---|---|---|---|---|---|---|
| 8 | 01-09-2021 | 1 | Consistency limits, Consistency indices | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25 |
| 9 | 02-09-2021 | 1 | Grain size analysis, Indian standard soil classification system | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.25-26 |
| 10 | 06-09-2021 | 1 | Plasticity of soil | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.27-32 |
| 11 | 08-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.34-39 |
| 12 | 09-09-2021 | 1 | Problems | COb-1 CO-1 | Gopal Ranjan & ASR Rao, pp.40-42 |

Signature of HOD                                         Signature of faculty

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# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                     Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

Lesson No:     1                Duration of Lesson: 1hr
Lesson Title: Scope of soil mechanics

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Express about soil and soil mechanics
2. Discuss the importance of Geotechnical Engineering in Civil Engineering

TEACHING AIDS          : White board, marker
TEACHING POINTS      :

- Soil
- Soil mechanics
- Civil Engineering
- Geotechnical Engineering

Assignment / Questions:
    1. .Explain about importance of soil mechanics in Civil Engineering.        (Cob -1, CO-1)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III    Section: A

Course/Subject:  Geotechnical Engineering    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    2    Duration of Lesson: 1hr
Lesson Title: Types of soils

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Discuss about formation of soil
2. Distinguish between residual soils and transported soils

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Soil formation
- Weathering of soils
- Residual soils
- Transported soils

Assignment / Questions:
1. Distinguish between residual soils and transported soils
2. Explain about soil formation.
        (Cob -1, CO-1)

                                                                        Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear        : 2021-22

Semester               :  I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering         Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya        Dept.: Civil Engineering

Designation:  Professor

Lesson No:   3        Duration of Lesson: 1hr
Lesson Title: Soil formation

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Discuss about mode of arrangement of soil particles
2. Express structure of clay minerals
3. Distinguish between different clay minerals

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Soil structure
- Flocculated clay structure
- Dispersed clay structure
- Structure of clay minerals
- Kaolinite
- Montmorillonite
- Illite

Assignment / Questions:
1. Explain clay mineralogy with clay minerals
      (Cob -1, CO-1)

             Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear        : 2021-22

Semester             :   I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject: Geotechnical Engineering             Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya             Dept.: Civil Engineering

Designation: Professor

Lesson No:   <u>4</u>         Duration of Lesson: <u>1hr</u>

Lesson Title: <u>Basic Definitions and Relationships,</u>

<u>INSTRUCTIONAL/LESSON OBJECTIVES:</u>

On completion of this lesson the student shall be able to:

1. Explain about adsorbed water

TEACHING AIDS      : White board, marker
TEACHING POINTS     :
- Adsorbed water
- Clay crystal
- Hydrogen bonding
- Water molecule

Assignment / Questions:
      Discuss about adsorbed water.             (Cob -1, CO-1)

                                           Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear                    : 2021-22

Semester                         :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

Lesson No:    5            Duration of Lesson: 1hr

Lesson Title: Soil as three-phase system

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Interpret about Mass-volume relationship.
2. Distinguish between various definitions / parameters involved in soil mechanics

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Mass- volume relationships
- Phase diagram
- Saturated soils
- Dry soils
- Partially saturated soils
- Density

Assignment / Questions:
   1. Derive the relation between dry density and wet density.  (Cob -1, CO-1)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear            : 2021-22

Semester                   :   I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                       Dept.: Civil Engineering

Designation:  Professor

Lesson No:    6            Duration of Lesson:  1hr

Lesson Title: Determination of moisture content by oven dry method, pycnometer and sand bath method

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Explain about Relative density

2. Classify the soils based on Relative density

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Relative density
- Minimum Void ratio
- Maximum void ratio
- Density
- Classification of coarse grained soils

Assignment / Questions:
1.Discuss about minimum and maximum void ratio.
2. Explain IS classification of soils.
      (Cob -1, CO-1)

                                                                      Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear                    : 2021-22

Semester                              :   I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                            Dept.: Civil Engineering

Designation:  Professor

Lesson No:    8            Duration of Lesson:  1hr

Lesson Title: Index properties of soils

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Review various index properties of soils

2. Describe the soils based on Index properties of soils

TEACHING AIDS        : White board, marker
TEACHING POINTS      :

- Index properties
- Describe the soils
- Soil grain properties
- Soil aggregate properties

Assignment / Questions:
       1. Discuss consistency limits and indices.
               (Cob -1, CO-1)

                                                                Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester              :   I

Name of the Program: B.Tech Civil Engineering     Year: III       Section: A

Course/Subject:  Geotechnical Engineering          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation:  Professor

Lesson No:   9         Duration of Lesson:  1hr
Lesson Title: Grain size analysis

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess grain size and grain shape
2. Find the percent finer through sieve analysis

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Describe the soils
- Soil grain size
- Soil grain shape

Assignment / Questions:
      1. Explain sieve analysis test procedure.
          (Cob -1, CO-1)

                          Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                         Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                         Dept.: Civil Engineering

Designation:  Professor

Lesson No:     10            Duration of Lesson:  1hr
Lesson Title: Sieve and Hydrometer methods

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess grain size distribution
2. Find the percent finer through sieve analysis and hydrometer analysis
3. Illustrate between dry and wet analysis

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Grain size distribution
- Set of sieves
- Sieve analysis or dry analysis
- Hydrometer analysis or wet analysis
- Corrections applied to hydrometer readings

Assignment / Questions:
     1. Discuss about sieve analysis by using hydrometer test.
          (Cob -1, CO-1)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering           Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation:  Professor

Lesson No:   11         Duration of Lesson: 1hr
Lesson Title: Consistency limits

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Find consistency of clayey soils
2. Compute consistency limits
3. Interpret results of consistency limits

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Consistency limits or Atterberg Limits
- Boundary water contents
- Liquid Limit
- Plastic Limit
- Shrinkage Limit

Assignment / Questions:
     1.Discuss about Consistency limits and its importance.     (Cob -1, CO-1)

                               Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester               :  I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation:  Professor

Lesson No:   12         Duration of Lesson: 1hr
Lesson Title: Consistency indices

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Find consistency indices of clayey soils
2. Compute consistency indices
3. Interpret results of consistency indices

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Consistency indices
- Liquidity index
- Plasticity index
- Consistency index
- Flow index
- Toughness index

Assignment / Questions:
     1.Interpret the results of consistency indices  with varied results.
        (Cob -1, CO-1)

                                   Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                    :  I

Name of the Program: B.Tech Civil Engineering     Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    13            Duration of Lesson: 1hr
Lesson Title: I.S. Classification of soils

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess classification of soils
2. Predict coarse grained soils and fine grained soils
3. Find the type of soil

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- I.S classification of soils
- Types of soils
- Division of soil fractions
- Well graded soils
- Poorly graded soils
- Plasticity index

Assignment / Questions:
   1. Assess the standard procedure for classification of soils. (Cob -1, CO-1)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering       Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

Lesson No:    14            Duration of Lesson: 1hr
Lesson Title: Plasticity Chart

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Interpret and classify the soils using plasticity chart
2. Distinguish between silt and clay soils

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Plasticity chart
- Classification of silt and clay
- A-line
- Liquid limit
- Plasticity index
- Low, medium and high plasticity

Assignment / Questions:
      1.Interpret and classify the soils using plasticity chart for fine grained soils. (Cob -1, CO-1)

Signature of faculty

## TUTORIAL SHEET - 1

**A**cademic **Y**ear                    : 2021-22

Semester                           :   I

Name of the Program: B.Tech Civil Engineering      Year: III              Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

This Tutorial corresponds to Unit No.  - I & Lesson

Q1. Indicate and derive the relation between degree of saturation, void ratio, water content and specific gravity of solids.

Q2. A soil has bulk density of 20.1kN/m$^3$ and water content of 15%. Estimate the water content if the soil partially dries to a density of 19.4kN/m$^3$ and the void ratio remains unchanged.

Q3. The liquid limit and plastic limit of a soil are 75% and 33% respectively. Compute plasticity index. The void ratio of the soil on oven-drying was found to be 0.63. Find the shrinkage limit. Assume grain specific gravity as 2.7.

Q4. Write short notes on the Methods of determination of Atterberg limits.


Objective Nos.: 1
Outcome Nos.: 1


Signature of HOD                                                          Signature of faculty

## ASSIGNMENT SHEET – 1

**A**cademic **Y**ear                    : 2021-22

Semester                              :    I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

This Assignment corresponds to Unit No.  - I & Lesson

Q1. Describe Void ratio, Porosity, Degree of saturation, Water content, Dry density, Bulk density, and Submerged unit weight.

Q2. Indicate and derive the relation between bulk density, dry density and water content

Q3. Briefly demonstrate the procedure to determine the Liquid Limit of a soil.

Q4. A soil has a plastic limit of 25% and a plasticity index of 30. If the natural water content of the soil is 34%, Compute liquidity index and its consistency index? How do you illustrate the consistency?

Objective Nos.: 1
Outcome Nos.: 1

Signature of HOD                                                          Signature of faculty

# SCHEDULE OF INSTRUCTIONS
# UNIT PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering         Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                Dept.: Civil Engineering

Designation:  Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 | | 13-09-2021 | 1 | Darcy's law, validity of Darcy's law | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.137 |
| 2 | | 15-09-2021 | 1 | Determination of permeability by constant-head method and falling-head method | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.133-134 |
| 3 | | 16-09-2021 | 1 | Field method by pumping- out test | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.138-139 |
| 4 | II | 20-09-2021 | 1 | Permeability of stratified soils | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.145-146 |
| 5 | | 22-09-2021 | 1 | Factors affecting permeability of soil | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.140-141 |
| 6 | | 23-09-2021 | 1 | Seepage Analysis, Characteristics of flow nets | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.147-148 |
| 7 | | 27-09-2021 | 1 | Effective stress principle and effect of water table | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.142-144 |
| 8 | | 29-09-2021 | 1 | Soils saturated by capillary action, | COb-2 CO-2 | Gopal Ranjan & ASR Rao, |

| | | | | | quick sand condition | | pp.173-174 |
|---|---|---|---|---|---|---|---|
| 9 | | 30-09-2021 | 1 | | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.149-152 |
| 10 | | 04-10-2021 | 1 | | Problems | COb-2 CO-2 | Gopal Ranjan & ASR Rao, pp.148 |

Signature of HOD                                                     Signature of faculty


Note:    1. Ensure that all topics specified in the course are mentioned.
         2. Additional topics covered, if any, may also be specified in bold
         3. Mention the corresponding course objective and out come numbers against each topic.

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                      :   I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:      1              Duration of Lesson:  1hr
Lesson Title: Permeability

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Assess the coefficient of permeability for various soils
2.  Use of coefficient of permeability

TEACHING AIDS          : White board, marker
TEACHING POINTS      :

- Range of Coefficient of permeability
- Type of soils
- Use of Coefficient of permeability

Assignment / Questions:
1. Assess the importance of coefficient of permeability for soils.
        (Cob -2, CO-2)

                                                            Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear           : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject:  Geotechnical Engineering           Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation:  Professor

Lesson No:    2         Duration of Lesson: 1hr
Lesson Title: Capillary rise

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Apply knowledge of capillary rise in water table
2. Compute height of capillary rise

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Capillary water
- Capillary pressure
- Hydrostatic pressure
- Capillary rise

Assignment / Questions:
      1. Discuss the importance of capillary rise in soils.  (Cob -2, CO-2)

                                       Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear                    : 2021-22

Semester                              :   I

Name of the Program: B.Tech Civil Engineering      Year: III                Section: A

Course/Subject:  Geotechnical Engineering                          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

Lesson No:     3            Duration of Lesson: <u>1hr</u>
Lesson Title: <u>Darcy's law</u>

<u>INSTRUCTIONAL/LESSON OBJECTIVES:</u>

On completion of this lesson the student shall be able to:

1.  Find the coefficient of permeability using Darcy's Law
2.  Illustrate the experiment conducted on pure sand by Darcy.

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Flow of water
- Coefficient of permeability
- Pressure head and elevation head
- Flow per unit time
- Hydraulic gradient

Assignment / Questions:
    1. Analyse the coefficient of permeability using Darcy's Law. (Cob -2, CO-2)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering     Year: III          Section: A

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    4              Duration of Lesson:  1hr
Lesson Title: Factors affecting permeability

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Relate the factors effecting permeability
2. Interpret type of soils and its behavior in terms of permeability
3. Compute coefficient of permeability

TEACHING AIDS        : White board, marker
TEACHING POINTS      :

- Permeability
- Factors effecting permeability
- Void ratio
- Particle size
- Degree of saturation
- Adsorbed water
- Stratified layers

Assignment / Questions:
    1. Explain the factors effecting permeability. (Cob -2, CO-2)

Signature of faculty

# LESSON PLAN

Academic Year : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                              Dept.: Civil Engineering

Designation:  Professor

Lesson No:    5            Duration of Lesson:  1hr
Lesson Title: Laboratory determination of coefficient of permeability

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate coefficient of permeability for various soils
2. Demonstrate laboratory determination of coefficient of permeability

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Range of Coefficient of permeability
- Type of soils
- Constant head test
- Variable head test or falling head test

Assignment / Questions:
    1. Explain the laboratory procedure for determination of coefficient of permeability.
    (Cob -2, CO-2)

                                                                            Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester               :  I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject:  Geotechnical Engineering             Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

Lesson No:    6          Duration of Lesson:  1hr
Lesson Title: Permeability of layered systems

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess permeability
2. Find the permeability for layered soils
3. Illustrate between horizontal and vertical permeability

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Permeability
- Factors effecting permeability
- Horizontal flow
- Vertical flow
- Average flow

Assignment / Questions:
    1. Differentiate between horizontal and vertical permeability for layered soils. (Cob -2, CO-2)

                                                   Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester             : I

Name of the Program: B.Tech Civil Engineering     Year: III       Section: A

Course/Subject: Geotechnical Engineering           Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation: Professor

Lesson No:    7          Duration of Lesson: 1hr
Lesson Title: In-situ permeability tests (pumping out tests)

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Calculate field coefficient of permeability for various flows
2. Find in-situ coefficient of permeability for confined and unconfined flow

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Coefficient of permeability
- Confined pumping out test
- Unconfined pumping out test

Assignment / Questions:
    1.Calculate field coefficient of permeability for various flows. (Cob -2, CO-2)

                             Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear            : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:     8              Duration of Lesson: 1hr
Lesson Title: Seepage through soils

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Illustrate seepage of water through a soil specimen
2.  Assess Laplace's equation for two dimensional flow

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Seepage through water
- Laplace's equation
- Seepage analysis

Assignment / Questions:
     1.Assess Laplace's equation for two dimensional flow for seepage of soils. (Cob -2, CO-2)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester              :  I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation:  Professor

Lesson No:   9        Duration of Lesson: <u>1hr</u>
Lesson Title: <u>Total, neutral and effective stresses</u>

<u>INSTRUCTIONAL/LESSON OBJECTIVES:</u>

On completion of this lesson the student shall be able to:

1. Find effective stress, total stress and pore water pressure for the soil strata at various depths
2. Assess the concept of effective stress, total stress and neutral stress
3. Interpret results of effective stress and total stress at various depths

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Effective stress
- Total stress
- Neutral stress
- Thickness of layers
- Density of soil
- Water table
- Capillary fringe

Assignment / Questions:
1. Interpret results of effective stress, neutral stress and total stress at various depths.
(Cob -2, CO-2)

                                             Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject: Geotechnical Engineering                    Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation: Professor

Lesson No: ___10___        Duration of Lesson: _1hr_
Lesson Title: Quick sand condition

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess the concept of quick sand condition

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Quick sand condition
- Critical hydraulic gradient
- Effective stresses

Assignment / Questions:
    1. Write short notes on quick sand condition. (Cob -2, CO-2)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester               :  I

Name of the Program: B.Tech Civil Engineering    Year: III      Section: A

Course/Subject:  Geotechnical Engineering             Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

Lesson No:    12        Duration of Lesson: 1hr
Lesson Title: Flow nets

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Assess the concept of flow nets
2. Use flow nets
3. Illustrate the flownets

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Flow net
- Flow line
- Equipotential line
- Flow channel
- Field

Assignment / Questions:
    1. Assess the characteristics and uses of flow nets.        (Cob -2, CO-2)

                Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear            : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering      Year: III                Section: A

Course/Subject:  Geotechnical Engineering                        Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                        Dept.: Civil Engineering

Designation:  Professor

Lesson No:     13            Duration of Lesson:  1hr
Lesson Title: Characteristics and Uses

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Assess the characteristics of flow nets
2.  Uses of flow nets
3.  Calculate quantity of seepage through flow nets

TEACHING AIDS        : White board, marker
TEACHING POINTS     :

- Uses and characteristics of flow nets
- Quantity of seepage
- Seepage pressure
- Hydrostatic pressure
- Exit gradient

Assignment / Questions:
    1. Assess the characteristics and uses of flow nets.   (Cob -2, CO-2)

                                                                        Signature of faculty

## TUTORIAL SHEET - 2

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                     Dept.: Civil Engineering

Designation:  Professor

This Tutorial corresponds to Unit No.  -II & Lesson

Q1.  Illustrate the difference between constant head and variable head permeameters.

Q2. Calculate the coefficient of permeability for a uniform sand where a sieve analysis indicates that the $D_{10}$ size is 0.12mm.

Q3. The discharge of water collected from a constant head permeameter in a period of 15minutes is 500ml. The internal diameter of the permeameter is 5cm and the measured difference in head between two gauging points 15cm vertically apart is 40cm. Calculate the coefficient of permeability.

Q4. Write short notes on Flow nets and its characteristics.


Objective Nos.: 2
Outcome Nos.: 2


Signature of HOD                                         Signature of faculty

## ASSIGNMENT SHEET – 2

**A**cademic **Y**ear          : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject: Geotechnical Engineering                 Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya                 Dept.: Civil Engineering

Designation: Professor

This Assignment corresponds to Unit No. - II & Lesson

Q1. Relate the various parameters that affect the permeability of soil in the field?

Q2. A horizontal stratified soil deposit consists of three layers each uniform in itself. The permeability's of these layers are $8\times10^{-4}$cm/s, $52\times10^{-4}$cm/s, and $6\times10^{-4}$cm/s, and their thicknesses are 7m, 3m and 10m respectively. Find the effective average permeability of the deposit in the horizontal and vertical directions.

Q3. Write short notes on neutral and effective pressure. What is the role of effective stress in soil mechanics?

Q4. A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5m below ground level. If the bulk density of saturated sand is 17.66kN/m$^3$, calculate the effective and neutral pressure on the top of the clay layer.

Objective Nos.: 2
Outcome Nos.: 2

Signature of HOD                                              Signature of faculty

# SCHEDULE OF INSTRUCTIONS
# UNIT PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III    Section: A

Course/Subject: Geotechnical Engineering    Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya    Dept.: Civil Engineering

Designation: Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 | | 07-10-2021 | 1 | Theory of compaction, laboratory determination of OMC & MDD | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200 |
| 2 | | 11-10-2021 | 1 | Factors affecting compaction | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.200-202 |
| 3 | | 13-10-2021 | 1 | Compaction in field and compaction control | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202-208 |
| 4 | III | 14-10-2021 | 1 | Stresses due to point load, line load, strip load, uniformly loaded circular area, rectangular loaded area | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.202, 203 |
| 5 | | 21-10-2021 | 1 | Pressure bulb and Isobars | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.212, 213 |
| 6 | | 25-10-2021 | 1 | Boussinesq's equation | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.210-211 |

| | | | | | |
|---|---|---|---|---|---|
| 6 | | 27-10-2021 | 1 | Theory of Newmark's Influence Chart | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |
| 7 | | 27-10-2021 | 1 | Equivalent point load method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp. |
| 8 | | 28-10-2021 | 1 | Two to one method | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.208-210 |
| 9 | | 01-11-2021 | 1 | Problems | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.220 |
| 10 | | 01-11-2021 | 1 | Problems | COb-3 CO-3 | Gopal Ranjan & ASR Rao, pp.220 |

Signature of HOD                                                                      Signature of faculty

Note:   1. Ensure that all topics specified in the course are mentioned.
2. Additional topics covered, if any, may also be specified in bold
3. Mention the corresponding course objective and out come numbers against each topic.

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester             :   I

Name of the Program: B.Tech Civil Engineering    Year: III      Section: A

Course/Subject:  Geotechnical Engineering          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation:  Professor

Lesson No:   1         Duration of Lesson: 1hr
Lesson Title: Compaction

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Differentiate between compaction and consolidation
2. Identify the importance of compressibility

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Compressibility
- Compaction
- Consolidation
- Methods of compaction

Assignment / Questions:
    1.Differentiate between compaction and consolidation.      (Cob -3, CO-3)

Signature of faculty

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

# LESSON PLAN

**A**cademic **Y**ear            : 2021-22

Semester                 :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                     Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                     Dept.: Civil Engineering

Designation:  Professor

Lesson No:    2          Duration of Lesson: 1hr
Lesson Title: Mechanism of compaction

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse the mechanism involved in compaction parameters
2. Identify the maximum dry density and optimum moisture content

TEACHING AIDS        : White board, marker
TEACHING POINTS     :

- Compaction
- Maximum dry density
- Optimum moisture content
- Type of compaction
- Compactive energy

Assignment / Questions:
1.Explain importance of MDD and OMC in compaction.                     (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester              : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject: Geotechnical Engineering        Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya        Dept.: Civil Engineering

Designation: Professor

Lesson No:   3        Duration of Lesson: 1hr
Lesson Title: Factors affecting compaction

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Infer the factors affecting compaction
2. Identify the compaction parameters
3. Illustrate the improvement of compaction parameters

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Compaction
- Method of compaction
- Water content
- Compactive effort
- Type of soil
- Addition of admixtures

Assignment / Questions:
1. Infer the factors affecting compaction.    (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

Academic Year : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                Dept.: Civil Engineering

Designation:  Professor

Lesson No:    4            Duration of Lesson: 1hr
Lesson Title: Effects of compaction on soil properties

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Infer the factors affecting compaction on soil properties
2. Identify the soils compacted at dry or wet of optimum
3. Illustrate the improvement of soil properties due to compaction

TEACHING AIDS        : White board, marker
TEACHING POINTS     :

- Structure
- Permeability
- Compressibility
- Swelling
- Shrinkage
- Stress-strain behavior
- Pore water pressure

Assignment / Questions:
1. Explain about improvement of soil properties due to compaction. (Cob -3, CO-3)

                                                                Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                Dept.: Civil Engineering

Designation:  Professor

Lesson No:    5          Duration of Lesson: 1hr
Lesson Title: Field compaction Equipment

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Differentiate between various types of rollers
2. Identify the equipment suitable based on type of soil
3. Identify the equipment suitable based on type of soil and nature of project

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Rammers
- Smooth wheel rollers
- Sheep foot rollers
- Pneumatic rollers
- Vibratory rollers

Assignment / Questions:
1. Identify suitable field equipment for compaction control. (Cob -3, CO-3)

                                                                          Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester                 :  I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject: Geotechnical Engineering            Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation: Professor

Lesson No:   6          Duration of Lesson: 1hr
Lesson Title: Compaction control

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse the degree of compaction achieved
2. Differentiate between degree of compaction and relative compaction
3. Identify the parameters for compaction control

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Compaction control parameters
- In-situ dry density
- Moisture content
- Relative compaction
- Degree of compaction

Assignment / Questions:
1.Identify the suitable parameters for compaction control in field. (Cob -3, CO-3)

                                              Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester               : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering           Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation:  Professor

Lesson No:    7          Duration of Lesson: <u>1hr</u>
Lesson Title: <u>Stress distribution in soils</u>

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at various points
3. Identify stress distribution beneath loaded areas

TEACHING AIDS     : White board, marker
TEACHING POINTS    :

- Stress distribution
- Vertical stresses
- Stress distribution diagrams
- Stresses due to point load
- Stresses due to uniformly distributed load

Assignment / Questions:
1. Analyse the stress distribution in soils. (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

Lesson No:    8             Duration of Lesson: 1hr
Lesson Title: Boussinesq's Theory – Point loads, udl

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at varying depth and at radial distance
3. Identify stress distribution beneath loaded areas

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Vertical stress distribution diagrams
- Isobar
- Pressure bulb
- Vertical stress distribution on horizontal plane
- Vertical stress distribution on vertical plane

Assignment / Questions:
1. Analyse the stress distribution in soils. (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear            : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering      Year: III              Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

Lesson No:     9            Duration of Lesson:  1hr
Lesson Title: Boussinesq's Theory – areas of different shapes

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at varying depth and at radial distance for different shapes
3. Identify stress distribution beneath loaded areas

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Vertical stress distribution diagrams
- Stress distribution for rectangular areas
- Stress distribution for circular areas
- Stress distribution for square footings

Assignment / Questions:
1. Analyse the stress distribution in soils. (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester             :  I

Name of the Program: B.Tech Civil Engineering     Year: III       Section: A

Course/Subject:  Geotechnical Engineering            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

Lesson No:    10         Duration of Lesson:  1hr
Lesson Title: Variation of vertical stress

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at varying depth and at radial distance
3. Identify stress distribution beneath loaded areas

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Vertical stress distribution diagrams
- Isobar
- Pressure bulb
- Vertical stress distribution on horizontal plane
- Vertical stress distribution on vertical plane

Assignment / Questions:
1. Analyse stress distribution beneath loaded areas.            (Cob   -3,   CO-3)

                            Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester               :   I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation:  Professor

Lesson No:    11         Duration of Lesson: 1hr
Lesson Title: Wester gaard's theory

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at varying depth and at radial distance
3. Identify stress distribution beneath loaded areas

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Vertical stress distribution diagrams
- Vertical stress distribution on horizontal plane
- Vertical stress distribution on vertical plane

Assignment / Questions:
1. Analyse stress distribution beneath loaded areas.  (Cob -3, CO-3)

                                           Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear        : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

Lesson No:    12         Duration of Lesson: 1hr
Lesson Title: Appropriate stress distribution methods

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse stress distribution in soils
2. Calculate stresses at varying depth and at radial distance
3. Identify stress distribution beneath loaded areas

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Equivalent point load method
- Two to one method

Assignment / Questions:
1. Analyse stress distribution beneath loaded areas.  (Cob -3, CO-3)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear         : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering             Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya             Dept.: Civil Engineering

Designation:  Professor

Lesson No:    13         Duration of Lesson: 1hr
Lesson Title: Newmark's influence chart

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse Newmark's influence chart
2. Calculate stresses at any point inside or outside loaded area
3. Identify various circles for influence chart

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Newmark's influence chart
- No.of circles
- Loaded area
- Influence value
- Vertical stress

Assignment / Questions:
1. Analyse Newmark's influence chart in stress dsiribution. (Cob -3, CO-3)

                                                 Signature of faculty

## TUTORIAL SHEET - 3

**A**cademic **Y**ear          : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject: Geotechnical Engineering              Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya               Dept.: Civil Engineering

Designation: Professor

This Tutorial corresponds to Unit No. - III & Lesson

Q1. Analyse the concept of 'Pressure Bulb' in soils.

Q2. A line load of 100kN/metre run extends to a long distance. Determine the intensity of vertical stress at a point, 2 m below the surface and (*i*) directly under the line load, and (*ii*) at a distance of 2 m perpendicular to the line. Use Boussinesq's theory.

Q3. Analyse Boussinesq's theory for vertical stress at a point due to a load on the surface of an elastic medium.

Q4. A rectangular area 4 m × 6 m carries a uniformly distributed load of $100kN/m^2$ at the ground surface. Calculate vertical pressure at a depth of 6 m vertically below the centre and also below a corner of the loaded area.

Objective Nos.: 3
Outcome Nos.: 3

Signature of HOD                                                 Signature of faculty

## ASSIGNMENT SHEET – 3

**A**cademic **Y**ear               : 2021-22

Semester                              :   I

Name of the Program: B.Tech Civil Engineering       Year: III                    Section: A

Course/Subject:  Geotechnical Engineering                          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                                Dept.: Civil Engineering

Designation:  Professor

This Assignment corresponds to Unit No.  - III & Lesson

Q1. Analyse Westergaad's theory for vertical stress at a point due to a load on the surface of an elastic medium.

Q2. A concentrated load of 22.5 kN acts on the surface of a homogeneous soil mass of large extent. Determine the stress intensity at a depth of 15 meters and (*i*) directly under the load, and (*ii*) at a horizontal distance of 7.5 metres. Use Boussinesq's equations.

Q3. Outline a brief critical note on 'Newmark's influence chart'.

Q4. A load 1000 kN acts as a point load at the surface of a soil mass. Calculate stress at a point 3 m below and 4 m away from the point of action of the load by Boussinesq's formula. Compare the value with the result from Westergaard's theory.

Objective Nos.: 3
Outcome Nos.: 3

Signature of HOD                                                      Signature of faculty

# SCHEDULE OF INSTRUCTIONS
# UNIT PLAN

**A**cademic **Y**ear          : 2021-22

Semester              :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject:   Geotechnical Engineering             Course Code:   GR18A3002

Name of the Faculty: Dr. C.Lavanya               Dept.: Civil Engineering

Designation:   Professor

| Lesson No. | Unit No. | Date | No. of Peri ods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 | | 03-11-2021 | 1 | Consolidation of Soil - Introduction | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.106 |
| 2 | | 08-11-2021 | 1 | Comparison between compaction and consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.106-107 |
| 3 | | 08-11-2021 | 1 | Initial, primary & secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.109-113 |
| 4 | | 10-11-2021 | 1 | Spring analogy for primary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.113-119 |
| 5 | IV | 11-11-2021 | 1 | Terzaghi's theory of consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.119-120 |
| 6 | | 15-11-2021 | 1 | Interpretation of consolidation test results | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.221-222 |
| 7 | | 17-11-2021 | 1 | Consolidation settlement and secondary consolidation | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.224-227&237 |
| 8 | | 18-11-2021 | 1 | Problems | COb-4 CO-4 | Gopal Ranjan & ASR Rao, pp.240-241 |

| 9 | | 22-11-2021 | 1 | Problems | COb-4<br>CO-4 | Gopal Ranjan &<br>ASR Rao,<br>pp.226,230-233 |

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Signature of HOD                                                                 Signature of faculty

Note:     1. Ensure that all topics specified in the course are mentioned.
              2. Additional topics covered, if any, may also be specified in bold
              3. Mention the corresponding course objective and out come numbers against each topic.

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester               : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering           Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation:  Professor

Lesson No:   1        Duration of Lesson: 1hr
Lesson Title: Consolidation

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Outline about total vertical deformation of a soil
2. Classify various components of settlement
3. Discriminate between primary consolidation settlement and secondary consolidation settlement.

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

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- Compressibility
- Consolidation
- Vertical deformation
- Primary consolidation
- Secondary consolidation

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Assignment / Questions:
1.Outline about various settlements of total vertical deformation of soil. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III          Section: A

Course/Subject:  Geotechnical Engineering                     Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                     Dept.: Civil Engineering

Designation:  Professor

Lesson No:    2              Duration of Lesson: 1hr
Lesson Title: Computation of settlements

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Outline about total settlement
2. Classify various components of settlement.

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Consolidation settlement
- Coefficient of consolidation
- Coefficient of compressibility
- Consolidation test

Assignment / Questions:
1. Classify various components of settlement. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering     Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                         Dept.: Civil Engineering

Designation:  Professor

Lesson No:    3            Duration of Lesson:  1hr
Lesson Title: stress history of clay, OCR

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Outline about stress history of clayey soils
2. Classify various stresses
3. Distinguish between normally consolidated soils and under consolidated soils

TEACHING AIDS        : White board, marker
TEACHING POINTS     :

- Stress history of clays
- Recompression curve
- Preconsoidation stress
- OCR

Assignment / Questions:
1. Outline about stress history of clay soils. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester              :   I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject: Geotechnical Engineering            Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation: Professor

Lesson No:     4           Duration of Lesson: <u>1hr</u>
Lesson Title: Laboratory Consolidation test

<u>INSTRUCTIONAL/LESSON OBJECTIVES:</u>

On completion of this lesson the student shall be able to:

1. Analyse rate of settlement
2. Determine coefficient of consolidation
3. Outline the points referring to boundary conditions

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Consolidation settlement
- Coefficient of consolidation
- Double drainage and single drainage
- Time taken for consolidation

Assignment / Questions:
1.Outline the laboratory procedure of consolidation test. (Cob -4, CO-4)

                                           Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                 :   I

Name of the Program: B.Tech Civil Engineering      Year: III            Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    5          Duration of Lesson: 1hr
Lesson Title: logarithm of time fitting method, square root of time fitting method

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse rate of settlement
2. Determine coefficient of consolidation
3. Outline the points referring to boundary conditions

TEACHING AIDS        : White board, marker
TEACHING POINTS    :

- Consolidation settlement
- Coefficient of consolidation
- Time taken for 90% consolidation
- Time taken for 50% consolidation

Assignment / Questions:
1.Outline the laboratory procedure of consolidation test. (Cob -4, CO-4)

                                                                Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III    Section: A

Course/Subject:  Geotechnical Engineering    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    6    Duration of Lesson: 1hr
Lesson Title: Pre-consolidation pressure

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine pre-consolidation pressure
2. Infer void ratio and log effective stress curve

TEACHING AIDS    : White board, marker
TEACHING POINTS    :

- Pre-consolidation stress
- Casagrande's method of determination
- Consolidation curve

Assignment / Questions:
1. Outline about stress history of clay soils. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester               :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject:   Geotechnical Engineering                Course Code:   GR18A3002

Name of the Faculty: Dr. C.Lavanya                  Dept.: Civil Engineering

Designation:   Professor

Lesson No:    7           Duration of Lesson:   1hr
Lesson Title: Terzaghi's Theory

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Analyse rate of settlement
2. Determine coefficient of consolidation
3. Outline the points referring to boundary conditions

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Consolidation settlement
- One dimensional consolidation theory
- Boundary conditions
- Coefficient of consolidation
- Double drainage and single drainage
- Degree of consolidation

Assignment / Questions:
1. Analyse rate of settlement and consolidation parameters. (Cob -4, CO-4)

                                                   Signature of faculty

## TUTORIAL SHEET - 4

**A**cademic **Y**ear                    : 2021-22

Semester                            :   I

Name of the Program: B.Tech Civil Engineering      Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

This Tutorial corresponds to Unit No.  - IV & Lesson

Q1. Debate factors affecting compaction of a soil.

Q2. The maximum dry density and optimum moisture content of a soil from standard proctor's test is $18kN/m^3$ and 16% respectively. Calculate degree of saturation of the sample, assuming the specific gravity of soil grains as 2.70.

Q3. Analyse a suitable procedure to determine the preconsolidation pressure.

Q4. A 30 mm thick oedometer sample of clay reached 30% consolidation in 15 minutes with drainage at top and bottom. Determine how long would it take the clay layer from which this sample was obtained to reach 60% consolidation? The clay layer had one-way drainage and was 6m thick.

Objective Nos.: 4
Outcome Nos.: 4

Signature of HOD                                                Signature of faculty

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Bachupally, Kukatpally, Hyderabad – 500 090, (040) 6686 4440**

## ASSIGNMENT SHEET – 4

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering     Year: III          Section: A

Course/Subject:  Geotechnical Engineering                      Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                         Dept.: Civil Engineering

Designation:  Professor

This Assignment corresponds to Unit No.  - IV & Lesson


Q1. Differentiate between 'compaction' and 'consolidation'.

Q2. Debate the effect of compaction on soil properties.

Q3. A soil in the borrow pit is at a dry density of 17kN/m$^3$ with a moisture content of 10%. The soil is excavated from this pit and compacted in an embankment to a dry density of 18kN/m$^3$ with a moisture content of 15%. Determine the quantity of soil to be excavated from the borrow pit and the amount of water to be added for 100 m$^3$ of compacted soil in the embankment.

Q4. In a consolidation test the following results have been obtained. When the load was changed from 50kN/m$^2$ to 100kN/m$^2$, the void ratio changed from 0.70 to 0.65. Determine the coefficient of volume decrease, m$_v$ and the compression index, C$_c$.


Objective Nos.: 4
Outcome Nos.: 4


Signature of HOD                                             Signature of faculty

# Gokaraju Rangaraju Institute of Engineering and Technology
## (Autonomous)
### Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

## SCHEDULE OF INSTRUCTIONS
## UNIT PLAN

**A**cademic **Y**ear                    : 2021-22

Semester                          :    I

Name of the Program: B.Tech Civil Engineering       Year: III              Section: A

Course/Subject:  Geotechnical Engineering                          Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                          Dept.: Civil Engineering

Designation:  Professor

| Lesson No. | Unit No. | Date | No. of Periods | Topics | Course Objectives & Outcomes | References Text Book Page No. |
|---|---|---|---|---|---|---|
| 1 | | 24-11-2021 | 1 | Shear Strength - Mohr circle and its characteristics | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.287 |
| 2 | | 25-11-2021 | 1 | principal planes, relation between major and minor principal stresses | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.287-289 |
| 3 | | 25-11-2021 | 1 | Mohr-Coulomb theory | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.290-296 |
| 4 | V | 29-11-2021 | 1 | Direct shear test and it merits | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.296-302 |
| 5 | | 29-11-2021 | 1 | Tri-axial compression test and its behaviour of UU, CU and CD | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.311-313 |
| 6 | | 01-12-2021 | 1 | Unconfined compression test and vane shear test | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.303-308 |
| 7 | | 02-12-2021 | 1 | Computation of effective shear strength parameters | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.314 |
| 8 | | 06-12-2021 | 1 | Problems | COb-5 CO-5 | Gopal Ranjan & ASR Rao, pp.314 |

| 9 | | 08-12-2021 | 1 | Problems | COb-5<br>CO-5 | Gopal Ranjan &<br>ASR Rao, pp. |

Signature of HOD                                                      Signature of faculty


Note:    1. Ensure that all topics specified in the course are mentioned.
         2. Additional topics covered, if any, may also be specified in bold
         3. Mention the corresponding course objective and out come numbers against each topic.

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III          Section: A

Course/Subject:  Geotechnical Engineering                    Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    1            Duration of Lesson:  1hr

Lesson Title: Shear strength of soils

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Determine the shear strength of soils
2. Identify Mohr circle of stress
3. Analyse the mechanism of shear resistance

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Shear strength
- Shear stress
- Type of soils
- Angle of internal friction
- Cohesion

Assignment / Questions:
1. Analyse the mechanism of shear resistance and strength. (Cob -5, CO-5)

Signature of faculty

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# LESSON PLAN

**A**cademic **Y**ear              : 2021-22

Semester                     :   I

Name of the Program: B.Tech Civil Engineering     Year: III          Section: A

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                      Dept.: Civil Engineering

Designation:  Professor

Lesson No:     2              Duration of Lesson: 1hr
Lesson Title: Mohr circle of stress

<u>INSTRUCTIONAL/LESSON OBJECTIVES:</u>

On completion of this lesson the student shall be able to:

1.  Identify Mohr failure criteria
2. Illustrate normal and shear stress

TEACHING AIDS        : White board, marker
TEACHING POINTS     :

- Principal stresses
- Normal stress
- Shear stress
- Mohr circle

Assignment / Questions:
1. Analyze the mechanism of Mohr failure criteria. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear        : 2021-22

Semester           :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject:  Geotechnical Engineering            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation:  Professor

Lesson No:     3          Duration of Lesson: 1hr
Lesson Title: Mohr - Coulomb Failure theories

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1.  Identify Mohr failure criteria
2. Calculate shear strength of soils
3. Illustrate shear strength parameters

TEACHING AIDS       : White board, marker
TEACHING POINTS     :

- Shear strength
- Mohr theory
- Coulomb's equation
- Cohesion
- Angle of internal friction

Assignment / Questions:
1. Explain determination of shear strength of soils. (Cob -4, CO-4)

                                     Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject: Geotechnical Engineering          Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation: Professor

Lesson No:   4         Duration of Lesson: 1hr
Lesson Title: Types of laboratory strength tests

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Identify the various tests involved in shear strength
2. Compare the merits and demerits of tests
3. Determine the results of various shear tests

TEACHING AIDS      : White board, marker
TEACHING POINTS    :

- Laboratory tests
- Direct shear test
- Tri-axial test
- Unconfined compression test
- Vane shear test
- Drainage conditions

Assignment / Questions:
1. Outline merits and demerits of direct shear test. (Cob -4, CO-4)

                                  Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear          : 2021-22

Semester                :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject: Geotechnical Engineering             Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation: Professor

Lesson No:    5          Duration of Lesson: 1hr
Lesson Title: Shear strength of sands

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Differentiate between shear strength of loose and dense sands
2. Compare shear stress and shear strain for sands
3. Compare shear stress and normal stress for sands

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Shear strength
- Shear stress
- Normal stress
- Shear strain
- Critical void ratio
- Dense sand and loose sand

Assignment / Questions:
1. Differentiate between shear strength of loose and dense sands (Cob -4, CO-4)

                                                    Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear        : 2021-22

Semester              : I

Name of the Program: B.Tech Civil Engineering    Year: III      Section: A

Course/Subject: Geotechnical Engineering          Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya          Dept.: Civil Engineering

Designation: Professor

Lesson No:   6        Duration of Lesson: 1hr
Lesson Title: shear strength of clays

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Differentiate between various drainage conditions in clayey soils
2. Analyse the shear strength of clays
3. Identify Mohr circles

TEACHING AIDS     : White board, marker
TEACHING POINTS   :

- Shear strength
- Undrained test
- Consolidated undrained test
- Drained test

Assignment / Questions:
1. Differentiate between shear strength of sands and clays. (Cob -4, CO-4)

Signature of faculty

# LESSON PLAN

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: A

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                    Dept.: Civil Engineering

Designation:  Professor

Lesson No:    7          Duration of Lesson: 1hr
Lesson Title: Critical Void Ratio - Liquefaction

INSTRUCTIONAL/LESSON OBJECTIVES:

On completion of this lesson the student shall be able to:

1. Outline about critical void ratio
2. Infer about liquefaction

TEACHING AIDS       : White board, marker
TEACHING POINTS    :

- Critical void ratio
- Liquefaction
- Saturated fine cohesionless soils
- Shear strength

Assignment / Questions:
1. Outline about critical void ratio and liquefaction. (Cob -4, CO-4)

Signature of faculty

## TUTORIAL SHEET - 5

**A**cademic **Y**ear          : 2021-22

Semester                 :   I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject:  Geotechnical Engineering            Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya           Dept.: Civil Engineering

Designation:  Professor

This Tutorial corresponds to Unit No.  - V & Lesson

Q1. Analyse Mohr-Coulomb failure envelope.

Q2. Compare the stress-strain relationship for dense and loose sands.

Q3. In a tri-axial shear test conducted on a soil sample having cohesion of $12kN/m^2$ and angle of shearing resistance of 36°, the cell pressure was $200kN/m^2$. Determine the value of the deviator stress at failure.

Objective Nos.: 5
Outcome Nos.: 5

Signature of HOD                                            Signature of faculty

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## ASSIGNMENT SHEET – 5

**A**cademic **Y**ear            : 2021-22

Semester                    :   I

Name of the Program: B.Tech Civil Engineering     Year: III        Section: A

Course/Subject:  Geotechnical Engineering             Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya             Dept.: Civil Engineering

Designation:  Professor

This Assignment corresponds to Unit No.  - V & Lesson

Q1. Differentiate the advantages and disadvantages of a direct shear test?

Q2. A vane, 10.8 cm long, 7.2 cm in diameter, was pressed into soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45 Nm. Determine shear strength of the clay on a horizontal plane.

Q3. A cylindrical specimen of a saturated soil fails under an axial stress $150kN/m^2$ in an unconfined compression test. The failure plane makes an angle of 52° with the horizontal. Calculate the cohesion and angle of internal friction of the soil.

Objective Nos.:  5
Outcome Nos.: 5

Signature of HOD                                               Signature of faculty

# EVALUATION STRATEGY

**A**cademic **Y**ear        : 2021-22

Semester             :   I

Name of the Program: B.Tech Civil Engineering     Year: III         Section: A

Course/Subject: Geotechnical Engineering            Course Code: GR18A3002

Name of the Faculty: Dr. C.Lavanya            Dept.: Civil Engineering

Designation: Professor

## 1. TARGET:

A) Percentage for pass: 90%

b) Percentage of class:

Total Strength: 130

| S. No. | Class / Division | No. of Students |
|--------|------------------|-----------------|
| 1 | First Class with distinction | 60 |
| 2 | First Class | 60 |
| 3 | Pass Class | 10 |

## 2. COURSE PLAN & CONTENT DELIVERY

| S.No | Plan | Brief Description |
|------|------|-------------------|
| 1 | Practice classes | 51 Theory classes for Section A, B |
| 2 | Demonstration | Demonstration of experiments in the lab |
| 3 | Assignments | Assignments for solving numerical problems |

## 3. METHOD OF EVALUATION

### 3.1 Continuous Assessment Examinations

- Assignments: Assignments to assess the knowledge of the student on the basics and concepts in Geotechnical Engineering, index properties, permeability, stress distribution, compaction, consolidation and shear strength of soils.
- Seminars: To assess the knowledge of the student in Geotechnical Engineering.
- Quiz: To assess the knowledge of the student in various concepts and basics of Geotechnical Engineering.
- Internal Examination: Internal Examinations to assess their overall knowledge in Geotechnical Engineering.

### 3.2. Semester/End Examination

To test their abilities in the course Geotechnical Engineering and to approve their abilities learnt during the same.

**4.** List out any new topic(s) or any innovation you would like to introduce in teaching the subjects in this Semester.

Introducing some practical laboratory exercises on course grained soils.

Signature of HOD                                              Signature of faculty

# MAPPING

| GR18A3002/ Geotechnical Engineering | Program Outcomes / Program Specific Outcomes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Course Outcomes** | a | b | c | d | e | f | g | h | i | j | k | l | PSO1 | PSO2 |
| Identify basic Engineering properties of soil and classify the soil. | H | M | M | M | | | | | | | | | | M |
| Perform and evaluate the experiments to determine the permeability and effective stresses of soil. | M | H | M | H | | | | | | | | M | | |
| Identify, formulate and solve various problems in compaction and stresses in soils. | M | H | H | H | | | M | | | M | | M | | M |
| Analyse the mechanism and behaviour of soil under consolidation process. | M | H | H | H | | | M | | | M | | M | | |
| Evaluate the behaviour of shear strength of soil mass. | M | M | H | H | | | | | | M | | M | | |

**Assignments**

### Assignment – I

1. A soil has a plastic limit of 26% and a plasticity index of 30. If the natural water content of the soil is 38%, Compute liquidity index and its consistency index? How do you illustrate the consistency?

2. The dry unit weight of a sand sample in the loosest state is 12.5kN/m$^3$ and in the densest state, it is 19kN/m$^3$. Compute the density index of the sand when it has a porosity of 41%. Assume the grain specific gravity as 2.7.

3. Classify the following soils as per IS Soil classification system for (i) Liquid limit = 63% and Plastic limit = 24% (ii) If 71% of the soil by weight is retained on 75µ IS Sieve and 63% of the soil passing through 4.75 mm IS sieve of the coarse fraction (+75 µ). From GSD curve, the values for Coefficient of uniformity and Coefficient of curvature are 4.8 and 2.1 respectively.

4. A soil sample has a diameter of 38mm and a height of 76mm. Its wet weight is 1.15N. Upon drying its weight reduced to 0.5N. In the wet state what was the degree of saturation, water content, void ratio, porosity, total unit weight and dry unit weight. Take Gs=2.7

## Assignment – II

1. Explain factors effecting permeability.

2. What are the characteristics and uses of flow nets?
3. A sample in a variable head permeameter is 8cm in diameter and 10cm high. The permeability of the sample is estimated to be $10\times10^{-4}$ cm/s. If it is desired that the head in the stand pipe should fall from 24cm to 12cm in 3minutes, determine the size of the standpipe which should be used.

4. Determine the neutral and effective stress at a depth of 16 m below the ground level for the following conditions: Water table is 3 m below ground level; G = 2.68; e = 0.72; average water content of the soil above water table is 8%.

## Assignment – III

1. Outline a brief critical note on 'Newmark's influence chart'.

2. A load 1000 kN acts as a point load at the surface of a soil mass. Calculate stress at a point 3m below and 4m away from the point of action of the load by Boussinesq's formula. Compare the value with the result from Westergaard's theory.

3. Explain the factors affecting compaction.

## Assignment – IV

1. A 30 mm thick oedometer sample of clay reached 30% consolidation in 15 minutes with drainage at top and bottom. Determine how long would it take the clay layer from which this sample was obtained to reach 60% consolidation? The clay layer had one-way drainage and was 6m thick.

2. A layer of soft clay is 6m thick and lies under a newly constructed building. The weight of sand overlying the clayey layer produces a pressure of $260kN/m^2$ and the new construction increases the pressure by $100kN/m^2$. If the compression index is 0.5, compute the settlement. Water content is 40% and specific gravity of grains is 2.65.

## Assignment – V

1. Explain shear strength of clays.
2. A vane, 10.8 cm long, 7.2 cm in diameter, was pressed into soft clay at the bottom of a bore hole. Torque was applied and the value at failure was 45 Nm. Determine shear strength of the clay on a horizontal plane.
3. The angle of internal friction of a saturated, cohesionless soil is 40°. Determine the ratio of shear stress to normal effective stress on the failure plane.
4. In a direct shear test, a dry sand sample failed at a shear stress of $90kN/m^2$ when the normal stress on the sample was $120kN/m^2$. The angle of internal friction of the sand sample is approximately.

# RUBRIC TEMPLATE

**A**cademic **Y**ear : 2021-22
Semester : I
Name of the Program: B.Tech Civil Engineering     Year: III     Section: A
Course/Subject:  Geotechnical Engineering     Course Code:  GR18A3002
Name of the Faculty: Dr. C. Lavanya     Dept.: Civil Engineering
Designation:  Professor

Objective: To learn basics and concepts of soil mechanics.
Student Outcome: Learn basic concepts and engineering properties of soils.

| S.No | Name of the Student | Performance Criteria | Beginning 1 | Developing 2 | Reflecting Development 3 | Accomplished 4 | Exemplary 5 | Score |
|---|---|---|---|---|---|---|---|---|
| 1 | x | The level of knowledge on basic concepts of soil mechanics | Low level of knowledge on basic concepts of soil mechanics | Able to understand the basic concepts of soil mechanics | Ability to explain the basic concepts of soil mechanics | Full knowledge on basic concepts of soil mechanics | Analysing and implementing the knowledge of basic concepts of soil mechanics | 5 |
| | | The level of knowledge on engineering properties of soils | Low level of knowledge on engineering properties of soils | Able to understand engineering properties of soils | Ability to explain engineering properties of soils | Full knowledge on engineering properties of soils | Analysing and application of knowledge of engineering properties of soils | 4 |
| | | The level of knowledge to analyse the behavior of soil. | Low level of knowledge to analyse the behavior of soil. | Able to understand to study the behavior of soil. | Ability to explain to the behavior of soil. | Full knowledge to analyse the behavior of soil. | Analysing and implementing the knowledge of the behavior of soils. | 3 |
| | | | | | | | Average Score | 4 |

## COURSE COMPLETION STATUS

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering     Year: III     Section: A

Course/Subject:  Geotechnical Engineering     Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya     Dept.: Civil Engineering

Designation:  Professor

Actual Date of Completion & Remarks, if any

| Units | Remarks | Objectives Achieved | Outcomes Achieved |
|-------|---------|---------------------|-------------------|
| Unit I | 09-09-2021<br>Unit covered on time | 1 | 1 |
| Unit II | 04-10-2021<br>Unit covered on time | 2 | 2 |
| Unit III | 01-11-2021<br>Unit covered on time | 3 | 3 |
| Unit IV | 22-11-2021<br>Unit covered on time | 4 | 4 |
| Unit V | 08-12-2021<br>Unit covered on time | 5 | 5 |

Signature of HOD     Signature of faculty

Note:  After the completion of each unit mention the number of Objectives & Outcomes Achieved.

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## COURSE COMPLETION STATUS

**A**cademic **Y**ear : 2021-22

Semester : I

Name of the Program: B.Tech Civil Engineering    Year: III        Section: B

Course/Subject:  Geotechnical Engineering                Course Code:  GR18A3002

Name of the Faculty: Dr. C.Lavanya                Dept.: Civil Engineering

Designation:  Professor

Actual Date of Completion & Remarks, if any

| Units | Remarks | Objectives Achieved | Outcomes Achieved |
|-------|---------|---------------------|-------------------|
| Unit I | 14-09-2021 <br> Unit covered on time | 1 | 1 |
| Unit II | 08-10-2021 <br> Unit covered on time | 2 | 2 |
| Unit III | 05-11-2021 <br> Unit covered on time | 3 | 3 |
| Unit IV | 19-11-2021 <br> Unit covered on time | 4 | 4 |
| Unit V | 07-12-2021 <br> Unit covered on time | 5 | 5 |

Signature of HOD                                                Signature of faculty

Note:  After the completion of each unit mention the number of Objectives & Outcomes Achieved.

**B.Tech III Year-I Sem (2021-22)**                    **I-Mid Term Examination,  18-10-2021**

**Geotechnical Engineering (GR18A3002)**

**Objective Exam**

**Name:**_____          **Hall Ticket No.:** _____

**Answer all the questions.**

**All questions carry equal marks.**        **Time: 10Min**                          **Max. Marks: 05**

**Choose the correct alternative:**

1. _____ of a soil mass is the ratio of the volume of voids to the total volume of the soil mass.
   (a) void ratio      (b) degree of saturation   (c) porosity  (d) air content                    [      ]
2. In clay mineralogy, which mineral is called least active mineral.                          [      ]
   a) Montmorillonite   b) Kaolinite   c) Illite     d) Halloysite

3. The size of the coarse sand is _____.                                        [      ]
   (a) 4.75mm – 2.0mm   b) 2.0mm – 0.425mm  (c) 2.0mm – 0.075mm  (d) 0.425mm – 0.075mm

4. The ratio of difference between natural water content of soil and its plastic limit to its plasticity index is called _____.                                [      ]
   (a) flow index   b) liquidity index        (c) toughness index      (d) shrinkage ratio
5. The soil is classified as _____ if the value plot below A-line and liquid limit is 55% in the plasticity chart.                                                [      ]
   (a) CL    (b)  CH        (c)  MH         (d)  MI
6. The relation between total stress (σ), effective stress (σ′) and pore water pressure (u) is _____.
   (a) $\sigma' = \sigma / u$     (b)  $\sigma' = \sigma * u$           (c) $\sigma' = \sigma + u$   (d)  $\sigma' = \sigma - u$               [      ]
7. The permeability of a partially saturated soil is comparatively _____ than that of fully saturated soils.
   (a) more          (b)  less       (c)  same       (d)  no change                          [      ]
8. The permeability in clayey soils _____due to adsorbed water.
   (a) increases    (b)  decreases        (c)  same       (d)  no change                    [      ]

9. In permeability for stratified soils when flow is horizontal, then _____.                [      ]
   (a) Velocity of flow is same          b) hydraulic gradient is different
   c) Velocity of flow is different     d) head loss if different

10. The pressure transmitted through soil mass by soil particles through their points of contact is called _____.                                        [      ]
    (a) Total stress   (b) Effective stress  (c) Neutral stress  (d) pore pressure

-------X-------

**Gokaraju Rangaraju Institute of Engineering and Technology**

**(Autonomous)**

**Department of Civil Engineering**

**I-Mid Term Examination (Descriptive)**                    **Oct - 2021**

**Sub: Geotechnical Engineering (GR18A3002)**              **Year: B.Tech III Year-I Sem (2021-22)**

**Date of Exam:   18/10/2021 (AN)**         **Max. Marks: 15**              **Time: 90 Min**

------------------------------------------------------------------------------------------------------------------------

**Answer any Three questions.**

All questions carry equal marks.

1.  (a) Derive the relation between degree of saturation, void ratio, water content and specific gravity of solids.                                                                           (2.5M)
    (b) The porosity of a soil sample is 35% and the specific gravity of its particles is 2.7. Calculate its void ratio, dry density, saturated unit weight and submerged unit weight.          (2.5M)

2.  Outline about Indian Standard Soil Classification System for coarse grained and fine grained soils.                                                                                        (5M)

3.  An unconfined aquifer is known to be 32m thick below the water table. A constant discharge of 2cubic meters per minute is pumped out of the aquifer through a well till the water level in the well becomes steady. Two observation wells at distances of 15m and 70m from the well show falls of 3m and 0.7m respectively from their static water levels. Find the permeability of the aquifer.                                                                                        (5M)

4.  A saturated sand layer over a clay stratum is 5m in depth. The water is 1.5m below ground level. If the bulk density of saturated sand is 17.66kN/m$^3$, calculate the total, effective and neutral stress on the top of the clay layer.  Take G=2.65. Assume soil above water table is dry.
                                                                                              (5M)

-------X-------

**Gokaraju Rangaraju Institute of Engineering and Technology**
**(Autonomous)**
**Department of Civil Engineering**

**B.Tech III Year-I Sem (2021-22)**          **II-Mid Term Examination, 09-12-2021 (AN)**
**Geotechnical Engineering (GR18A3002)**

**Objective Exam**
**Name:_____          Hall Ticket No.: _____**

**Answer all the questions.**
**All questions carry equal marks.**          **Time: 10Min**          **Max. Marks: 05**

**Choose the correct alternative:**

1.  For the determination of the vertical stress at any point caused by any irregular loaded area, _____is
    used.                                                                                          [    ]
    (a) Newmark's chart (b) Boussinesq's theory (c) Westergaard's theory (d) none of the above

2.  The weight and height of fall of the rammer used for heavy compaction test is_____. [      ]
    (a) 2.6kg and 31cm      (b) 3.9kg and 40cm          (c) 4.9kg and 45cm          (d) none of the above

3.  The vertical stress of a uniformly circular loaded area of radius R, intensity q acting at a depth z, directly
    below the center is given by _____.                                                        [    ]
        a) $q[ 1 – (1/(1+(R/z)^2))^{5/2}]$                          b) $q[ 1 – (1/(1+(R/z)^2))^{3/2}]$
        c) $q[ 1 + (1/(1+(R/z)^2))^{3/2}]$                          d) $q[ 1 + (1/(1+(R/z)^2))^{5/2}]$

4.  The compactive effort in the modified proctor test is about _____ times more than that of standard
    proctor test.                                                                                  [    ]
    (a) 5.46        (b) 4.56        (c) 3.46          (d) none of the above

5.  Time taken for _____consolidation can be estimated by using Casagrande's Logarithm of time
    fitting method.                                                                                [    ]
    (a) 20%      (b) 50%      (c) 90%      (d) none of the above

6.  The consolidation test results are used to find the _____.                            [    ]
    (a) void ratio  (b) coefficient of consolidation (c)  coefficient of compressibility (d) All the above

7.  If the unconfined compressive strength of the soil is 300kN/m$^2$, then its undrained shear strength
    is _____ kN/m$^2$.                                                                       [    ]
    (a) 100                b) 150                (c) 50                (d) 25

8.  In direct shear test, the failure plane is _____.                                        [    ]
        (a) inclined        (b) horizontal                (c) vertical        (d) in any direction

9.  _____is useful to obtain undrained strength to evaluate the sensitivity of soil.  [    ]
    (a) Direct shear test    (b) Tri-axial test (c) Unconfined compression test          (d) Vane shear test

10. _____ is the test where drainage conditions can be controlled.                        [    ]
    (a) Direct shear test    (b) Tri-axial test (c) Unconfined compression test          (d) Vane shear test

-------X-------

**II-Mid Term Examination (Descriptive)**                           **Dec - 2021**

**Sub: Geotechnical Engineering (GR18A3002)**                 **Year: B.Tech III Year-I Sem (2021-22)**

**Date of Exam:   09/12/2021 (AN)**              **Max. Marks: 15**                    **Time: 90 Min**

------------------------------------------------------------------------------------------------------------------------

**Answer any Three questions.**

All questions carry equal marks.

1. (a) Discuss the factors affecting compaction of a soil.                                    (2.5M)
   (b) A load 1000kN acts as a point load at the surface of a soil mass. Estimate the stress at a point 3m below and 4m away from the point of action of the load by Boussinesq's theory. Compare the value with the result from Westergaard's theory.                       (2.5M)

2. (a) Outline about Casagrande logarithm of time fitting method for determining of coefficient of consolidation.                                                                                    (2.5M)
   (b) In a consolidation test the following results have been obtained. When the load was changed from $50kN/m^2$ to $100kN/m^2$, the void ratio changed from 0.70 to 0.65. Determine the coefficient of volume decrease, $m_v$ and the compression index, $C_c$.                (2.5M)

3. (a) Differentiate the merits and demerits of direct shear test?                    (2.5M)
   (b) Analyze the shear strength of clays.                                              (2.5M)

4. (a) Outline Newmarks Influence chart with a neat sketch.                        (2.5M)
   (b)  Explain about unconfined compressive strength.                             (2.5M)

-------X-------