

**PAVEMENT DESIGN**  
**(GR18A4067)**

IV-B.Tech – II Semester

**G.SWETHA**  
**Assistant Professor**



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

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# Gokaraju Rangaraju Institute of Engineering and Technology

(Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

IV Year B.Tech. CE – II Semester

GR 18 Regulations (2021-2022)

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## Pavement Design

**UNIT I Introduction to pavement design:** Types of Pavements-Functions of individual layers, Variables considered in Pavement Design- Factors affecting Pavement Design: Wheel loads, Tire Pressure, Contact Pressure, ESWL & ESAL concepts

**UNIT II Material characteristics:** Tests on sub-grade, Tests on aggregates-Aggregate properties and their importance-Tests on Bitumen-Requirements of design mix-Marshall method of mix design.

**UNIT III Stresses in flexible and rigid pavements:** Stresses in Flexible pavements -Layered systems concept-One layer system- Boussinesq two layer system- Burmister theory of Pavement design. Stresses in Rigid pavements -Importance of Joints in rigid Pavements-Types of joints-use of tie bars and dowel bars - Relative stiffness -Modulus of Subgrade Reaction-Stresses due to warping Stresses due to loads - Stresses due to friction.

**UNIT IV Flexible and rigid pavement design:** Flexible Pavement Design concepts-CBR method of Flexible Pavement design-IRC method of design-Asphalt Institute method and AASTHO methods. Rigid Pavement design concepts-IRC method of Rigid pavement design-PCA method-Design of tie bars and dowel bars.

**UNIT V Highway construction and maintenance:** Construction: Construction of Bituminous Pavements, construction of Cement Concrete Roads. Highway maintenance –Pavement failures: failures in flexible Pavements, Rigid Pavement failures, Pavement evaluation- Overlay design by Benkelman Beam method.

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.  
2. Pavement Design – Yang H. Huang  
3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak  
4. Highway and traffic Engineering-Subash Saxena

# **Gokaraju Rangaraju Institute of Engineering and Technology**

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**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

## **Program Educational Objectives**

***This education is meant to prepare our students to thrive and lead. During their progression, our graduates will***

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

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

**PEO 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.

### **Program Specific Outcomes (PSOs)**

**PSO1:** Recognize the need for a sustainable environment and design smart infrastructure considering the global challenges.

**PSO 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. (040) 6686 4440**

**COURSE OBJECTIVES**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A/B

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

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

S.No	Objectives
1	To give a detailed notion of methods of highway design and controlling factors
2	To introduce software tools for design and maintenance of pavements
3	To provide the idea of design standards and traffic data collection for flexible and rigid pavements.
4	To give the knowledge of predictability about material constraints and optimal utilization.
5	To introduce the vital traffic parameters and the methods of their estimation.
6	To provide the knowledge of major failures in pavements, causes and preventive measures.

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.  
2. Pavement Design – Yang H. Huang  
3. Principles of Pavement Design – E. J. Yoder, M. W. Witzak  
4. Highway and traffic Engineering-Subash Saxena

Signature of HOD

Signature of faculty

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

**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

**COURSE OUTCOMES**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A/B

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

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

S.No	Outcomes
1	Illustrate highway design methods, constraints and controlling factors.
2	Apply the design standards in designing principle elements of the highway.
3	Predict the resource constraints and allows to utilize the available materials in a sustainable way
4	Examining the basic parameter of traffic engineering and the methods which helps to estimate those parameters
5	Recognize the major failure modes of flexible and rigid pavement and helps in maintaining them properly.

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.  
2. Pavement Design – Yang H. Huang  
3. Principles of Pavement Design – E. J. Yoder, M. W. Witzak  
4. Highway and traffic Engineering-Subash Saxena

Signature of HOD

Signature of faculty



## Gokaraju Rangaraju Institute of Engineering and Technology (Autonomous)

Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440

S.No	Reg No	Student Name
1	17241A0153	SUJITH KUMAR SHINDE
2	17241A0157	VUPPULA MITHUNKUMAR Reddy
3	18241A0101	AJMEERA GANESH
4	18241A0102	ANABOTULA SRAVANI
5	18241A0103	ANUMATLA MANOJ
6	18241A0104	BYNA RISHITHA
7	18241A0105	BURA THARASRI
8	18241A0106	PUDARI BADRINATH GOUD
9	18241A0107	BALASANI ROHITH
10	18241A0108	BANDARI VEERASWAMY
11	18241A0109	BANDI VARUN KUMAR
12	18241A0110	BASHIPAKA PRADEEP
13	18241A0111	BATHULA NIKHIL
14	18241A0112	BATIKIRI VEERENDRA SWAMY
15	18241A0113	BHUKYA SOUJANYA
16	18241A0114	BHUKYA VARUN NAIK
17	18241A0115	BODDU PAVAN
18	18241A0116	BYAGARI RANGARAJU
19	18241A0117	CHADA RUCHITA
20	18241A0118	CHINTHAKUNTLA THRIVEEN
21	18241A0119	CV JASWANTH SURYA
22	18241A0120	DOSAPATI NISHU
23	18241A0121	G PRASHANTH
24	18241A0122	GADDIPATI LOHITHA
25	18241A0123	GANGAM ROHIT REDDY
26	18241A0124	GOTTEMUKKALA GOVARDHAN



27	18241A0125	HRISHIKESH BANSAL
28	18241A0126	JANAPATI RAJU
29	18241A0127	JYOTHIKA MANNAVA
30	18241A0128	K HARSHITHA REDDY
31	18241A0129	KOLAN RESHIKESH REDDY
32	18241A0130	KARRI BHARATH CHANDRA REDDY
33	18241A0131	KUPPALA NIHAR
34	18241A0132	KURVA LAVANYA
35	18241A0133	MADDIMSETTY SRI CHARAN
36	18241A0134	MAGANOOOR MANASWINI
37	18241A0135	MALOTH BHAVSINGH
38	18241A0136	MALOTHU NAVEENA
39	18241A0137	MANDA ITHIHAS
40	18241A0138	MOHAMMAD ASHFAQ AHMED
41	18241A0139	MOHAMMED OMER SHAREEF
42	18241A0140	MUKUNDU NAVEEN
43	18241A0141	NALUMASU SAHITHI
44	18241A0142	NAMPELLY RAVI KUMAR
45	18241A0143	NARRA SHASHIDHAR REDDY
46	18241A0144	PATLOLA VINAY REDDY
47	18241A0145	Pattambetty Pavan Kumar
48	18241A0146	POLA THARUN
49	18241A0147	POSANI S V A KALYAN
50	18241A0148	pulle manichandra
51	18241A0149	RAJULAPATI ROHIT NAGA SAI
52	18241A0150	S Subbaram Reddy
53	18241A0153	SUNKARI VIKAS
54	18241A0154	THIRUPATHI RAO SALLA
55	18241A0155	Trivikram reddy
56	18241A0156	Trupthi shreya
57	18241A0157	Vakamalla Bhavya sree
58	18241A0158	Vemula Manisha
59	18241A0159	VUPPULA KEERTHANA

60	18241A0160	YALLA ANITHA
61	17241A0161	Abdul Samad
62	18241A0161	A NACHIKETH
63	18241A0162	ALETI JAGADISH
64	18241A0163	AMIRNENI ANUSHA
65	18241A0164	ANIREDDY AVINASH
66	18241A0165	ASHITHA GOLLA
67	18241A0166	ANIMESH BAATHUK
68	18241A0167	BOPPU LOKESH
69	18241A0168	BUDAGAM HARSHITH
70	18241A0169	CHILUMULA SRIDHAR
71	18241A0170	DANDRE VENNELA
72	18241A0171	DOTI UPENDER
73	18241A0172	EDA MANASA
74	18241A0173	GONDA HARSHINI
75	18241A0174	GORE KAMALAKAR SAILESH
76	18241A0175	GORE KAMALAKAR SANDEEP
77	18241A0176	GUDDATI ARUN
78	18241A0177	VIJAY NARASIMHA REDDY KOLAGTLA
79	18241A0178	KANCHARAKUNTLA DEEPIKA
80	18241A0179	KOTA RASHMITHA
81	18241A0180	KOTHURI PRANAY
82	18241A0181	KUDALA RAMA
83	18241A0182	KUMMARI SRILEKHA
84	18241A0183	KUNCHALA ADARSH
85	18241A0184	K.Neeraj Prasad
86	18241A0185	KYAMA PAVAN
87	18241A0186	M SHEKHAR
88	18241A0187	MALRAJ MANVITHA
89	18241A0188	MATHARASI SAI KUMAR
90	18241A0189	MD AMEER SOHAIL
91	18241A0190	MD AMIR
92	18241A0191	MEDARI VIKRAM ADITHYA
93	18241A0192	MEDIGA KARTHIK
94	18241A0193	SUNKARA MONIESH REDDY
95	18241A0194	KAUSHIK NADELLA
96	18241A0195	NIKHITHA KASUVOJULA
97	18241A0196	NUNAVATH SUMAN
98	18241A0197	POTHULAPALLY KISHOR
99	18241A0198	P.Spandana Reddy
100	18241A0199	PRATHYUSHA MADDALA

101	18241A01A0	PRATYUSH BAVANARI
102	18241A01A1	PUTTA ROHIT
103	18241A01A2	RAHUL PRADHAN
104	18241A01A3	RAMPELLI PRAVALIKA
105	18241A01A4	RANGU SONIYA
106	18241A01A5	RENTALA ADARSH REDDY
107	18241A01A6	RITISH J
108	18241A01A7	SEELAM RAHUL GOUD
109	18241A01A8	SHAIK AFEEZ
110	18241A01A9	SHAIK SHOAB
111	18241A01B0	SHIVARATHRI SAI KUMAR
112	18241A01B1	SHIVARATHRI THARUN
113	18241A01B2	SOWMIKA BOYAPATI
114	18241A01B3	VISHRUTH REDDY T N
115	18241A01B4	TEKULA PRASHANTH REDDY
116	18241A01B5	TEEGALA SOMESHWAR REDDY
117	18241A01B6	THATIPAMULA VIGNA SAI
118	18241A01B7	THOTA SRI SAI
119	18241A01B8	VEDATI MANIKANTA KARTHIK
120	18241A01B9	VALLAPU REDDY SUSHRUTHA
121	18241A01C0	YANALA RITHISH REDDY
122	19245A0101	Kancherla Bharath
123	19245A0102	ELUPULA KUMARASWAMY
124	19245A0103	Brahmadevara bhavitha
125	19245A0104	Dasari namratha
126	19245A0105	T chandana
127	19245A0106	Kola.Haritha
128	19245A0107	CHOUGONI SHIVA SHANKAR
129	19245A0108	KOTA ANVESH
130	19245A0109	polagani Chandu goud
131	19245A0110	SADGARI KARTHIK
132	19245A0111	GUGULOTHU PAVAN
133	19245A0112	A RAGHAVENDRA

## **GUIDELINES TO STUDY THE COURSE/SUBJECT**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year

**Section:** A /B

**Course/Subject** : Pavement Design

**Course Code:**GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

### **Guidelines to Students:**

Guidelines to study the course / subject: Pavement Design

This course aids in understanding the importance of roads in transportation field. Students will learn to differentiate several types of pavements, their structural variations and suitability under various loading and environmental conditions. This course helps students to learn standard and advanced methods of pavement construction.

So the students should have the following pre-requisites:

1. Knowledge of engineering materials and their mechanical properties
2. Knowledge of mathematics and statistics
3. Knowledge of geotechnical properties of soil
4. Basics of mechanics and dynamics

#### **Where will this subject help?**

- a. Useful in constructing pavements of various types under varying traffic loads
- b. Useful in learning effective design methods to ensure structural soundness of pavements
- c. Helps to evaluate existing pavements and notify different types of pavement failures.
- d. Gives the knowledge of several types of construction methods and also of advanced equipment in road construction

## Books / Material:

<b>Text Books</b>	
1.	Highway Engineering-S.K.khanna&C.J.Justo, Nemchand& Bros.
2.	Principles & Practices of Highway Engineering - Dr.L.R.Kadiyali & Dr.N.BLal, Khanna Publishers.
3.	Transportation Engineering, K.P.Subramanian
4.	Highway and traffic Engineering, Subash Saxena

<b>References</b>	
1.	Pavement Design – Yang H. Huang
2.	Principles of Pavement Design – E. J. Yoder, M. W. Witzak

**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

Date:

Signature of faculty

Date:



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### COURSE SCHEDULE

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program:** B.Tech      **Year:** IV Year      **Section:** A/B

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

The Schedule for the whole Course / Subject is:

S. No.	Description	Duration (Date)		Total No. Of Periods
		From	To	
1.	<b>UNIT-I</b> Introduction to Pavement Design	10/1/2022	02/02/2022 2	10
2.	<b>UNIT-II</b> Material characteristics	07/02/2022	23/02/2022 2	10
3.	<b>UNIT-III</b> Stresses in flexible and rigid pavements	28/02/2022	21/03/2022 2	10
4.	<b>UNIT-IV</b> Flexible and rigid pavement design	22/03/2022	11/04/2022 2	12
5.	<b>UNIT-V</b> Highway construction and maintenance	12/04/2022	02/05/2022 2	9

Total No. of Instructional periods available for the course: **65** Hours / Periods

**Gokaraju Rangaraju Institute of Engineering and Technology Department  
of Civil Engineering**

**SESSION PLAN**

<b>Lesson No.</b>	<b>Date</b>	<b>Unit No</b>	<b>Topics / Sub – Topics</b>	<b>Section: A/B</b>
1	10/1/2022	1	Introduction - Requirements of a Pavement	
2	11/1/2022		Types of pavement-Suitability	
3	12/1/2022		Functions of pavement component layers	
4	17/1/2022		Problems on Contact pressure and tire Pressure concept	
5	18/1/2022		Factors effecting pavement Design: Wheel load, tire pressure & contact pressure	
6	19/1/2022		Factors affecting pavement design- Environmental factors, Structural models	
7	24/1/2022		ESAL	
8	25/1/2022		ESWL – Determination (Stress criteria, Vertical Deformation criteria)	
9	31/1/2022		EALF & VDF calculation	
10	01/02/2022		Problems on ESWL concept	
11	02/02/2022		Problems on EALF concept	
12	07/02/2022	2	Pavement Materials- Importance	
13	08/02/2022		Soil characteristics, types	
14	09/02/2022		Tests on sub-grade; CBR test	
15	14/02/2022		Tests on aggregates, Engineering properties	
16	15/02/2022		Impact test, Abrasion test, Specific gravity test	
17	15/02/2022		Shape test-elongation test and flakiness test, crushing test, stripping test	
18	16/02/2022		Difference between Bitumen and Tar, Types of Bitumen	
19	16/02/2022		Uses of bitumen, Tests on bitumen	
20	21/02/2022		Penetration test, viscosity test, softening point test	
21	21/02/2022		Flash and fire test, Ductility test, specific gravity test	
22	22/02/2022		Requirements of Mix design.	
23	22/02/2022		Procedure for mix, sample preparation	
24	23/02/2022		Marshall method of mix design procedure	
25	28/02/2022	3	Stresses in Flexible pavements, layered system concept	
26	01/03/2022		One layer system concept	
27	01/03/2022		Bossiness two layer system	
28	02/03/2022		Burmister theory of pavement design	
29	07/03/2022		MID-1	
30	08/03/2022		MID-1	



31	14/03/2022		Problems	
32	14/03/2022		Stress in Rigid pavement	
33	15/03/2022		Importance of joints in rigid pavements	
34	15/03/2022		Types of joints	
35	21/03/2022		Use of tie bars and dowel bars	
36	21/03/2022		Relative stiffness, Modulus of subgrade reaction	
37	22/03/2022	4	Introduction to pavement designs	
38	22/03/2022		Flexible pavement design-criteria	
39	28/03/2022		CBR method	
40	28/03/2022		Problems- IRC design of flexible pavements	
41	29/03/2022		IRC method of design- estimation of traffic (axle loads, traffic distribution)	
42	29/03/2022		IRC method of design-pavement thickness and composition, Drainage measures	
43	04/03/2022		AASHTO methods	
44	04/04/2022		Rigid pavement design-criteria	
45	05/04/2022		IRC method of rigid pavement design	
46	05/04/2022		PCA method of design	
47	11/04/2022		Design of tie bars and dowel bars	
48	11/04/2022		Problems	
49	12/04/2022		5	Construction: Construction of Bituminous Pavements
50	12/04/2022			Construction of bituminous pavements
51	18/04/2022	Construction of cement concrete roads- cement concrete slab		
52	19/04/2022	Highway construction and maintenance		
53	25/04/2022	Pavement failures- in Flexible pavements		
54	26/04/2022	Failures in Rigid pavements		
55	26/04/2022	Failures in Rigid pavements-Examples		
56	02/05/2022	Pavement evaluation- Benkelman Beam method		
57	02/05/2022	Revision class		

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**SCHEDULE OF INSTRUCTIONS  
UNIT PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**UNIT NO: 1**

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

S. No.	Date	No. of Periods	Topics / Sub – Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References
1.	10/1/2022	1	Requirements of a Pavement	CoB- 1,3 CO- 1,2	K2	Text Book 1 & 3
2.	11/1/2022	1	Types of pavement	CoB-1,3 CO- 1,2	K2	Text Book 1 & 3
3.	12/1/2022	1	Functions of pavement components	CoB-1,3 CO- 1,2	K2	Text Book 1 & 3
4.	17/1/2022	1	Factors effecting pavement: Wheel load, tire pressure & contact pressure	CoB-1,3 CO- 1,2	K3	Text Book 1 & 3
5.	18/1/2022	1	ESAL & ESWL concepts	CoB-1,3 CO- 1,2	K3	Text Book 1 & 3
6.	19/1/2022	1	Strength characteristics of pavement materials	CoB-1,3 CO- 1,2	K2	Text Book 1 & 3
7.	24/1/2022	1	Traffic analysis, ADT & AADT	CoB-1,3,5 CO- 1,2	K3	Text Book 1 & 3
8.	25/1/2022	1	Problems on Contact pressure and tire Pressure concept	CoB-1,3 CO- 1,2	K2	Text Book 1 & 3
9.	31/1/2022	1	Problems on ESWL concept	CoB-1,3 CO- 1,2	K2	Text Book 1 & 3
10.	01/02/2022	1	Determination of elastic modulus of pavement layers	CoB-1,3,2 CO- 1,2	K3	Text Book 1 & 3

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.

3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak



## Gokaraju Rangaraju Institute of Engineering and Technology

### Department of Civil Engineering

## SCHEDULE OF INSTRUCTIONS UNIT PLAN

**Academic Year** : 2021-2022

**Semester** : II

**UNIT NO: 2**

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:**GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

S.No	Date	No. of Periods	Topics / Sub – Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References
1.	07/02/2022	1	Pavement Materials-Importance	CoB- 1,4 CO- 5,7	K1	Text Book 1 & 2
2.	08/02/2022	1	Aggregate properties and their importance	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2
3.	09/02/2022	1	Tests on aggregates	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2
4.	14/02/2022	1	Bitumen- Properties	CoB-1,4 CO- 1,5,7	K1	Text Book 1 & 2
5.	15/02/2022	1	Bitumen characteristics & applications	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2
6.	15/02/2022	1	Emulsions-Types and applications	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2
7.	16/02/2022	1	Bituminous mixes-Types	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2
8.	16/02/2022	1	Marshall method of mix design	CoB-1,4 CO- 1,5,7	K3	Text Book 1 & 2
9.	21/02/2022	1	Problems on volumetric analysis	CoB-1,3 CO- 1,2	K2	Text Book 1 & 2
10.	21/02/2022	1	Details of Marshall test	CoB-1,4 CO- 1,5,7	K2	Text Book 1 & 2

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.

2. Pavement Design – Yang H. Huang



## Gokaraju Rangaraju Institute of Engineering and Technology

### Department of Civil Engineering SCHEDULE OF INSTRUCTIONS UNIT PLAN

**Academic Year** : 2021-2022

**Semester** : II

**UNIT NO: 3**

**Name of the Program** : B.Tech **Year:** IV Year

**Section: A**

**Course/Subject** : Pavement Design

**Course Code:**GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

Lesson No.	Date	No. of Periods	Topics / Sub – Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References
1.	28/02/2022	1	Flexible Pavement stress analysis- Layers concept	CoB- 1,6 CO- 1,3,7	K2	Text Book 1 & 3
2.	01/03/2022	1	Boussinesq's theory and Problems	CoB-1,6 CO- 1,3,7	K3	Text Book 1 & 3
3.	01/03/2022	1	Burmister theory of pavement design	CoB-1,6 CO- 1,3,7	K3	Text Book 1 & 3
4.	02/03/2022	1	Determination of thickness of pavement	CoB-1,6,2 CO- 1,3,7	K3	Text Book 1 & 3
5.	07/03/2022	1	California bearing ratio method	CoB-1,6 CO- 1,3,7	K3	Text Book 1 & 3
6.	08/03/2022	1	Rigid pavement stress analysis- types of stresses	CoB-1,6 CO- 1,3,6,7	K2	Text Book 1 & 3
7.	14/03/2022	1	Design of joints in cement concrete pavements	CoB-1,6 CO- 1,3,7	K3	Text Book 1 & 3
8.	14/03/2022	1	IRC specifications of rigid pavement design	CoB-1,6 CO- 1,3,7	K1	Text Book 1 & 3
9.	15/03/2022	1	Design for slab thickness	CoB-1,3,2 CO- 1,3	K2	Text Book 1 & 3
10.	15/03/2022	1	Design of dowel bars	CoB-1,3 CO- 1,3	K2	Text Book 1 & 3

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.

3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak



## Gokaraju Rangaraju Institute of Engineering and Technology

### Department of Civil Engineering SCHEDULE OF INSTRUCTIONS UNIT PLAN

**Academic Year** : 2021-2022

**Semester** : II

**UNIT NO: 4**

**Name of the Program** : B.Tech

**Year:** IV Year

**Section:** A/B

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

Lesson No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References
1.	22/03/2022	1	Flexible pavement design-criteria	CoB- 1,3,6 CO- 1,3,4	K1	Text Book 1,3 & 4
2.	22/03/2022	1	IRC method of design-estimation of traffic (axle loads, traffic distribution)	CoB- 1,3,6 CO- 1,3,4	K3	Text Book 1,3 & 4
3.	28/03/2022	1	IRC method of design-pavement thickness and composition, Drainage measures	CoB- 1,3,6 CO- 1,3,4	K3	Text Book 1,3 & 4
4.	28/03/2022	1	Vehicle damage factor calculations	CoB- 1,3,6 CO- 1,3,4	K2	Text Book 1,3 & 4
5.	29/03/2022	1	Rigid pavement design-criteria	CoB- 1,3,6 CO- 1,3,4	K1	Text Book 1,3 & 4
6.	29/03/2022	1	IRC method of rigid pavement design	CoB- 1,3,6 CO- 1,3,4	K2	Text Book 1,3 & 4
7.	04/03/2022	1	PCA method of design	CoB- 1,3,6 CO- 1,3,4	K2	Text Book 1,3 & 4
8.	04/04/2022	1	Importance of joints in rigid pavements	CoB- 1,3,6 CO- 1,3,4	K1	Text Book 1,3 & 4
9.	05/04/2022	1	Types of joints, Use of tie bars and dowel bars	CoB- 1,3,6 CO- 1,3,7	K1	Text Book 1,3 & 4

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.

3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak

4. Highway and traffic Engineering-Subash Saxena

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**  
**SCHEDULE OF INSTRUCTIONS**  
**UNIT PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**UNIT NO: 5**

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:**GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

Lesson No.	Date	No. of Periods	Topics / Sub - Topics	Objectives & Outcomes Nos.	Blooms Taxonomy	References
1.	12/04/2022	1	Types of pavement construction, Preparation of sub-grade	CoB- 4,6 CO- 3,7	K1	Text Book 1,2 & 4
2.	12/04/2022	1	Construction of embankments & WBM roads	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
3.	18/04/2022	1	Construction of bituminous pavements-Interface treatment	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
4.	19/04/2022	1	Penetration macadam, Bituminous macadam & Bituminous concrete	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
5.	25/04/2022	1	Construction of built-up spray grout, premixed bituminous carpet	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
6.	26/04/2022	1	Construction of cement concrete roads- cement concrete slab	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
7.	26/04/2022	1	Construction of joints	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
8.	02/05/2022	1	Pavement failures- in Flexible, Rigid pavements	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4
9.	02/05/2022	1	Pavement evaluation- Benkelman Beam method	CoB- 4,6 CO- 3,7	K2	Text Book 1,2 & 4

**TEXT BOOKS:** 1. Highway Engineering-S.K. Khanna &C.E.G. Justo, Nemchand & Bros.

3. Principles of Pavement Design – E. J. Yoder, M. W. Witczak

4. Highway and traffic Engineering-Subash Saxena

Signature of HOD

Date:

Signature of faculty

Date:



**Gokaraju Rangaraju Institute of Engineering and Technology Department of  
Civil Engineering  
LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** B

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** :G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 1 **Duration of Lesson:** 1 hr

**Lesson Title:** Requirements of a pavement

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the functional and structural requirements of a pavement

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Road surface should be even along longitudinal profile to ensure safety and comfort.
- Structural strength of a pavement should be sufficient enough to sustain anticipated number of load repetitions.
- Sub-grade should be constructed well above the ground water level to keep the sub-grade relatively dry.

Assignment / Questions:

1.What are the various functional and structural requirements of a pavement?( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**GR14A4015 Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 2 **Duration of Lesson:** 1 hr

**Lesson Title:** Types of pavement

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the classification of pavements based on their structural behavior.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Classification mainly depends on the force transferring mechanism if we apply an external load onto pavement.
- Flexible Pavements- Grain to grain contact and area of load distribution increases as we move down towards sub-grade
- Rigid Pavements- Load distribution through flexure (slab action) and very high in flexural resistance.

**Assignment / Questions:**

1.What are the various types of pavement and the respective constituting materials?( CoB-1,3 : CO-1,2)

Signature of faculty





# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech      **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 3      **Duration of Lesson:** 1 hr

**Lesson Title:** Functions of pavement components

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.Understand the function of various pavement components such as sub-grade, base course & wearing course etc.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Sub-grade: Level of compaction of sub-grade should be determined from the relation between dry density and optimum moisture content.
- Sub-grade need to be evaluated for structural soundness before laying further layers.
- Base & Sub-base courses: Stress transmitting medium to spread the surface wheel load to prevent consolidated settlements.
- Wearing course: To provide a smooth and comfortable riding

Assignment / Questions:

1. Write about the tests to be performed on pavement components and their significance? ( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 4 **Duration of Lesson:** 1 hr

**Lesson Title:** Factors effecting pavement: Wheel load, tyre pressure & contact pressure

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.Understand and analyze various factors that effect pavement.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Standard axle loads for several roadways as per IRC and also traffic data are to be analyzed to fix the design wheel load.
- With constant tyre pressure the total load governs the stress on the top of sub-grade within allowable limits

Assignment / Questions:

1.What is the influence of tyre pressure and contact pressure on vertical stress distribution? Explain in detail.( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 5 **Duration of Lesson:** 1 hr

**Lesson Title:** ESAL & ESWL concept

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.convert all the loads into a particular standard axle load.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Indian road conditions speaks of variable traffic and vehicle. So, while designing a pavement, we need a common load to design for.
- We convert all the loads into a particular standard axle load, such that design will be easy. ( all other commercial vehicles into number of standard axles)

Assignment / Questions:

1.Draw the graph between ESWL and depth, both on log scale, when load is 'P' on each wheel , clear gap between wheels is 'd' and center to center spacing between wheels is 's'. ( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 6 **Duration of Lesson:** 1 hr

**Lesson Title:** Strength characteristics of pavement materials

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Evaluate pavement materials to use in different layers.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- California Bearing ratio test- to evaluate sub-grade soils for their suitability in pavement construction.
- Elastic moduli for sub-grade and base & sub-base courses using plate bearing test to find out the stresses under various loads.

**Assignment / Questions:**

1. What is displacement factor? Write down the factors that effect displacement factor.

( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 7 **Duration of Lesson:** 1 hr

**Lesson Title:** Traffic analysis-ADT & AADT

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Analyze traffic patterns over existing facilities and design new facilities such as intersections, signal timings etc.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Volume studies: Number of vehicles crossing a section of road per unit time in a selected period.
- Volume counts: Mechanical and Manual counts. Method of choice depends on parameter of interest.
- Average Daily Traffic and Annual Average Daily Traffic helps in deciding the relative importance of a route in phasing the road development programme.

**Assignment / Questions:**

1. Explain the term traffic volume. What are the objects of carrying out traffic volume studies?(CoB-1,3 : CO-1,2)

Signature of faculty



**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No: 1**

**Name of the Program** : B.Tech **Year:** IV Year

**Section: A**

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 8 **Duration of Lesson:** 1 hr

**Lesson Title:** Problems on contact pressure and tyre pressure concepts

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Analyze various factors that effect pavement

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Standard axle loads for several roadways as per IRC and also traffic data are to be analyzed to fix the design wheel load.
- With constant tyre pressure the total load governs the stress on the top of sub-grade within allowable limits

Assignment / Questions:

1. Given tyre pressure=0.56MPa and wheel load=40kN, then calculate the radius of contact area of tyre? ( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 9 **Duration of Lesson:** 1 hr

**Lesson Title:** Problems on ESWL concept.

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. convert all the loads into a particular standard axle load.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Indian road conditions speaks of variable traffic and vehicle. So, while designing a pavement, we need a common load to design for.
- We convert all the loads into a particular standard axle load, such that design will be easy. ( all other commercial vehicles into number of standard axles)

Assignment / Questions:

1. Calculate ESWL of a dual wheel assemble carrying 2004kg each for pavement thickness of 15,20,25cms. Centre to centre tyre spacing is 27cm and distance between the walls of the tyres is 11cm. ( CoB-1,3 : CO-1,2)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 1

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 10 **Duration of Lesson:** 1 hr

**Lesson Title:** Details of bitumen elastic modulus

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the factors which influence elastic modulus of bitumen.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Bitumen modulus of elasticity - Stress dependent value
- Visco-elastic property
- Temperature dependency
- Level of exposure to atmosphere

Assignment / Questions:

1.What is Visco-elasticity? Explain in detail.( CoB-1,3 : CO-1,2)

Signature of faculty





**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 1 **Duration of Lesson:** 1 hr

**Lesson Title:** Pavement Materials - Importance

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the role of materials in pavement construction.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Subgrade soil
- Stone Aggregates
- Bituminous Materials
- Bituminous paving mixes
- Cement Concrete

Assignment / Questions:

1. What are the desirable properties of subgrade soil? (CoB-1,4 : CO-4,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 2 **Duration of Lesson:** 1 hr

**Lesson Title:** Aggregate properties & their importance

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the engineering properties of aggregates and their role in road construction.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Strength
- Hardness
- Toughness
- Durability
- Shape of aggregates
- Adhesion with bitumen

Assignment / Questions:

1. Explain the desirable properties of aggregates to be used in different types of pavement construction. (CoB-1,4 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 3 **Duration of Lesson:** 1 hr

**Lesson Title:** Tests on aggregates

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Evaluate stone aggregates to decide the suitability for use in construction.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Crushing test
- Abrasion test
- Impact test
- Soundness
- Shape test
- Specific gravity and water absorption test
- Bitumen adhesion test

Assignment / Questions:

1. Discuss the objects of carrying out each of these tests and their advantages & limitations. (CoB-1,4 : CO-1,3)



**Gokaraju Rangaraju Institute of Engineering and  
Technology Department of Civil Engineering  
LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 4 **Duration of Lesson:** 1 hr

**Lesson Title:** Bitumen-Properties

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the properties of bitumen and its application in road construction. .

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Adequacy of viscosity at mixing and compaction
- Non-susceptibility to temperature
- Durability
- Adequate affinity and adhesion with aggregates.

Assignment / Questions:

1. Discuss the desirable properties of bitumen. Compare tar and bitumen. (CoB-1,4 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 5 **Duration of Lesson:** 1 hr

**Lesson Title:** Tests on Bitumen

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. evaluate bitumen for suitability in road construction.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Penetration tests
- Ductility tests
- Softening point test
- Viscosity tests
- Flash and Fire point test

Assignment / Questions:

1. What are the various tests carried out on bitumen? Briefly mention the principle and uses of each test. (CoB-1,4 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 6 **Duration of Lesson:** 1 hr

**Lesson Title:** Emulsions- Types & Applications

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand various types of emulsions and their uses in road construction.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Rapid setting (RS)- surface dressing
- Medium setting (MS) – Open grade aggregate premix
- Slow setting (SS) – Priming, fog seal, crack seal
- Surface treatments
- Tack coat & Prime coat

Assignment / Questions:

1. What are the functions of 'prime coat' 'tack coat' & 'seal coat' in bituminous construction?  
(CoB-1,4 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 7 **Duration of Lesson:** 1 hr

**Lesson Title:** Bituminous mixes-types

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know various types of bituminous mixes and also the properties & requirements of a good mix.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Premix carpet, surface dressing, Bituminous macadam, DBM, SDBM, BC etc
- Factors to be considered: Stability, Bitumen content, voids, flexibility, workability, economy.

**Assignment / Questions:**

1.What are the desirable properties of bituminous mixes? What are the steps in bituminous mix design? Discuss briefly.(CoB-1,4 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Date:** 01/02/2016

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 8 **Duration of Lesson:** 1 hr

**Lesson Title:** Marshall method of mix design

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the principles of Marshall method of mix design.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Density-Void analysis
- Stability-flow test
- Plots b/w %of bitumen and various parameters

Assignment / Questions:

1.Explain briefly the Marshall method of design. (CoB-1,4 : CO-1,3)

Signature of faculty





# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Date:** 02/02/2016

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 9 **Duration of Lesson:** 1 hr

**Lesson Title:** Details of Volumetric analysis

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Find out design parameters required for bituminous mix design.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Volume of VMA, compacted mix, VFA, air voids, asphalt, absorbed asphalt.
- Specific gravity of compacted mix
- Specific gravity of void less volume of paving mix.

Assignment / Questions:

1. The specific gravity of weight proportions of aggregate and bitumen are as under for the preparation of Marshall mix design. The volume and weight of one marshall specimen was found to be 475cc and 1100gms. Assuming absorption of bitumen in aggregate is zero, find  $V_v$ ,  $V_b$ , VMA & VFB. (CoB-1,3 : CO-1,2)

	A1	A2	A3	A4	B
Weight(gm)	825	200	325	150	100
S.G	2.63	2.51	2.46	2.43	1.05



**Gokaraju Rangaraju Institute of Engineering and  
Technology Department of Civil Engineering  
LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 2

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 10 **Duration of Lesson:** 1 hr

**Lesson Title:** Details of Marshall test

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the application of results of Marshall test in bituminous mix design

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Graphs: % of bitumen Vs stability, flow value, unit weight, % voids in total mix, VFB.
- Optimum binder content
- Minimum VMA
- Mixing and compacting temperatures
- Test procedure
- Marshall stability and Flow values

**Assignment / Questions:**

1. The results of Marshall test for 5 specimen are given below. Find the optimum bitumen content of mix. (CoB-1,4 : CO-1,5,7)

Bitumen content	Stability(kg)	Flow(units)	V <sub>v</sub>	VFB	G <sub>m</sub>
3	499.4	9.0	12.5	34	2.17
4	717.3	9.6	7.2	65	2.21
5	812.7	12.0	3.9	84	2.26
6	767.3	14.8	2.4	91	2.23
7	662.8	19.5	1.9	93	2.18



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 1 **Duration of Lesson:** 1 hr

**Lesson Title:** Flexible pavement stress analysis-Layer's concept

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the function of layers and their behavior under loads.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Load transferring mechanism in flexible pavement.
- Composition of layers
- Elastic moduli of different layers
- Material characteristics and boundary conditions
- Allowable deflections in sub-grade.

**Assignment / Questions:**

1. What are the different types of layers using in flexible pavement construction and what is their composition? (CoB-1,2 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 2 **Duration of Lesson:** 1 hr

**Lesson Title:** Boussinesq's theory and problems

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. find out stresses in pavement layers under different loading conditions.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Assumptions in Boussinesq's theory
- Vertical stress- Derivation : Under a point load
- Vertical stress- Derivation: Under uniformly distributed load over a circular area.

Assignment / Questions:

1. Calculate intensity of vertical pressure due to point load of 4200Kg at a depth of 4m from the surface and a distance of 2m from the axis of loading. (CoB-1,2 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Date:** 08/02/2016

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 3 **Duration of Lesson:** 1 hr

**Lesson Title:** Burmister theory of pavement design

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. find out stresses in pavement layers under different loading conditions.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Assumptions in Burmister's theory
- Multi-layer system- Methods of analysis
- Plate load test
- Derivation of expression for surface deflections

Assignment / Questions:

1. Calculate the rebound surface deflection on a single layer pavement under a wheel load of 40kN with a tyre pressure of 0.8MPa. The effective elastic modulus of subgrade may be taken as 40MPa and poisson's ratio of soil as 0.5

(CoB-1,2 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 4 **Duration of Lesson:** 1 hr

**Lesson Title:** Determination of thickness of pavement

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.find out the thickness of pavement when allowable deflections on sub-subsequent layers are known.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Allowable deflections
- Elastic moduli of different layers
- Thickness of pavement layers

Assignment / Questions:

1. Determine the required thickness of an airfield pavement based on Burmister's theory using the following plate load test data and input parameters.

Diameter of plate=75cm, pressure observed at 1.25mm deflection when the test conducted on subgrade=0.82Kg/cm<sup>2</sup> and on the base course of 16cm thickness=2.1Kg/ cm<sup>2</sup>, Design wheel load=23000Kg, Tyre pressure=15Kg/ cm<sup>2</sup> and the allowable deflection=0.125cm.

? (CoB-1,2 : CO-1,3)

Signature of faculty



**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 5 **Duration of Lesson:** 1 hr

**Lesson Title:** California Bearing Ratio method

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1..find out the thickness of pavement when CBR of sub-grade is known.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Standard proctor test
- Re-moulded sample
- Empirical design charts
- Estimation of traffic

Assignment / Questions:

1. From the results of CBR, a graph is plot between load & Penetration. Discuss about the shape of the graph and what it represents. (CoB-1,2 : CO-1,3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 6 **Duration of Lesson:** 1 hr

**Lesson Title:** Rigid pavement stress analysis- Types of stresses

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand different types of stresses in rigid pavements

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Wheel load stresses
- Frictional stresses
- Warping stresses
- Combined stresses at corner region

**Assignment / Questions:**

1. A cement concrete pavement of thickness 20cm rests over a WBM base course with modulus of reaction  $30 \text{ kg/cm}^3$ . Find the load stresses at the edge and corner regions under a wheel load of 5100kg unit IRC stress charts. Assume  $a=15\text{cm}$ ,  $E= 3 \times 10^5 \text{ kg/cm}^2$  and Poisson's ratio = 0.15.  
(CoB-1,2 : CO-1,3)

Signature of faculty





# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 7 **Duration of Lesson:** 1 hr

**Lesson Title:** Design of joints in cement concrete pavements

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.design various types of joints in cement concrete pavements.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Expansion joints
- Contraction joints
- Warping joints
- Spacing of joints

**Assignment / Questions:**

1. Determine the spacing between contraction joints for 3.5m slab width having thickness of 0cm and  $f = 1.5$ , for plain cement concrete, allowable  $S_c = 0.8 \text{ kg/cm}^2$  (CoB-1,6 : CO-1,3,7)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 8 **Duration of Lesson:** 1 hr

**Lesson Title:** IRC specifications of rigid pavement design

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the standard recommendations of IRC for design of concrete pavements.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Design wheel load
- Mean daily and annual temperatures
- Modulus of sub-grade reaction
- Flexural strength of cement concrete
- Calculation of stresses
- Design of other elements like joints.

Assignment / Questions:

1. Briefly outline the IRC recommendations for determining the thickness of cement concrete pavement. (CoB-1,6 : CO-1,3,7)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 9 **Duration of Lesson:** 1 hr

**Lesson Title:** Design of slab thickness

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. design the thickness of slab for cement concrete pavements.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Width of the slab
- Length of the slab
- Trial thickness-check for stresses
- Design thickness-traffic intensity

Assignment / Questions:

1. Discuss the critical combination of stresses due to wheel load and temperature effects.(CoB-1,6 : CO-1,3,7)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Date:**

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 10 **Duration of Lesson:** 1 hr

**Lesson Title:** Design of dowel bars

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. provide joints with dowel bar system.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Load transfer capacity of dowel bar
- Shear in the bar
- Bending in the bar
- Length of embedment of dowel bar
- Spacing of dowel bars

Assignment / Questions:

1. Design the CC pavement thickness, expansion and contraction joint spacing, dowel & tie bars for a wheel load of 5100kg. Assume all data suitably. (CoB-1,6 : CO-1,3,7)

Signature of faculty



## Gokaraju Rangaraju Institute of Engineering and Technology

### Department of Civil Engineering

## LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 1

**Duration of Lesson:** 1 hr

**Lesson Title:** Flexible pavement design criteria

### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the vital parameters in the design of flexible pavements.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Rutting due to permanent deformation in subgrade
- Rutting due to permanent deformation in bituminous layer
- Fatigue cracking in bituminous layer

Assignment / Questions:

1. What are the mechanistic parameters that control flexible pavement performance? (CoB-1,3,6 : CO-1,3,4)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 2 **Duration of Lesson:** 1 hr

**Lesson Title:** IRC method of design: Estimation of traffic

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. estimate the design traffic based on IRC method.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Commercial vehicles per day
- Traffic growth rate
- Design life
- Distribution of commercial traffic over the carriageway.
- Vehicle damage factor

Assignment / Questions:

1. Find out the design traffic in terms of cumulative number of standard axles. Annual growth rate=0.08, design life=15years, initial traffic=1259.7cvpd, LDF=0.75, VDF=3.5. (CoB-1,3,6 : CO-1,3,4)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 3 **Duration of Lesson:** 1 hr

**Lesson Title:** IRC method of design: Pavement thickness, composition and drainage measures

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. find out thickness of pavement using IRC method of design.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Subgrade-Dry density and CBR
- Sub-base – CBR
- Base course-composition
- Bituminous surfacing
- Thickness from design charts
- Drainage layer-Composition & standards

Assignment / Questions:

1. Design the pavement for construction of a new bypass with the following data.  $A=5600$  cvpd, 4 lane divided carriageway, design life=15 years, subgrade CBR=5%,  $r=8\%$ , VDF=4.5.  
(CoB-1,3,6 : CO-1,3,4)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 4 **Duration of Lesson:** 1 hr

**Lesson Title:** Vehicle damage factor calculations

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.find out the damage induced by one commercial vehicle on the pavement.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Total number of commercial vehicles
- Total number of standard axles

Assignment / Questions:

1. Derive the expression for the calculation of VDF. (CoB-1,3,6 : CO-1,3,4)

Signature of faculty





# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 3

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 5 **Duration of Lesson:** 1 hr

**Lesson Title:** Rigid pavement design criteria.

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. know vital parameters in the design of rigid pavements

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Rut resistant surface layer
- Fatigue resistant bituminous layer (bottom)
- Surface layer to delay top-down cracking

Assignment / Questions:

1. What are the mechanistic parameters that control flexible pavement performance?. (CoB-1,3,6 : CO-1,3,4)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 6 **Duration of Lesson:** 1 hr

**Lesson Title:** IRC method of rigid pavement design

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. design rigid pavements based on IRC method.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Design wheel load
- Mean daily and annual temperatures
- Modulus of sub-grade reaction
- Flexural strength of cement concrete
- Calculation of stresses
- Design of other elements like joints.

Assignment / Questions:

1.Design the pavement slab thickness by IRC method, using following data.

Modulus of subgrade reaction= $8\text{kg/cm}^3$ , Present traffic intensity= $1000\text{cvpd}$ , Design wheel load(P)= $5100\text{kg}$ , Radius of contact area= $15\text{cm}$ . (CoB-1,3,6 : CO-1,3,4)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR14A4015

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 7 **Duration of Lesson:** 1 hr

**Lesson Title:** PCA method of design.

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.design rigid pavement based on PCA method.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Differential temperatures
- Flexural strength of concrete
- Modulus of rupture value considering 28 days strength.
- Stress ratio factor

**Assignment / Questions:**

1. What is stress ratio factor? Explain about it.(CoB-1,3,6 : CO-1,3,4)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 8 **Duration of Lesson:** 1 hr

**Lesson Title:** Importance of joints in rigid pavements

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the function of joints in rigid pavements.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Spacing and layout
- Load transfer at Transverse joints

Assignment / Questions:

1. What will happen if we don't provide joints in rigid pavements? Explain in detail. (CoB-1,3,6 : CO-1,3,4)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 9 **Duration of Lesson:** 1 hr

**Lesson Title:** Types of joints

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the types of joints in rigid pavements.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Longitudinal & Transverse.
- Expansion joints – Maximum temperature variations
- Contraction joints – Frictional resistance, extent of reinforcement etc
- Warping joints

Assignment / Questions:

1. The width of the expansion joint gap is 2.5cm in a cement concrete pavement. If the laying temperature is 10°C, and the maximum slab temperature in summer is 54°C, calculate the spacing between expansion joints. Assume co-efficient of thermal expansion of concrete as  $10 \times 10^{-6}$  per °C. (CoB-1,3,6 : CO-1,3,4)

Signature of faculty



**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 4

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 10 **Duration of Lesson:** 1 hr

**Lesson Title:** Uses of tie-bars and dowel-bars.

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. understand the application of tie-bars and dowel-bars in rigid pavement construction..

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Dowel bars-Expansion joints
- Tie bars- Longitudinal joints
- Load transfer capacity of dowel bar
- Shear, bending in the bar
- Frictional force at slab bottom
- Length of embedment of dowel bar
- Spacing of dowel bars, Spacing of tie bars

Assignment / Questions:

1. Design the CC pavement thickness, expansion and contraction joint spacing, dowel & tie bars for a wheel load of 5100kg. Assume all data suitably(CoB-1,2 : CO-1,3)

Signature of faculty



**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**LESSON PLAN**

**Academic Year** : 2021-2022

**Date:** 24/03/2016

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 1 **Duration of Lesson:** 1 hr

**Lesson Title:** Types of pavement construction

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know different methods of pavement construction and factors that govern the design.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Earth and gravel roads
- Soil stabilized roads
- WBM roads
- Bituminous roads
- Cement concrete roads

Assignment / Questions:

1.What are the factors that affect the selection of materials for base course and surface course?  
(CoB-2,5 : CO-3,5)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Date:** 28/03/2016

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 2 **Duration of Lesson:** 1 hr

**Lesson Title:** Construction of embankments & WBM roads

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the method of construction of embankments & WBM roads.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Preparation of subgrade- soil compaction, gradation of aggregates, binding material, setting & drying.
- Embankment: Height, fill material, settlement, stability of foundations & stability of slopes
- Field control tests: Moisture content & dry density.
- WBM: Gradation requirements, Screenings, rolling, Lateral confinement, sprinkling and grouting, setting & drying, surface evenness, Rectification of defects.

Assignment / Questions:

1. Specify the materials required for construction of WBM roads. What are the uses and limitations of this type of road?(CoB-4,5 : CO-3,5)

Signature of faculty





# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 3 **Duration of Lesson:** 1 hr

**Lesson Title:** Construction of bituminous pavements-Interface treatment

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the methods of interface treatments .

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Prime coat
- Tack coat
- Bituminous surface dressing
- Seal coat

Assignment / Questions:

1. Write short notes on, Surface dressing and seal coat.CoB-4,5 : CO-3,5)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 4 **Duration of Lesson:** 1 hr

**Lesson Title:** Penetration Macadam, Bituminous Macadam & Bituminous Concrete

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.know the methods of construction of penetration macadam, bituminous macadam & bituminous concrete.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Specifications of materials – Gradation (MORTH)
- Preparation of existing layer
- Tack coat/ prime coat application
- Premix preparation
- Placement
- Rolling and finishing the paving mix

Assignment / Questions:

1.What are materials required, plants and equipment and construction steps for the following methods of bituminous constructions: Penetration macadam, bituminous concrete & Bituminous macadam. (CoB-4,5: CO-3,5)



**Gokaraju Rangaraju Institute of Engineering and  
Technology Department of Civil Engineering  
LESSON PLAN**

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech      **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 5      **Duration of Lesson:** 1 hr

**Lesson Title:** Construction of built-up spray grout, premixed bituminous carpet

**INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Understand the methods of construction of built-up spray grout & premixed bituminous carpet.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Specifications of materials – Gradation (MORTH)
- Preparation of existing layer
- Tack coat/ prime coat application
- Premix preparation
- Rolling and finishing the paving mix
- Surface finish
- Opening to traffic

**Assignment / Questions:**

1. What are the materials required, plants and equipment and construction steps for the following methods of bituminous constructions: built-up spray grout & premixed bituminous carpet.(CoB-2: CO-5)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 6 **Duration of Lesson:** 1 hr

**Lesson Title:** Construction of cement concrete roads-cement concrete slab

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Understand the construction techniques of cement concrete slabs.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Specifications of material
- Plants and equipment
- Construction steps : preparation of subgrade & subbase, placing of forms, batching of material & mixing, transporting and placing of concrete, compaction and finishing, belting, brooming & edging, curing of cement concrete.
- 

**Assignment / Questions:**

1. What are the advantages and drawbacks of cement concrete roads? Explain cement concrete slabs and their uses.

(CoB-4 : CO-3)



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 7 **Duration of Lesson:** 1 hr

**Lesson Title:** Construction of joints

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1.Understand various joints in cement concrete pavements and their methods of construction.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Types of joints
- Arrangement of joints
- Joint filler
- Joint sealer
- Reinforcement

Assignment / Questions:

1.Discuss the object of expansion and contraction joints.(CoB-4 : CO-3)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 8 **Duration of Lesson:** 1 hr

**Lesson Title:** Pavement failures-In flexible pavements

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Understand the types of failures and causes of failures in flexible pavements.

**TEACHING AIDS** : White Board, Marker

TEACHING POINTS :

- Failures in subgrade - inadequate stability, excessive stress application
- Failures in subbase or base course – loss of binding action, loss of base course materials, inadequate wearing course, lack of lateral confinement for the granular base course.
- Failure in wearing course

Assignment / Questions:

1. What are the various types of failure in flexible pavement? Explain the causes.. (CoB-4,5 CO-3,5)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 9 **Duration of Lesson:** 1 hr

**Lesson Title:** Failures in Rigid pavements

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Understand the types of failures and causes of failures in Rigid pavements.

**TEACHING AIDS** : White Board, Marker

**TEACHING POINTS** :

- Scaling of cement concrete
- Shrinkage cracks
- Spalling of joints
- Warping of cracks
- Mud pumping
- Structural cracks

**Assignment / Questions:**

1. Explain the various types of failures in cement concrete pavements and their causes.(CoB-4,5 : CO-3,5)

Signature of faculty



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### LESSON PLAN

**Academic Year** : 2021-2022

**Semester** : II

**Unit No:** 5

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**Lesson No:** 10 **Duration of Lesson:** 1 hr

**Lesson Title:** Pavement evaluation- Benkelman Beam method

#### **INSTRUCTIONAL/LESSON OBJECTIVES:**

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

1. Evaluate the existing pavements using Benkelman Beam apparatus.

**TEACHING AIDS** : White Board, Marker

#### **TEACHING POINTS :**

- Structural evaluation
- Functional evaluation
- Overlay design
- Benkelman beam : Function, Operation, Rebound deflection, Analysis of results

Assignment / Questions:

- 1.Explain the principle and uses of Benkelman Beam test. (CoB-4,5 : CO-3,5)





**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**EVALUATION STRATEGY**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

1. TARGET:

- a) Percentage for pass: 87%
- b) Percentage of class:

First class with distinction	47
First class	52
Pass class	32
Total strength	133

2. COURSE PLAN& CONTENT DELIVERY

- Total number of 57 lecture classes and 10 tutorial classes to impart theoretical and practical knowledge on pavement design & evaluation

**METHOD OF EVALUATION**

a.	Internal Examination	2
b.	Assignments/Quiz/Seminars	5
c.	Final Examination	1

### 3. METHOD OF EVALUATION

#### 3.1 Continuous assessment examinations:

**1. Assignments:** Assignments to assess the knowledge of student on numerical ability and logical thinking in solving practical problems of pavement design and evaluation.

**2. Internal Examinations:** Internal examinations to assess the overall knowledge of student on Pavement Design.

3.2 External Examination To test their ability in dealing with analytical concepts of Pavement Design and to approve their abilities learnt during the course.  
To test their ability in dealing with analytical concepts of Pavement Design and to approve their abilities learnt during the course.

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

- To introduce Falling Weight Deflectometer and its diverse uses in the pavement evaluation

Signature of HOD

Date:

Signature of faculty

Date:



**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Assessment in relation to CO's and COB's**

**Assessment:**

1. Assignment
2. Internal Examination
3. External Examination
4. Practical Projects
5. Viva

Course Outcomes	1	2	3	4	5
<b>Assessments</b>					
1	X				
2		X			
3			X		
4				X	
5					X

Course Objectives	1	2	3	4	5
<b>Assessments</b>					
1	X				
2		X			
3			X		
4				X	
5					X

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

**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

**Mappings of CO's, COB's Vs PO's, POB's**

**Course Objectives - Course Outcomes Relationship Matrix**

Course Objectives	Course Outcomes				
	1	2	3	4	5
1	X				
2		X			
3			X		
4				X	
5					X

Code	Subject	Course Outcomes	Programme Outcomes											P o s 1	P o s 2		
			a	b	c	d	e	f	g	h	I	j	K			l	
<b>III Year I Semester</b>																	
GR18A4067	<b>Pavement Analysis &amp; Design</b>	Illustrate highway design methods, constraints and controlling factors.	M	M	M	L		M	M	H		M		H	M		
		Apply the design standards in designing principal elements of the highway.	H	M	H	M		H	M			M		H		M	
		Predict the resource constraints and utilize the available	L	L	L	L		M	L	M	M	M	L	M	M		

		materials in a sustainable way.														
		Examine the basic parameter of traffic engineering and the methods which help to estimate those parameters.	H	H	M	H		L	L	M		M		M		M
		Recognize the major failure modes of flexible and rigid pavement and helps in maintaining them properly.	M	M	L	H		M	H	M	M	M	L	H	M	H



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

**Bachupally, Kukatpally, Hyderabad – 500 090. (040) 6686 4440**

**MAPPING**

GR18A4067/ Pavement Design	Course Outcomes				
Course Objectives	1	2	3	4	5
1	X				
2		X			
3			X		
4				X	
5					X

**Assessments**

1. Assignment 2. Internal Examination 3. External Examination
4. Practical Projects 5. Viva

GR18A4067/ Pavement Design	Course Outcomes				
Assessments	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X
4					
5					

GR18A4067/ Pavement Design	<b>Course Objectives</b>				
Assessments	1	2	3	4	5
1	X	X	X	X	X
2	X	X	X	X	X
3	X	X	X	X	X
4					
5					

## Rubric Template

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech

**Year**: III Year

**Section**: A

**Course/Subject** : Pavement Design

**Course Code** : GR18A4067

**Name of the Faculty** : G.Swetha

**Designation**: Assistant Professor

**Dept.:** Civil Engineering

		<b>Beginning</b>	<b>Developing</b>	<b>Reflecting Development</b>	<b>Accomplished</b>	<b>Exemplary</b>	<b>Score</b>
<b>Name of the Student</b>	<b>Performance Criteria</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>	
18241 A0117 CHAD A RUCHI TA	Level of knowledge on types of pavements and methods of design	Low level of knowledge on different pavements, and factors effecting the structural design.	Able to understand the types of pavement and methods of design	Ability to explain the basic difference between various pavements and their designing methods	Full knowledge on different types of pavements, the structural design methods and the data required for design.	Analyzing and application of knowledge on design methods in designing different layers of pavement.	
	Level of knowledge on characteristics of pavement materials and their optimum utilization	Low level of knowledge on characteristics of pavement materials and their optimum utilization	Able to understand the characteristics of pavement materials and their role in design.	Ability to apply the knowledge of materials in the design of pavement layers	Full Knowledge on material characteristics and optimum utility of materials in the design of pavements	Analyzing and application of knowledge on pavement materials in the design of different pavement layers in an optimum and sustainable manner	
	Level of knowledge on pavement evaluation and maintenance.	Low level of knowledge on methods of pavement evaluation	Able to understand the importance and methods of pavement evaluation.	Ability to apply the knowledge on pavement evaluation in evaluating existing pavements.	Full knowledge on methods of pavement evaluation and the need for periodical maintenance	Analyzing and application of knowledge in the functional and structural evaluation of pavements under various conditions to maintain it periodically	

**Objectives:** To learn the design and evaluation methods of pavements.



**Students Outcomes:** Learn application of design and evaluation methods including Indian Standards

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**COURSE COMPLETION STATUS**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech **Year:** IV Year **Section:** A&B

**Course/Subject** : Pavement Design **Course Code:** GR14A4015

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor **Dept.:** Civil Engineering

Actual Date of Completion & Remarks, if any

<b>Units</b>	<b>Remarks</b>	<b>No. of Objectives Achieved</b>	<b>No. of Outcomes Achieved</b>
Unit 1	Covered on time	1	1
Unit 2	Covered on time	2	2
Unit 3	Covered on time	3	3
Unit 4	Covered on time	4	4
Unit 5	Covered on time	5	5

Signature of HOD

Signature of faculty

Date:

Date:



**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**TUTORIAL SHEET - 1**

**Academic Year** : 2021-2022

**Date:**

**Semester** : II

**Name of the Program** : B.Tech **Year:** IV Year

**Section:** A

**Course/Subject** : Pavement Design

**Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**This Tutorial corresponds to Unit No. 1**

Q1. Write down a short note on types of pavements and the basic difference between them.

Q2. Estimate design traffic for a two lane road, when ADT=4000cvpd (two way), VDF=5, Design life= 15 years, Rate of growth= 7%.

Q3.A set of dual tyres has a total load of 4090kg, a contact radius of 11.4cm and a center to center spacing of 34.3cm. Find ESWL at a depth of 34.3cm.

Q4.Let number of load repetitions expected by 80kN standard axle is 1000, 160kN is 100 and 40kN is 1000. Find the equivalent axle load.

Objective Nos.: 1,3,5

Outcome Nos.: 1,2

Signature of HOD

Signature of faculty



Date:

Date:

**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**TUTORIAL SHEET - 2**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech **Year:** IV Year **Section:** A

**Course/Subject** : Pavement Design **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

**This Tutorial corresponds to Unit No. 2**

Q1. The results of Marshall test for 5specimen are given below. Find the optimum bitumen content of mix. (CoB-1,4 : CO-1,5,7)

Bitumen content	Stability(kg)	Flow(units)	V <sub>v</sub>	VFB	G <sub>m</sub>
3	499.4	9.0	12.5	34	2.17
4	717.3	9.6	7.2	65	2.21
5	812.7	12.0	3.9	84	2.26
6	767.3	14.8	2.4	91	2.23
7	662.8	19.5	1.9	93	2.18

Q2. Explain the desirable properties of aggregates to be used in different types of pavement construction

Q3. Explain briefly the Marshall method of design

Objective Nos.: 1,4

Outcome Nos.: 5,3

Signature of HOD

Signature of faculty

Date:

Date:



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### TUTORIAL SHEET - 3

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year**: IV Year      **Section**: A

**Course/Subject** : Pavement Design      **Course Code**: GR18A4067

**Name of the Faculty** : G.Swetha

**Designation**: Assistant Professor      **Dept.:** Civil Engineering

**This Tutorial corresponds to Unit No. 3**

Q1. What are the assumptions in the Boussinesq's theory? Derive the expression for Vertical stress in a soil mass.

Q2. Determine the required thickness of an airfield pavement based on Burmister's theory using the following plate load test data and input parameters.

Diameter of plate=75cm, pressure observed at 1.25mm deflection when the test conducted on subgrade=0.82Kg/cm<sup>2</sup> and on the base course of 16cm thickness=2.1Kg/cm<sup>2</sup>, Design wheel load=23000Kg, Tyre pressure=15Kg/cm<sup>2</sup> and the allowable deflection=0.125cm.

Q3. Calculate the rebound surface deflection on a single layer pavement under a wheel load of 40kN with a tyre pressure of 0.8MPa. The effective elastic modulus of subgrade may be taken as 40MPa and poisson's ratio of soil as 0.5.

Objective Nos.: 1,3

Outcome Nos.: 1,2

Signature of HOD

Signature of faculty



**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**TUTORIAL SHEET - 4**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

**This Tutorial corresponds to Unit No. 4**

Q1. Design the pavement slab thickness by IRC method, using following data.  
Modulus of subgrade reaction=8kg/cm<sup>3</sup>, Present traffic intensity=1000cvpd, Design wheel load(P)=5100kg, Radius of contact area=15cm.

Q2. What is stress ratio factor? Explain about it

Q3. Design the CC pavement thickness, expansion and contraction joint spacing, dowel & tie bars for a wheel load of 5100kg. Assume all data suitably

Objective Nos.: 1,3,5

Outcome Nos.: 1,3,4



# Gokaraju Rangaraju Institute of Engineering and Technology

## Department of Civil Engineering

### ASSIGNMENT SHEET – 1

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

This Assignment corresponds to Unit No. 1

Q1. Given tyre pressure=0.56MPa and wheel load=40kN, then calculate the radius of contact area of tyre?

Q2. The number of load repetitions by 80kN standard axle is 1000, 160kN is 100 and 40kN is 10,000. Find the equivalent number of standard axles?

Q3. Calculate ESWL of a dual wheel assemble carrying 2004kg each for pavement thickness of 15,20,25cms. Centre to centre tyre spacing is 27cm and distance between the walls of the tyres is 11cm.

Objective Nos.: 1,3,5

Outcome Nos.: 1,2

Signature of HOD

Signature of faculty

Date:

Date:

**Gokaraju Rangaraju Institute of Engineering and Technology**  
**Department of Civil Engineering**

**ASSIGNMENT SHEET – 2**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

This Assignment corresponds to Unit No. 2

Q1. What are the desirable properties of subgrade soil

Q2. What are the desirable properties of bituminous mixes? What are the steps in bituminous mix design? Discuss briefly

Q3. The specific gravity of weight proportions of aggregate and bitumen are as under for the preparation of Marshall mix design. The volume and weight of one marshall specimen was found to be 475cc and 1100gms. Assuming absorption of bitumen in aggregate is zero, find  $V_v$ ,  $V_b$ , VMA & VFB

	A1	A2	A3	A4	B
Weight(gm)	825	200	325	150	100
S.G	2.63	2.51	2.46	2.43	1.05

Objective Nos.: 1,3,4

Outcome Nos.: 1,5

Signature of HOD

Signature of faculty

Date:

Date:



## Gokaraju Rangaraju Institute of Engineering and Technology

### Department of Civil Engineering

### ASSIGNMENT SHEET – 3

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year**: IV Year      **Section**: A

**Course/Subject** : Pavement Design      **Course Code**: GR18A4067

**Name of the Faculty** : G.Swetha

**Designation**: Assistant Professor

**Dept.:** Civil Engineering

This Assignment corresponds to Unit No. 3

Q1. A semi-infinite soil mass is subjected to a stress under a circular plate having 15cm radius. The load intensity over the plate is 4000kg. Calculate the vertical stress in the soil under the axis of the circular plate at 2m depth.

Q2. Calculate intensity of vertical pressure due to point load of 4200Kg at a depth of 4m from the surface and a distance of 2m from the axis of loading.

Q3. Calculate the rebound surface deflection on a single layer pavement under a wheel load of 80kN with a tyre pressure of 0.7MPa. The effective elastic modulus of subgrade may be taken as 30MPa and poisson's ratio of soil as 0.4.

Objective Nos.: 1,2,3

Outcome Nos.: 1,3,5

Signature of HOD

Signature of faculty



**Department of Civil Engineering**

**ASSIGNMENT SHEET – 4**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor      **Dept.:** Civil Engineering

This Assignment corresponds to Unit No. 4

Q1. Design the pavement slab thickness by IRC method, using following data.

Modulus of subgrade reaction=8kg/cm<sup>3</sup>, Present traffic intensity=1000cvpd, Design wheel load(P)=5100kg, Radius of contact area=15cm.

Q2. What is stress ratio factor? Explain about it

Q3. Design the CC pavement thickness, expansion and contraction joint spacing, dowel & tie bars for a wheel load of 5100kg. Assume all data suitably

Objective Nos.: 1,2,3

Outcome Nos.: 1,3,5

Signature of HOD

Signature of faculty

Date:

Date

**Department of Civil Engineering**

**ASSIGNMENT SHEET – 5**

**Academic Year** : 2021-2022

**Semester** : II

**Name of the Program** : B.Tech      **Year:** IV Year      **Section:** A

**Course/Subject** : Pavement Design      **Course Code:** GR18A4067

**Name of the Faculty** : G.Swetha

**Designation:** Assistant Professor

**Dept.:** Civil Engineering

This Assignment corresponds to Unit No. 5

1. Discuss about joints and joint failures in rigid pavements?
2. Elaborate the Design of Overlay by Benkelman Beam method.

Objective Nos.: 1,2,3

Outcome Nos.: 1,3,5

Signature of HOD

Signature of faculty

Date:

Date

GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY(AUTONOMOUS)

DEPARTMENT OF CIVIL ENGINEERING

IV B.Tech. II Semester Mid - I Examinations

PAVEMENT DESIGN (PROFESSIONAL ELECTIVE VI)

Subject Code: GR18A4067

Date: 08/02/2022 Duration: 75 Min

SUBJECTIVE

Max Marks: 15M

(Answer Any Three Questions)

(3 X 5 = 15 Marks)

Question No.		Blooms Levels*	Course Outcome
1	a) What are the types of pavements? b) explain the functions of each component layers of flexible pavement with neat sketch ?	BL1 & BL2	CO1
2	Write any two test in aggregate.	BL3 & BL4	CO2
3	a) what any three assumptions of Boussinesq theory. b) Explain concept of One layer system- Boussinesq theory?	BL5 & BL6	CO3
4	a) what is wheel load? b) Explain about Marshall method of mix design.	BL2 & BL3	CO1 & CO2

**PAVEMENT DESIGN (PROFESSIONAL ELECTIVE VI)**

**Subject Code: GR18A4067**

**Date: 08/02/2022**

**Duration: 15 Min**

**OBJECTIVE**

**Max Marks: 5M**

**Name:**

**Roll No:**

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codes gives the

1. Which of the below IS recommended practice for construction of subgrade for road works?  
a) IRC 36 b) IRC 27 c) IRC 2 d) IRC 25
2. Clay soils are the best to prepare subgrade.  
a) True b) False
3. Which type of compaction roller is unsuitable for well-graded soils?  
a) Sheep foot roller b) Vibratory roller c) Power rammer d) Smooth wheeled roller
4. The \_\_\_\_\_ test can be conducted in-situ as well as in the laboratory.  
a) CBR b) Unconfined compression c) Triaxial d) Direct shear
5. In a rigid pavement, what type of traffic requires dry lean concrete as a base course?  
a) Very heavy b) Light c) Moderate d) No
6. Toughness is defined as the resistance to \_\_\_\_\_.  
a) Deformation b) Impact c) Abrasion d) Friction
7. Which type of bitumen has a volatile oil added to it?  
a) Bitumen emulsion b) Modified c) Cut-back d) Oxidised
8. Bitumen having a higher softening point is preferred in hot climates.  
a) True b) False
9. Burmister's method of pavement design is a type of \_\_\_\_\_ method.  
a) Empirical b) Analytical c) Semi-empirical d) Theoretical
10. The assumption of Boussinesq equation is that the soil is \_\_\_\_\_.  
a) non-homogeneous b) homogeneous c) plastic d) semi-plastic

**GOKARAJU RANGARAJU INSTITUTE OF ENGINEERING AND TECHNOLOGY(AUTONOMOUS)**

DEPARTMENT OF CIVIL ENGINEERING

IV B.Tech. II Semester Mid - II Examinations

**PAVEMENT DESIGN (PROFESSIONAL ELECTIVE VI)**

Subject Code: GR18A4067

Date: 06/05/2022 Duration: 90 Min

**SUBJECTIVE**

**Max Marks: 15M**

**(Answer Any Three Questions)**

**(3 X 5 = 15 Marks)**

Question No.		Blooms Levels*	Course Outcome
1	Illustrate about Rigid Pavement Design concepts using as per IRC.	BL2	CO3
2	Calculate the rebound surface deflection on a single layer pavement under a wheel load of 40kN with a tyre pressure of 0.8MPa. The effective elastic modulus of subgrade may be taken as 40MPa and poisson's ratio of soil as 0.5.	BL3	CO4
3	Discuss about joints and joint failures in rigid pavements?	BL5	CO5
4	Elaborate the Design of Overlay by Benkelman Beam method.	BL5	CO5

**PAVEMENT DESIGN (PROFESSIONAL ELECTIVE VI)**

**Subject Code: GR18A4067**

**Date: 06/05/2022**

**Duration: 10 Min**

**OBJECTIVE**

**Max Marks: 5M**

**Name:**

**Roll No:**

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1. The filler material must be inelastic in nature.  
a) True      b) False      (   )
2. The maximum spacing between the contraction joints in a reinforced cement concrete slab is \_\_\_\_\_  
(   )  
a) 15 cm      b) 15 m      c) 14 cm      d) 14 m
3. For finding the spacing between contraction joints in an RCC slab, it is assumed that the reinforcement takes up all the compressive force in the slab.      (   )  
a) True    b) False
4. How is the load transference generally provided in the contraction joints? (   )  
a) Reinforcement bars    b) Aggregate interlocking    c) Bitumen filler    d) Concrete strips
5. Along which direction are the expansion joints provided?  
a) Transverse    b) Longitudinal    c) With traffic    d) Opposing traffic      (   )
6. The maintenance works required on the rigid pavement is mainly in the \_\_\_\_ (   )  
a) Surface coating    b) Steel reinforcement    c) Joints    d) Slab surface
7. Which temperature stress is generally ignored in the design?      (   )  
a) Frictional stress    b) Interior stress    c) Edge stress    d) Corner stress
8. The ultraviolet rays from the sun make the pavement \_\_\_\_\_      (   )  
a) Brittle    b) Smooth    c) Soft    d) Rough
9. What is the main reason for the swelling of the pavement surface?      (   )  
a) Frost    b) Waterlogging    c) Sunlight    d) Chemicals
10. The test started from an initial point is stopped after \_\_\_\_\_ for intermediate deflection measurement.      (   )  
a) 3 m    b) 2.7 m    c) 8.7 m    d) 9 m

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**MID – I MARKS**

**SECTION- A,B**

<b>S.No</b>	<b>Reg No</b>	<b>Student Name</b>	<b>Objective Marks (5)</b>	<b>Subjective Marks (15)</b>	<b>Total Marks (20)</b>
1	17241A0153	SUJITH KUMAR SHINDE	3	3	3
2	17241A0157	VUPPULA MITHUNKUMAR Reddy	3.5	3	4
3	18241A0101	AJMEERA GANESH	AB	AB	AB
4	18241A0102	ANABOTULA SRAVANI	2	8	2
5	18241A0103	ANUMATLA MANOJ	3	11	3
6	18241A0104	BYNA RISHITHA	2.5	4	3
7	18241A0105	BURA THARASRI	2.5	6	3
8	18241A0106	PUDARI BADRINATH GOUD	3	1	3
9	18241A0107	BALASANI ROHITH	2	AB	2
10	18241A0108	BANDARI VEERASWAMY	2.5	10	3
11	18241A0109	BANDI VARUN KUMAR	3	1	3
12	18241A0110	BASHIPAKA PRADEEP	2	4	2
13	18241A0111	BATHULA NIKHIL	2.5	6	3
14	18241A0112	BATIKIRI VEERENDRA SWAMY	2.5	8	3
15	18241A0113	BHUKYA SOUJANYA	3	4	3
16	18241A0114	BHUKYA VARUN NAIK	3	11	3
17	18241A0115	BODDU PAVAN	1.5	9	2
18	18241A0116	BYAGARI RANGARAJU	2.5	5	3
19	18241A0117	CHADA RUCHITA	3	10	3
20	18241A0118	CHINTHAKUNTLA THRIVEEN	1	4	1
21	18241A0119	CV JASWANTH SURYA	1	3	1
22	18241A0120	DOSAPATI NISHU	3.5	12	4

23	18241A0121	G PRASHANTH	1.5	6	2
24	18241A0122	GADDIPATI LOHITHA	2.5	8	3
25	18241A0123	GANGAM ROHIT REDDY	2	1	2
26	18241A0124	GOTTEMUKKALA GOVARDHAN	4	2	4
27	18241A0125	HRISHIKESH BANSAL	1	4	1
28	18241A0126	JANAPATI RAJU	2.5	9	3
29	18241A0127	JYOTHIKA MANNAVA	2.5	12	3
30	18241A0128	K HARSHITHA REDDY	4	8	4
31	18241A0129	KOLAN RESHIKESH REDDY	3.5	2	4
32	18241A0130	KARRI BHARATH CHANDRA REDDY	4.5	4	5
33	18241A0131	KUPPALA NIHAR	3	7	3
34	18241A0132	KURVA LAVANYA	3	5	3
35	18241A0133	MADDIMSETTY SRI CHARAN	2	3	2
36	18241A0134	MAGANOR MANASWINI	3.5	13	4
37	18241A0135	MALOTH BHAVSINGH	3	6	3
38	18241A0136	MALOTHU NAVEENA	3	15	3
39	18241A0137	MANDA ITHIHAS	2	7	2
40	18241A0138	MOHAMMAD ASHFAQ AHMED	3	7	3
41	18241A0139	MOHAMMED OMER SHAREEF	3	12	3
42	18241A0140	MUKUNDU NAVEEN	AB	AB	AB
43	18241A0141	NALUMASU SAHITHI	1.5	6	2
44	18241A0142	NAMPELLY RAVI KUMAR	2.5	8	3
45	18241A0143	NARRA SHASHIDHAR REDDY	3	14	3
46	18241A0144	PATLOLA VINAY REDDY	2	2	2
47	18241A0145	Pattambetty Pavan Kumar	1.5	2	2
48	18241A0146	POLA THARUN	3	5	3
49	18241A0147	POSANI S V A KALYAN	2	6	2
50	18241A0148	pulle manichandra	3	6	3
51	18241A0149	RAJULAPATI ROHIT NAGA SAI	3.5	15	4
52	18241A0150	S Subbaram Reddy	3.5	2	4
53	18241A0153	SUNKARI VIKAS	3.5	7	4



54	18241A0154	THIRUPATHI RAO SALLA	3	15	3
55	18241A0155	Trivikram reddy	0.5	2	1
56	18241A0156	Trupthi shreya	2.5	3	3
57	18241A0157	Vakamalla Bhavya sree	3	14	3
58	18241A0158	Vemula Manisha	1.5	8	2
59	18241A0159	VUPPULA KEERTHANA	2.5	10	3
60	18241A0160	YALLA ANITHA	3	6	3
61	17241A0161	Abdul Samad	1.5	2	2
62	18241A0161	A NACHIKETH	1	4	1
63	18241A0162	ALETI JAGADISH	4	2	4
64	18241A0163	AMIRNENI ANUSHA	3	14	3
65	18241A0164	ANIREDDY AVINASH	2	10	2
66	18241A0165	ASHITHA GOLLA	2.5	5	3
67	18241A0166	ANIMESH BAATHUK	1	2	1
68	18241A0167	BOPPU LOKESH	2	6	2
69	18241A0168	BUDAGAM HARSHITH	1.5	2	2
70	18241A0169	CHILUMULA SRIDHAR	1.5	4	2
71	18241A0170	DANDRE VENNELA	1.5	10	2
72	18241A0171	DOTI UPENDER	2.5	6	3
73	18241A0172	EDA MANASA	2.5	10	3
74	18241A0173	GONDA HARSHINI	2	13	2
75	18241A0174	GORE KAMALAKAR SAILESH	1	5	1
76	18241A0175	GORE KAMALAKAR SANDEEP	0.5	4	1
77	18241A0176	GUDDATI ARUN	1.5	3	2
78	18241A0177	VIJAY NARASIMHA REDDY KOLAGTLA	1.5	4	2
79	18241A0178	KANCHARAKUNTLA DEEPIKA	1.5	8	2
80	18241A0179	KOTA RASHMITHA	1	1	1
81	18241A0180	KOTHURI PRANAY	3	9	3
82	18241A0181	KUDALA RAMA	1.5	9	2
83	18241A0182	KUMMARI SRILEKHA	3	15	3
84	18241A0183	KUNCHALA ADARSH	1	2	1
85	18241A0184	K.Neeraj Prasad	1.5	8	2
86	18241A0185	KYAMA PAVAN	3	4	3
87	18241A0186	M SHEKHAR	2	7	2
88	18241A0187	MALRAJ MANVITHA	4	15	4
89	18241A0188	MATHARASI SAI KUMAR	1.5	3	2
90	18241A0189	MD AMEER SOHAIL	3	7	3
91	18241A0190	MD AMIR	3	7	3
92	18241A0191	MEDARI VIKRAM ADITHYA	1.5	3	2

93	18241A0192	MEDIGA KARTHIK	2.5	7	3
94	18241A0193	SUNKARA MONIESH REDDY	3.5	2	4
95	18241A0194	KAUSHIK NADELLA	2.5	4	3
96	18241A0195	NIKHITHA KASUVOJULA	1.5	14	2
97	18241A0196	NUNAVATH SUMAN	2	4	2
98	18241A0197	POTHULAPALLY KISHOR	1.5	1	2
99	18241A0198	P.Spandana Reddy	2	5	2
100	18241A0199	PRATHYUSHA MADDALA	2.5	14	3
101	18241A01A 0	PRATYUSH BAVANARI	3	8	3
102	18241A01A 1	PUTTA ROHIT	1	1	1
103	18241A01A 2	RAHUL PRADHAN	3.5	4	4
104	18241A01A 3	RAMPELLI PRAVALIKA	2.5	7	3
105	18241A01A 4	RANGU SONIYA	3	11	3
106	18241A01A 5	RENTALA ADARSH REDDY	1.5	8	2
107	18241A01A 6	RITISH J	3	8	3
108	18241A01A 7	SEELAM RAHUL GOUD	3	3	3
109	18241A01A 8	SHAIK AFEEZ	1.5	6	2
110	18241A01A 9	SHAIK SHOAB	3	7	3
111	18241A01B 0	SHIVARATHRI SAI KUMAR	1.5	4	2
112	18241A01B 1	SHIVARATHRI THARUN	3	2	3
113	18241A01B 2	SOWMIKA BOYAPATI	2.5	7	3
114	18241A01B 3	VISHRUTH REDDY T N	1.5	8	2
115	18241A01B 4	TEKULA PRASHANTH REDDY	3	8	3
116	18241A01B 5	TEEGALA SOMESHWAR REDDY	3	11	3
117	18241A01B 6	THATIPAMULA VIGNA SAI	3	5	3
118	18241A01B 7	THOTA SRI SAI	1.5	7	2
119	18241A01B 8	VEDATI MANIKANTA KARTHIK	3	9	3

120	18241A01B 9	VALLAPU REDDY SUSHRUTHA	2.5	7	3
121	18241A01C 0	YANALA RITHISH REDDY	2.5	6	3
122	19245A0101	Kancherla Bharath	3	8	3
123	19245A0102	ELUPULA KUMARASWAMY	2	10	2
124	19245A0103	Brahmadevara bhavitha	2.5	15	3
125	19245A0104	Dasari namratha	2.5	9	3
126	19245A0105	T chandana	4	9	4
127	19245A0106	Kola.Haritha	2.5	14	3
128	19245A0107	CHOUGONI SHIVA SHANKAR	4	8	4
129	19245A0108	KOTA ANVESH	3	5	3
130	19245A0109	polagani Chandu goud	3	8	3
131	19245A0110	SADGARI KARTHIK	3	4	3
132	19245A0111	GUGULOTHU PAVAN	2.5	6	3
133	19245A0112	A RAGHAVENDRA	2.5	4	3

**Gokaraju Rangaraju Institute of Engineering and Technology**

**Department of Civil Engineering**

**MID – II MARKS**

**SECTION-A, B**

<b>S.No</b>	<b>Reg No</b>	<b>Student Name</b>	<b>Objective Marks (5)</b>	<b>Subjective Marks (15)</b>	<b>Total Marks (20)</b>
1	17241A0153	SUJITH KUMAR SHINDE	2	4	6
2	17241A0157	VUPPULA MITHUNKUMAR Reddy	2.5	9	12
3	18241A0101	AJMEERA GANESH	AB	AB	AB
4	18241A0102	ANABOTULA SRAVANI	1.5	4	6
5	18241A0103	ANUMATLA MANOJ	1.5	12	14
6	18241A0104	BYNA RISHITHA	2	8	10
7	18241A0105	BURA THARASRI	2.5	14	17
8	18241A0106	PUDARI BADRINATH GOUD	AB	AB	AB
9	18241A0107	BALASANI ROHITH	3	5	8
10	18241A0108	BANDARI VEERASWAMY	1.5	7	9
11	18241A0109	BANDI VARUN KUMAR	2	2	4
12	18241A0110	BASHIPAKA PRADEEP	2	8	10
13	18241A0111	BATHULA NIKHIL	2.5	3	6
14	18241A0112	BATIKIRI VEERENDRA SWAMY	2	10	12
15	18241A0113	BHUKYA SOUJANYA	1.5	12	14
16	18241A0114	BHUKYA VARUN NAIK	1.5	7	9
17	18241A0115	BODDU PAVAN	1.5	10	12
18	18241A0116	BYAGARI RANGARAJU	1.5	6	8
19	18241A0117	CHADA RUCHITA	1	7	8
20	18241A0118	CHINTHAKUNTLA THRIVEEN	1	5	6
21	18241A0119	CV JASWANTH SURYA	1	2	3
22	18241A0120	DOSAPATI NISHU	1	14	15

23	18241A0121	G PRASHANTH	0.5	4	5
24	18241A0122	GADDIPATI LOHITHA	2.5	12	15
25	18241A0123	GANGAM ROHIT REDDY	1	2	3
26	18241A0124	GOTTEMUKKALA GOVARDHAN	2.5	6	9
27	18241A0125	HRISHIKESH BANSAL	1.5	7	9
28	18241A0126	JANAPATI RAJU	2.5	12	15
29	18241A0127	JYOTHIKA MANNAVA	2.5	15	18
30	18241A0128	K HARSHITHA REDDY	2.5	11	14
31	18241A0129	KOLAN RESHIKESH REDDY	1.5	2	4
32	18241A0130	KARRI BHARATH CHANDRA REDDY	3	4	7
33	18241A0131	KUPPALA NIHAR	2.5	8	11
34	18241A0132	KURVA LAVANYA	1	7	8
35	18241A0133	MADDIMSETTY SRI CHARAN	2	6	8
36	18241A0134	MAGANOR MANASWINI	2	14	16
37	18241A0135	MALOTH BHAVSINGH	2	6	8
38	18241A0136	MALOTHU NAVEENA	2.5	13	16
39	18241A0137	MANDA ITHIHAS	0.5	7	8
40	18241A0138	MOHAMMAD ASHFAQ AHMED	1.5	6	8
41	18241A0139	MOHAMMED OMER SHAREEF	1	14	15
42	18241A0140	MUKUNDU NAVEEN	AB	AB	AB
43	18241A0141	NALUMASU SAHITHI	2	10	12
44	18241A0142	NAMPELLY RAVI KUMAR	2	13	15
45	18241A0143	NARRA SHASHIDHAR REDDY	2.5	7	10
46	18241A0144	PATLOLA VINAY REDDY	2	1	3
47	18241A0145	Pattambetty Pavan Kumar	2	5	7
48	18241A0146	POLA THARUN	1	7	8
49	18241A0147	POSANI S V A KALYAN	2.5	10	13
50	18241A0148	pulle manichandra	2.5	5	8
51	18241A0149	RAJULAPATI ROHIT NAGA SAI	2.5	15	18
52	18241A0150	S Subbaram Reddy	2.5	1	4
53	18241A0153	SUNKARI VIKAS	2	13	15
54	18241A0154	THIRUPATHI RAO SALLA	1.5	10	12
55	18241A0155	Trivikram reddy	1.5	4	6

56	18241A0156	Trupthi shreya	2.5	7	10
57	18241A0157	Vakamalla Bhavya sree	2	9	11
58	18241A0158	Vemula Manisha	2.5	10	13
59	18241A0159	VUPPULA KEERTHANA	3	10	13
60	18241A0160	YALLA ANITHA	0.5	6	7
61	17241A0161	Abdul Samad	0.5	2	3
62	18241A0161	A NACHIKETH	1.5	6	8
63	18241A0162	ALETI JAGADISH	0.5	7	8
64	18241A0163	AMIRNENI ANUSHA	1.5	14	16
65	18241A0164	ANIREDDY AVINASH	2	8	10
66	18241A0165	ASHITHA GOLLA	1.5	9	11
67	18241A0166	ANIMESH BAATHUK	1.5	3	5
68	18241A0167	BOPPU LOKESH	2.5	5	8
69	18241A0168	BUDAGAM HARSHITH	0.5	5	6
70	18241A0169	CHILUMULA SRIDHAR	2	9	11
71	18241A0170	DANDRE VENNELA	1.5	11	13
72	18241A0171	DOTI UPENDER	2.5	6	9
73	18241A0172	EDA MANASA	2	8	10
74	18241A0173	GONDA HARSHINI	3	8	11
75	18241A0174	GORE KAMALAKAR SAILESH	0.5	5	6
76	18241A0175	GORE KAMALAKAR SANDEEP	1.5	4	6
77	18241A0176	GUDDATI ARUN	1	4	5
78	18241A0177	VIJAY NARASIMHA REDDY KOLAGTLA	0.5	8	9
79	18241A0178	KANCHARAKUNTLA DEEPIKA	0.5	12	13
80	18241A0179	KOTA RASHMITHA	0.5	3	4
81	18241A0180	KOTHURI PRANAY	1	7	8
82	18241A0181	KUDALA RAMA	2	5	7
83	18241A0182	KUMMARI SRILEKHA	1	13	14
84	18241A0183	KUNCHALA ADARSH	2	2	4
85	18241A0184	K.Neeraj Prasad	0.5	2	3
86	18241A0185	KYAMA PAVAN	0.5	2	3
87	18241A0186	M SHEKHAR	1	4	5
88	18241A0187	MALRAJ MANVITHA	0.5	15	16
89	18241A0188	MATHARASI SAI KUMAR	1	2	3
90	18241A0189	MD AMEER SOHAIL	0.5	12	13
91	18241A0190	MD AMIR	1.5	9	11
92	18241A0191	MEDARI VIKRAM ADITHYA	1.5	4	6
93	18241A0192	MEDIGA KARTHIK	1	5	6
94	18241A0193	SUNKARA MONIESH REDDY	0.5	2	3
95	18241A0194	KAUSHIK NADELLA	2	3	5

96	18241A0195	NIKHITHA KASUVOJULA	2.5	11	14
97	18241A0196	NUNAVATH SUMAN	1.5	9	11
98	18241A0197	POTHULAPALLY KISHOR	1	2	3
99	18241A0198	P.Spandana Reddy	3	5	8
100	18241A0199	PRATHYUSHA MADDALA	2	7	9
101	18241A01A0	PRATYUSH BAVANARI	1.5	6	8
102	18241A01A1	PUTTA ROHIT	2	5	7
103	18241A01A2	RAHUL PRADHAN	2.5	6	9
104	18241A01A3	RAMPELLI PRAVALIKA	1.5	11	13
105	18241A01A4	RANGU SONIYA	2	11	13
106	18241A01A5	RENTALA ADARSH REDDY	2.5	12	15
107	18241A01A6	RITISH J	0.5	5	6
108	18241A01A7	SEELAM RAHUL GOUD	0.5	4	5
109	18241A01A8	SHAIK AFEEZ	0.5	6	7
110	18241A01A9	SHAIK SHOAB	0.5	8	9
111	18241A01B0	SHIVARATHRI SAI KUMAR	0.5	3	4
112	18241A01B1	SHIVARATHRI THARUN	2	1	3
113	18241A01B2	SOWMIKA BOYAPATI	0.5	10	11
114	18241A01B3	VISHRUTH REDDY T N	1.5	7	9
115	18241A01B4	TEKULA PRASHANTH REDDY	0.5	11	12
116	18241A01B5	TEEGALA SOMESHWAR REDDY	1	5	6
117	18241A01B6	THATIPAMULA VIGNA SAI	1.5	3	5
118	18241A01B7	THOTA SRI SAI	1	11	12
119	18241A01B8	VEDATI MANIKANTA KARTHIK	2.5	12	15
120	18241A01B9	VALLAPU REDDY SUSHRUTHA	1	10	11
121	18241A01C0	YANALA RITHISH REDDY	1	7	8
122	19245A0101	Kancherla Bharath	1.5	14	16
123	19245A0102	ELUPULA KUMARASWAMY	1.5	8	10
124	19245A0103	Brahmadevara bhavitha	1	15	16
125	19245A0104	Dasari namratha	2	13	15
126	19245A0105	T chandana	0.5	14	15
127	19245A0106	Kola.Haritha	1.5	13	15
128	19245A0107	CHOUGONI SHIVA SHANKAR	1.5	7	9
129	19245A0108	KOTA ANVESH	3	5	8
130	19245A0109	polagani Chandu goud	1	5	6
131	19245A0110	SADGARI KARTHIK	1.5	7	9
132	19245A0111	GUGULOTHU PAVAN	2	8	10
133	19245A0112	A RAGHAVENDRA	3.5	7	11



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(12 Pages)

**MID TERM EXAMINATION**

No.

939543

H.T. No.

18241A0125

Name of the Examination IV-Btech -II Sem Mid -I Examinations

Course B.tech

Branch Civil

Date 9/5/22

Signature of the Invigilator

Q.NO.	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS													

START WRITING FROM HERE

4.) Illustrate about wheel loads, Tire pressure, Contact pressure.

Ans:- wheel loads:-

\* wheel loads are the <sup>wheel</sup> loads applied on the pavements.

\* These are mostly taken into focus in slow running vehicles, i.e. during the time of traffic.

4/15



2.) Any two test of Aggregate  
pavement Design:-

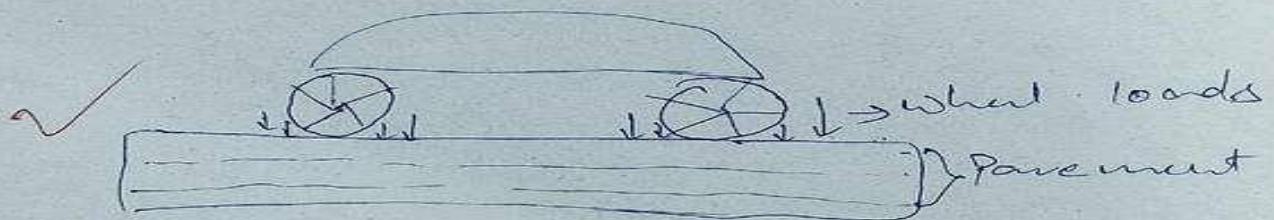
Aggregate Quality test:-

- \* It is very Important Test as the quality of the pavement should be the best and should be known before the laying down of pavement Design.
- \* The materials are taken to lab to check the quality.

Load Bearing Test:-

- \* It is the major Test required for the pavement Design.
- \* As one should the capacity the pavement should hold, in heavy traffic.
- \* In heavy traffic, the pavement should not Break down and cause problems.

- \* wheel loads are ~~high~~<sup>low</sup>, when the vehicle is moving fast.
- \* wheel loads are high, when, the vehicles running very slow in traffic.
- \* wheel loads are a reason for the pavement failures.
- \* These play a very significant role in affecting the pavement Design.



### Tyre Pressure:-

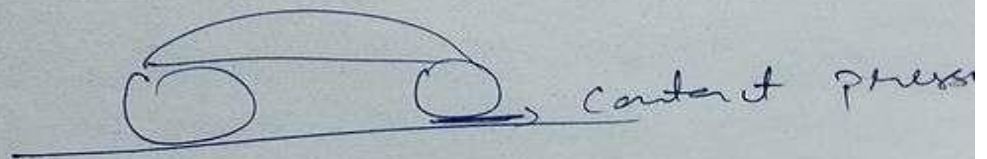
- \* Tyre pressure is a main indicator of loads on the pavements.
- \* less tyre pressure leads to more load on the pavement.
- \* Since less tyre pressure, leads to slow



- moving and more pressure on the tyres
- \* Tyres get flats, and hence leads to higher load on the roads.
  - \* Higher tyre pressure leads to less load on pavements, as the vehicle can move fast.
  - \* Therefore tyre pressure is very important in the pavement Design.

### Contact Pressure:-

- Contact pressure is the pressure which is obtained from the vehicle on specific pavement.
- \* It is very to calculate the contact pressure.
  - \* It is one of the important pressures to be taken note of.



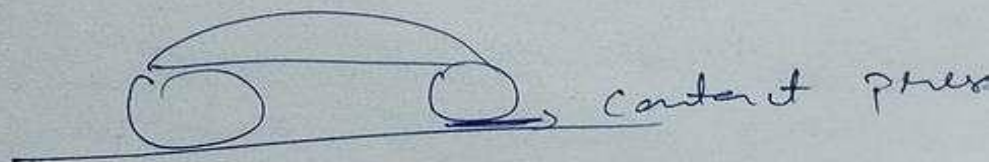
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I II **MID TERM EXAMINATION**

No. **419163** H.T. No. 1 9 2 4 5 A 0 1 0 6  
 Name of the Examination I-Mid Examination pavement design  
 Course Btech Branch Civil Engineering Date 8/03/22  
 Signature of the Invigilator

Q.NO.	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS													

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1A. factors affecting the pavement design are as follows.

14/15

(i) Subgrade strength

The strength of the subgrade of a pavement plays an

↳ important role.

→ If the strength or load bearing capacity of the subgrade is more the pavement has good strength.

→ The subgrade bearing capacity, is which the pavement design directly depends, Based on the soil bearing capacity the design is estimated.

⇒ The load from the surface is finally transferred to sub so it should be strong enough to transfer the load a larger area.

② Traffic  
The volume of the traffic also affects the design

pavement.

→ Based on the design the volume of traffic should flow if the traffic more than the designed volume of the traffic, it reduces its life span.

→ Traffic is directly in contact with the surface course, so it should be skid resistance and wear and tear of ~~car~~ wheels should be less.

③ Weather or climatic condition.

The surface course of pavement is directly exposed to the climatic condition.

→ The surface course must be designed in such a way that it should resist all the climatic conditions.

→ The rain water should be drained away.

④ Surface course

Surface course maintains direct contact with

wheels of a vehicle.

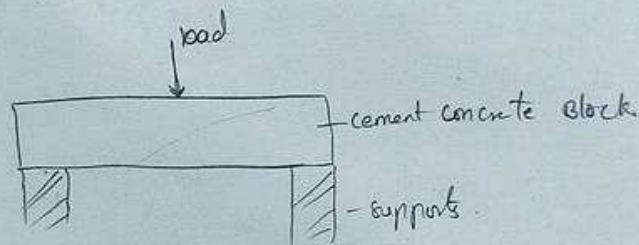
→ So the pavement design for surface course must be skid resistance.

→ less wear and tear of vehicular wheel.



- Rigid pavements are those pavements which are constructed or laid using cement concrete.
- So cement - the plate load test is done on cement concrete. because the strength of rigid pavements directly depends on the flexural or tensile strength of cement concrete block.

### Procedure



- A cement concrete block of certain dimension is prepared with design mix proportions of cement, sand, coarse aggregate with water.
- The block is then cured ~~for~~ at room temperature for 28 days.
- ⇒ Then the block is immersed in water for 28 days and then the block is ready for testing.
- The block is then cleaned and placed on the supports. (2 supports)

- The load on the block is applied.
- The load is constantly increased at a constant rate.
- The ~~failure~~ load is applied until the failure (Crack ~~or~~ -form of the block)
- The load at failure is noted.
- ⇒ Thus the flexural strength of concrete block is obtained.
- Based on the strength obtained the thickness of the pavement is ~~then~~ decided.
- Based on the strength, the volume of the traffic it can carry is calculated.

End





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I II

**MID TERM EXAMINATION**

No.

439599

H.T. No.

18 24 1 40 184

Name of the Examination IV B.Tech II Sem Mid-2 Examination

Course Pavement Design Branch Civil Engrg Date 7/5/22

Signature of the Invigilator

Q.NO.	1		2		3		4		5		6		TOTAL
	a	b	a	b	a	b	a	b	a	b	a	b	
MARKS													

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3) Joint means a load applied on slab is shared by adjacent slab for better performance.

Types:

→ Transverse joints: Expansion, contraction, Warping & construction joints

→ Longitudinal joints:

i) Expansion joints:

→ joints are provided to allow for expansion of slabs due to rise in slab temperatures.

#### 5. Mud Pumping:-

Excess water causes mud pumping in the rigid pavements.

#### 6. Spalling & Joints:-

Joints are broken due to expansion & contraction of slabs on the rigid pavements

#### 4) Design of Overlay by Benkelman Beam

##### method:-

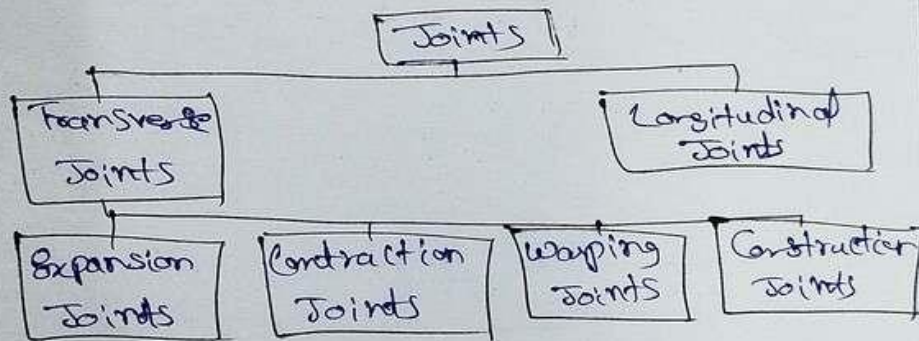
1. Benkelman Beam method is used to find the deflections on the flexible pavements.
2. When the flexible pavement undergoes over moving load, the deflections can be found and obtain design of overlay.
3. The following is the process for Design of overlay by Benkelman Beam method.

6. The Cement Concrete slabs are joined using joints.

7. There are two types of joints. They are:-

i) Longitudinal joints

ii) Transverse joints



8. Dowels and Ties are fixed to the joints.

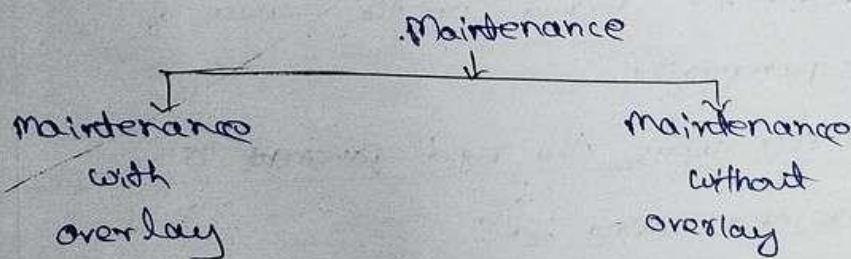
9. Dowels are fixed to Transverse joints.

10. Ties are fixed to longitudinal joints.



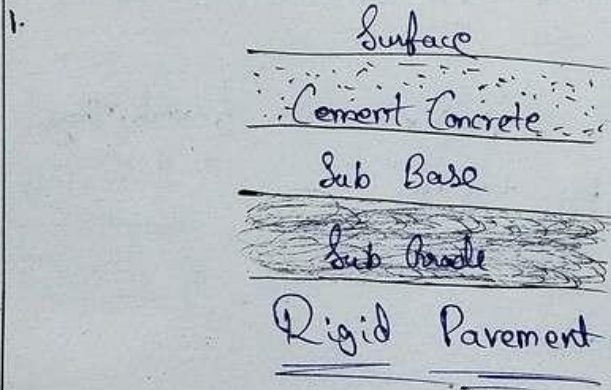
Process:-

1. Firstly, the pavement is checked properly and prepared to find the calculations.
2. All of the values are calculated with deflections
3. Two types of deflections are found. They are found by taking
  - i) Temperature deflections
  - ii) Traffic deflections
4. By calculating these deflections, we can design the overlay of the pavement.
5. Finally the overlay of the pavement is obtained.



6. In this way, Benkelman Beam method is used to design an overlay.

### i) Rigid Pavement Design using IRC



2. Firstly, the base is chosen
3. Then, surface type is selected and placed.
4. Cement Concrete is mixed in correct proportions based on the area of the pavement.
5. In this way, the rigid pavement is designed using IRC

