FACULTY OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF

CIVIL ENGINEERING

Marwadi University
Marwadi Chandarana Group

Pavement Engineering

01CI0619

Objective of the Course:

- To understand fundamentals of pavement structure.
- To learn different types of stresses in pavement layers.
- To explore the fundamentals of designing pavements.
- To explore the basics of pavement maintenance.

Credit Earned: 04

Student's learning outcomes:

After successful completion of the course, it is expected that students will be able to,

1. Interpret the characteristics of various construction materials of pavement.
2. Determine stress and strain in pavement structure with different loading conditions.
3. Evaluate pavement condition and suggest remedial measures for it.
4. Design pavement structure according to different conditions.

Teaching and Examination Scheme

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA (M)	CSE (I)	Viva (V)	Term Work (TW)	
03	01	00	04	50	30	20	25	25	150

Detailed Syllabus

Sr. No.	Title of the unit	Number of Hours
1	**Pavement Materials**	**08**
	1.1 Aggregates; Aggregate gradation and gradation parameters; Theories of aggregate blending, Aggregate shape and texture: quantification and importance; Aggregate strength properties, and relevant tests.	02
	1.2 Soil: Mechanical properties of soil	02
	1.3 Bitumen: Bitumen as a binding agent; Production of bitumen; Physical and rheological properties of bitumen, Chemistry of bitumen; Ageing of bitumen; Grading of bitumen, and relevant tests: Penetration grade, Viscosity grade, Performance grade;	04

	Bitumen modification: Need, Types and Importance; Introduction of bitumen emulsion and cutback: Types, Uses, and Application.	
2	**Bituminous Mixtures:**	**06**
	2.1 Production of bituminous mixtures: Laboratory and Plant; Role of bituminous mixture and desirable properties;	03
	2.2 Volumetric of bituminous mixture; Mix design of bituminous mixture: Marshall method.	03
3	**Design of Flexible Pavement**	**10**
	3.1 Layered system concepts, Stress solution for one, two- and three-layered systems, Fundamental design concepts	04
	3.2 Classification of axle types, standard and legal axle loads, tyre pressure, contact pressure, ESWL, EWLF and EAL concepts,	02
	3.3 Traffic analysis: ADT, AADT, truck factor, growth factor, lane distribution factor, directional distribution factor and vehicle damage factor, IRC – 37 2018 method of flexible pavement design,	04
4	**Design of Rigid Pavement**	**10**
	4.1 Westergaard's theory and assumptions, Stresses due to curling, stresses and deflections due to loading, frictional stresses,	04
	4.2 Stresses in dowel bars and tie bars	02
	4.3 IRC- 58 2015 method of plain jointed and continuously reinforced rigid pavement design.	04
5	**Construction and Maintenance of Pavement**	**08**
	5.1 Construction and preparation of subgrade, sub-base, base course, construction of bituminous layers, cement concrete surface course as per MoRT&H specifications,	04
	5.2 Introduction, factors affecting pavement deterioration, functional condition evaluation techniques, Types of Maintenance, IRC overlay design method	04
	Total	**42**

List of Tutorials

Sr No.	Topic Name	Hours
1.	To analyze two layers system with single wheel load in flexible pavement	02
2.	To analyze two layers system with single wheel load in flexible pavement	02
3.	To analyze temperature and wheel load stress in Rigid Pavement	02
4.	To analyze Stress in Flexible pavement using KENPAVE	04
5.	To analyze Strain in Flexible pavement using KENPAVE	04

Suggested Theory Distribution

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve an effective teaching-learning process

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
5%	10%	35%	30%	15%	5%

Instructional Method and Pedagogy:

1. At the start of course, the course delivery pattern, prerequisite of the subject will be discussed.
2. Lectures will be taken in class room with the use of multi-media presentations, white board– mix of both.
3. Attendance is compulsory in lectures and laboratory which carries a 5% component of the overall evaluation.
4. Minimum two internal exams will be conducted and average of two will be considered as a part of 15% overall evaluation
5. Assignments based on course content will be given to the students at the end of each unit/topic and will be evaluated at regular interval. It carries a weightage of 5%.
6. Surprise tests/Quizzes will be conducted which carries 5% component of the overall evaluation.

Recommended Study Material

1. Das, A**.** Analysis of Pavement Structures, CRC Press, Taylor and Francis Group, Florida, USA,2015.
2. S.K. Khanna and C.E.G. Gusto, A.Veeraragavan, Highway Engineering by Nem Chand and Bros, Roorkee.
3. Yoder, E.J. and M.W. Witczak, Principles of Pavement Design, Second Edition, John Wiley and Sons, New York, USA, 1975.
4. Pavement Design and Materials, Papagiannakis, A.T., Masad, E.A., Wiley, 2008, First Edition.
5. Croney, D. and P. Croney. The design and performance of road pavements, McGraw-Hill Book Company, London, UK, 1991.
6. IRC: 37-2018, Guidelines for the Design of Flexible Pavements, The Indian Roads Congress, New Delhi, India, 2018.
7. IRC:58-2015, Guidelines for the Design of Plain Jointed Rigid Pavements for Highways, The Indian Roads Congress, New Delhi, India, 2015.
8. MoRT&H specification