GUJARAT TECHNOLOGICAL UNIVERSITY

Program Name: Master of Engineering

Level: PG

Branch: Geotechnical Engineering

Subject Code: ME02076081

Subject Name: Pavement Analysis & Design

w.e.f.Academic Year:	2024-25
Semester:	2
Category of the Course:	Professional Elective Courses

Prerequisite:	Geotechnical Engineering and Fluid Mechanics.
Rationale:	The analysis and design of pavement requires in depth knowledge of pavement materials its characterization and testing methods relevant with latest codes. Pavement design based on its classification; Rigid and Flexible based on stress-strain development and fatigue conditions under various vehicular loads and geometrical/topographical conditions needs to be analysed and evaluated. Student will be able to design pavements, understand its behaviour and application of software's for pavement design, performance, life-cycle cost and sustainability.

Course Outcome:

After Completion of the Course, Student will able to:

No.	Course Outcomes
01	Understand various pavement material characterization techniques
02	Estimate the stresses and strains in rigid and flexible pavements under different wheel load configurations and other conditions
03	Design of flexible pavement using IRC, Asphalt Institute, MORTH and AASHTO methods.
04	Design a rigid pavement using IRC and AASHTO methods.

Teaching and Examination Scheme:

Teaching Scheme(in Hours)			Total Credits L+T+(PR/2)	Assessment Pattern and Marks				Total Marks
				Theory		Tutorial/Practical		
L	T	PR	C	ESE (E)	PA/ CA (M)	PA/CA(I)	ESE (V)	
3	0	2	4	70	30	20	30	150

Course Content:

Unit No.	Content	No.of Hours	% of Weightage
1.	Introduction: Types and component parts of pavements, Factors affecting design and performance of pavements. Highway and airport pavements, field CBR, field plate load test, modulus of sub grade reaction, Resilient modulus, Suitability of soil, Compaction equipment and Compaction Control.	07	20
2.	Stresses and strains in flexible pavements: Stresses and strains in an infinite elastic half space use of Boussinesq's equations - Burmister's two layer and three-layer theories; Wheel load stresses, various factors in traffic wheel loads; Equivalent single wheel load of multiple wheels. Repeated loads and EWL factors.	10	30
3.	Flexible pavement design methods for highways and airports: Empirical, semi-empirical and theoretical approaches; Development, principle, design steps of the different pavement design methods including AASHTO, Asphalt Institute, Shell Methods. IRC method of pavement design.	10	20
4.	Stresses in rigid pavements: Types of stresses and causes; Introduction to Westergaard's equations for calculation of stresses in rigid pavement due to the influence of traffic and temperature; Considerations in rigid pavement analysis, EWL; wheel load stresses, warping stresses, frictional stresses, combined stresses.	10	20
5.	Rigid pavement design: Design of cement concrete pavement for highways and runways; Design of joints, reinforcements, tie bars, dowel bars. IRC method of design; Design of continuously reinforced concrete pavements.	08	10
	Total	**45**	**100**

Suggested Specification Table with Marks (Theory):

Distribution of Theory Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
10	**20**	**25**	**25**	**10**	**10**

WhereR:Remember;U:Understanding;A:Application,N:AnalyzeandE:EvaluateC:Create(asperRevisedBloom'sTaxonomy)

References/Suggested Learning Resources:

(a) Books:

1. Atkins, N. Harold, Highway Materials, Soils and Concretes, Fourth Edition, 2002, Prentice Hall.
2. Yang H Huang - Pavement Analysis and Design, 2nd Edition, Pearson Education
3. Yoder.J. & Witzorac Mathew, W. Principles of Pavement Design, John Wiley & Sons Inc
4. Kerbs Robert D. and Richard D. Walker, Highway Materials, McGraw-Hill, Design of Functional Pavements, Nai C. Yang, McGraw Hill Publications
5. Relevant IRC codes and MORT&H manual.

(b) Open source software and website:

1. https://nptel.ac.in/courses/
2. https://ocw.mit.edu/courses/civil-and-environmental-engineering/

List of Experiments/ Tutorials:

1. Tutorial on Pavement materials and classification
2. Tutorial on Pavement classification /sections
3. Tutorial on Traffic Analysis recommended by IS code.
4. Tutorial on Pavement Design as per AASHTO/IRC/MORTH
5. Tutorial on Life cycle cost analysis and sustainability in pavement systems.

Suggested Project List: ---

Apart from above tutorials/experiments a group of students has to undertake one open ended problem/design problem. Few examples of the same are given below:

1. Design of Rigid and Flexible pavements using software's.

2. Survey of State/National Highways and their distress patterns.

3. Traffic survey for new proposed highways and its comparison.

Suggested Activities for Students: --- Refer periodicals/journals/handbooks and Visit to any material testing labs and Highway construction site visit.

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