Birla Institute of Technology & Science, Pilani
Hyderabad Campus

15-01-2022

SECOND SEMESTER 2021-2022

Course Handout Part II

In addition to Part-I (General Handout for all courses appended to the time table) this portion gives further specific details regarding the course.

Course No.	:	CE F244
Course Title	:	Highway Engineering
Instructor-in-Charge	:	Bandhan Bandhu Majumdar
Co-instructor	:	Prof. Sridhar Raju
Instructor	:	Vuthipalli Harshitha

1. SCOPE AND OBJECTIVES OF THE COURSE:

The growth of any country is measured by its transportation facilities through which economic, social, political and strategic developments take place. This course aims at providing a comprehensive insight of various elements of Highway transportation engineering. Topics related to the highway development, characterisation of different materials needed for highway construction, structural and geometric design of highway pavements along with the challenges and possible solutions to the traffic related issues will be covered as a part of this course.

2. Course Outcomes:

At the end of this course, the students will be able to:
CO1: Evaluate horizontal and vertical elements related to highway design.
CO2: Design flexible and rigid pavement as per latest Indian codes of practices
CO3: Estimate basic characteristics of traffic stream and conduct basic on-field traffic studies.
CO3: Conduct physical tests on aggregate, and bitumen, bitumen rheology and mix design using standard and advanced laboratory set-up.

Student Learning Outcomes (SLOs) assessed in this course – (a), (b), (c), (e), (f), (g), (h), (j), and (k).

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3. Textbooks:

T1. Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Engineering', Nem Chand & Bros. Revised Tenth Edition, 2018 (Reprint)

T2. Khanna, S.K, Justo, A and Veeraragavan, A, 'Highway Materials and Pavement Testing', Nem Chand & Bros., Fifth Edition, 2013

Reference books

R1. Kadiyali L R; Traffic Engineering and Transportation Planning; Khanna Publishers, New Delhi; 2003.

R2. Partha chakroborty and Animesh Das, Principles of Transportation Engineering, PHI, 2013

R3. Design Codes: Latest codes of IRC 37, IRC 58, IRC 81, MS 2 manual and other IS, MoRT&H Codes

R4. Kandhal, Prithvi Singh, Bituminous Road Construction in India, 2016, by PHI, **ISBN:** 978-81-203-5258-2

R5. Shell Bitumen Handbook. Sixth Edition

R6. Indo HCM 2017. Central Road Research Institute, New Delhi, India

4. Tentative Lecture Plan

Lecture No.	Topics to be covered	Learning Objectives	Chapter in the Text Book	SLO*
1	Introduction to highway engineering	To understand the basics of Highway engineering, planning and development	T1: Chapter-1 & 2	a
2	Physical Tests on aggregates	To learn about different physical tests on aggregates	T1: Chapters 6	a, b, c, d, e, f
3-4	Physical Tests on Bitumen and Bitumen Rheology	To test and evaluate physical and rheological properties of bitumen	T1: Chapters 6 and R5	a, b, c, d, e, f
5-7	Mixture Design by Modified Marshall's Method, Introduction to Superpave Mixture Design, Job Mix Formula	To design bituminous concrete mixtures and Superpave	T1: Chapters 6 and R5	a, b, c, d, e, f
8-10	Flexible Pavement Design using IRC codes	To design flexible pavements using IRC 37	T1: Chapter 7 and R3	a, c
11-13	Rigid Pavement Design using IRC codes	To design rigid pavements using IRC 58	T1: Chapter 7 and R3	a, c
14-16	Pavement Failure and Rehabilitation	To learn about flexible and rigid pavement distresses. To be able to design an overlay on a flexible pavement structure	T1: Chapter 7 and R3	a, c
17-18	Pavement construction	To learn about pavement construction techniques and equipment	T1: Chapter 7 and R4	a, c
19	Highway Planning	To know about details on highway planning	T1: Chapter 2	a, b, c, e
20	Factors affecting transportation	To learn about pavement construction techniques and equipment	T1: Chapter 2	a, b, c, e
21	Cross sectional elements	To know highway related cross sectional elements	T1: Chapter 4	a, b, c, e
22-23	Sight Distances	To design appropriate SSD, ISD and OSD	T1: Chapter 4	a, b, c, e

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24-25	Horizontal Alignment	To learn and apply different elements of horizontal alignment for highway design	T1: Chapter 4	a, b, c, e
26	Transition Curve	To know the theory and application of Transition curve in real field	T1: Chapter 4	a, b, c, e
27	Set Back Distance	To know the theory and application of Setback distance in real field	T1: Chapter 4	a, b, c, e
28-29	Vertical alignment	To learn and apply different elements of vertical alignment for highway design	T1: Chapter 4	a, b, c, e
30-32	Traffic Speed Flow Density	To learn the basic terms of traffic engineering, Establish relationship between Speed, Flow and Density	T1: Chapter 5 and R1	a, e
33	Spot Speed Study	To conduct spot-speed study and analyze results	T1: Chapter 5 and R1	a, e
34-36	Traffic Signal Design	To design Traffic Signals	T1: Chapter 5 and R1	a, e
37	Vehicle Arrival	To learn vehicle arrival and headway modelling	T1: Chapter 5 and R1	a, e
38	Intersections and Rotary	To know the basic elements of intersection and rotary	T1: Chapter 5 and R1	a, e
39-40	Capacity and Level of Service	To learn the method for estimation of Capacity and Level of service of highways	R6	a, e
41-42	Road Signs and Traffic Markings	To able to provide appropriate road signs and traffic markings	R3	h, k

***Student Learning Outcomes (SLOs):**

SLOs are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) An ability to apply knowledge of mathematics, science and engineering
(b) An ability to design and conduct experiments, as well as to analyze and interpret data
(c) An ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) An ability to function on multidisciplinary teams
(e) An ability to identify, formulate, and solve engineering problems
(f) An understanding of professional and ethical responsibility
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) A recognition of the need for, and an ability to engage in life-long learning
(j) A knowledge of contemporary issues
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

LABORATORY COMPONENT

EXPERIMENTS

Expt. No	Name of the Experiment	SLOs
E1	Determination of Abrasion and Crushing value of Aggregates	
E2	Determination of Flakiness and Elongation Index of Aggregates, determine Stripping	

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	Value of the Aggregates with and without anti-stripping agents	**b,c, f,g,k**
E3	To find the Specific Gravity and Impact Value of Aggregates	
E4	Spot Speed Study and traffic noise studies	
E5	Parking Inventory Study	
E6	To find Penetration, Softening Point and Specific Gravity of Bitumen samples	
E7	Determining ductility of bitumen and Elastic Recovery of a given modified bitumen	
E8	Preparation and Testing of Marshall's Samples for Mixture Design	
E9	Spot test and viscosity of bitumen using Brookfield rotational viscometer	
E10	Rheological studies using Dynamic Shear Rheometer - Part 1	
E11	Rheological studies using Dynamic Shear Rheometer - Part 2	
E12	Demonstration of Scanning Electron Microscope	

5. Evaluation Scheme:

Component	Duration	Weightage	Date & Time	Nature of Component
Midterm Test (including the laboratory portion)	90 Minutes	25%	15/03 11.00am to12.30pm	CB
Laboratory Experiments and related evaluation	Throughout the semester	15%	Continuous	OB
Assignments	Throughout the semester	5%	Continuous	OB
Term Project	Throughout the semester	5%	Continuous	OB
Quiz (only 2)	30 Minutes	10%	Will be announced	CB
Comprehensive Exam (including the laboratory portion)	120 Minutes	40%	17/05 AN	CB

6. Chamber Consultation Hour:

To be announced during the first class

7. Make Up Policy:

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- Make up requests received on social networking platforms / SMS / WhatsApp will be ignored and no further action is possible. Written makeup requests on the proforma available with the lab staff shall only be used
- Make up will be granted only for genuine reasons and will be considered on a case to case basis. However, prior permission is a must.
- For medical cases, a certificate from the concerned physician from the Medical Centre/hospital must be produced. In addition, copies of the prescription along with the medicine bills should be submitted as a proof.
- Made-up medical certificates / other proofs will be seriously considered and will be referred to disciplinary committee for further necessary action.
- Make up policy is applicable for Midterm and Comprehensive examinations and routine lab experiments only. All other components will not have any possibility of make-ups.

8. Academic honesty and academic integrity Policy:

Academic honesty and academic integrity are to be maintained by all of the students throughout the Semester and no type of academic dishonesty is acceptable.

9. Notices:

Notices, if any, concerning the course will be displayed through Google Classroom

INSTRUCTOR-IN-CHARGE
CE F244

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