



Birla Institute of Technology & Science, Pilani

Hyderabad Campus

ACADEMIC – GRADUATE STUDIES AND RESEARCH DIVISION SECOND SEMESTER 2022-2023 Course Handout Part II

Date: 16-01-2023

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 G518
Course Title : Pavement Analysis and Design
Instructor-in-Charge : Sridhar Raju

Course Description: Basic concepts in transportation planning, accessibility and mobility, land use interaction, government role in transportation planning. characteristics of travel and transport problems, transportation survey and data collection: planning, design and implementation, travel analysis zone (TAZ) development, traditional four-step modelling process, analysis of travel behavior and demand: studying travel behaviour, analysing urban travel markets; innovations in transportation modelling: travel behavior model, activity-based models. econometric modelling using r-studio, modelling travel demand with CUBE. Transportation Demand Management (TDM), Transportation System Management (TSM), Smart City Transportation Planning: Transit-Oriented Development (TOD), Pedestrian-Oriented Development, liveable street planning, multimodal transportation planning, shared mobility concepts, integrated transportation management and planning, transportation & energy, climate change, fuel choice and green mobility.

Scope and Objective of the Course:

This course primarily covers the analysis and design mechanisms for both flexible and rigid pavements in general. The multi-layer analysis for flexible pavements and slab analysis for rigid pavements structures will be covered with the relevant theory as well as software interfaces. The structural design of the pavements is usually dictated by the requirements of parameters related to traffic, foundation as well as environmental factors. Many International agencies like American Association of Highway Transport Officials (AASHTO), Asphalt Institute (AI), Australian Road Board (ARB), Portland Cement Association (PCA) along with Indian Roads Congress have introduced the necessary guidelines to design the pavement structures. Apart from the IRC guidelines, which are being followed throughout India, Mechanistic Empirical Pavement Design Guide, published by AASHTO for both flexible and rigid pavement structures has become an important standard to be followed throughout the World. In this direction, the course is planned with IRC and AASHTO guidelines for the design of pavements. In addition, course also deals with the prominent mechanisms available to design the structural overlays for the in-service failed flexible and rigid pavements. Drainage plays a very prominent role in up keeping the pavements in serviceable condition for long time. In this course, the drainage design will also be introduced to enable the student field ready.



Text Book(s)

T1. Yang H Huang (2010) Pavement Analysis and Design, Pearson, Prentice Hall, NJ, USA 2nd Edition

Reference Book(s)

- R1. E. J. Yoder, M. W. Witczak (2004) Principles of Pavement Design, 2nd Edition, Wiley International
 R2. Coleman O'Flaherty (ed.) (2015) Highways, The Location, Design, Construction and Maintenance of Road Pavements, ICE Publishing 5th edition, ISBN: 9780727759931
 R3. Rajib B. Mallick and Tahar El-Korchi, (2014) Pavement Engineering Principles and Practice, Second Edition, CRC Press.
 R4. Norbert J. Delatte, Concrete Pavement Design, Construction, and Performance, Second Edition, CRC Press.
 R5. Papagiannakis A T, Masad E A (2008), Pavement Design and Materials, Second Edition, John Wiley and Sons
 R6. ACI 325 – 12 R – 02, 2002, Guide for design of Jointed Concrete Pavements for Streets and Local Roads, American Concrete Institute, USA
 R7. Norbert J. Delatte, 2014, Concrete Pavement Design, Construction and Performance, 2nd edition, CRC Press
 R8. IRC 37-2012, IRC 58-2011, IRC 81-1997, IRC Sp 76 – 2015, MEPDG and other relevant codes of practices
 R9. AASHTO (2015) Mechanistic Empirical Pavement Design Guide – A Manual of Practice, USA, 2nd Edition
 R10. Pavement Drainage Theory and Practice by G L Sivakumar Babu, Prithvi S Kandhal, Nivedya Mandankara Kottayi, Rajib Basu Mallick and A Veeraragavan, CRC Press (2020).

Lecture No	Topics to be Covered	Learning Objectives	Reference
1-3	<u>Stresses and Strains in Flexible Pavements</u> : Homogeneous Mass; Layered Elastic Systems Viscoelastic Solutions	How to compute the stresses and strains at any point in a multi layered flexible pavement structure. Also should be able to identify locations where critical stresses and strains happen	Art 2.1 to 2.3 in T1 Chapter 3 in T1 for software
4-6	Stresses Due to Curling Stresses and Deflections Due to Loading Stresses Due to Friction Concept of Dowels and Joints	How to compute the stresses and strains at any point in a rigid pavement structure due to curling, loading and friction. Also should be able to learn the design concepts for dowel and tie bars	Art 4.1 to 4.4 in T1 Chapter 5 in T1 for software



7-8	<u>Traffic Loading and Volume for Pavement Design:</u> Equivalent Single-Wheel Load Equivalent Axle Load Factor Traffic Analysis and forecasting Design Traffic Estimation	How to arrive at a traffic load factor for the design of either flexible or rigid pavement. Should be able to forecast the traffic intensity for the chosen design period	Art 6.1 to 6.4 in T1
9-20	<u>Flexible Pavement Design:</u> IRC 37-2012 Method AASHTO MEPDG 2015 Method Design of Flexible Pavement Shoulders	Should be able to design a multi layered flexible pavement structure by IRC, AASHTO MEPDG Methods	Chapter 11 in T1 and relevant IRC, AASHTO codes of practices
21-30	<u>Rigid Pavement Design:</u> IRC 58-2011 Method MEPDG Method	Should be able to design a rigid pavement structure by IRC, AASHTO and MEPDG methods including low volume roads	Chapter 12 in T1 and relevant IRC, AASHTO codes of practices
31-40	<u>Overlay Design:</u> Types of overlay design methods IRC Method of flexible overlay design PCA Method of Overlay Design Rigid overlay design Thin white topping design with IRC: SP-76-2015	Should be able to design structural overlays for both flexible and rigid pavement structures as a rehabilitation process	Chapter 13 in T1 and relevant Codes of Practices
41-42	<u>Drainage Design :</u> Methods of controlling the water in pavements, Drainage design and drainage capacity computations	Should be able to design the drainage and also compute drainage capacity	Chapter 8 in T1 R10

Evaluation Scheme:

Component	Duration (mins)	Weightage (%)	Date & Time	Nature of Component
Midsem Test	90	25	13/03 2.00 - 3.30PM	OB
Assignments		15	Throughout the semester (4)	OB
Class Quizzes		15	Throughout the semester (2)	OB
Project work		10	TBA	OB
Compre Exam	180	35	09/05/2023 FN	OB



Chamber Consultation Hour: Wednesday 4 to 6 PM

Notices: Students are advised to look for notices in their respective CMS. Important notices will be put up in the Civil Engineering Department's notice board also.

Make-up Policy:

- Make up requests received on social networking platforms / SMS / WHATSAPP etc will be ignored and no further action will be initiated. Written makeup requests shall only be used to apply for makeups
- 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 should be submitted as a proof. Hostel office / warden / chief warden should certify that they have the information regarding the illness of the applicant.
- 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 Mid-semester test and the comprehensive examinations only. Other listed components will not have any scope for make-ups.

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. Students are encouraged to **use anti-plagiarism software** to check reports before submission.

INSTRUCTOR-IN-CHARGE
CE G518

