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Birla Institute of Technology & Science, Pilani
Hyderabad Campus

FIRST SEMESTER 2021-2022
Course Handout Part II

Date:10.08.2021

In addition to part-I (General Handout for all courses appended to the timetable), this portion gives further specific details regarding the course.

Course No.	**:** CE G534
Course Title	: Pavement Material Characterization
Instructor-in-charge	: V. VINAYAKA RAM

1. Scope & Objective of the course:

This course aims at introducing the fundamental concepts as well as the advancements in the domain of pavement materials. A wide coverage of laboratory and field investigations of soil, aggregate, straight run and modified bituminous binders, bituminous emulsions and cement concrete will be done during this course. Viscosity and superpave grading of bituminous binders will be highlighted along with other rheological investigations being carried out on the bituminous binders. Marshall's and Superpave mix design along with other performance tests such as resilient modulus, dynamic modulus, creep tests, 4-point bending fatigue test, Hamburg wheel tracking rutting test etc. will be covered in detail during this course. Pavement Quality Concrete mix design along with the tests on join sealants will be dealt in detail. Use of aggregated derived from Reclaimed Asphalt Pavement (RAP), Construction and Building demolition derived aggregates, fly ash, GGBS and other locally available and marginal materials will also be dealt during this course. The importance of chemical and mineral admixtures will also be dealt as a part of this course.

2. Reference Books

R1: Bituminous Road Construction in India, by Prithvi Signh Kandhal PHI, 2016

R2: Advances in Asphalt materials – Road and Pavement construction by Shin Che Huang and Herve Di Benedetto, Woodhouse Publishing, 2015

R3: The Shell Bitumen Handbook, by Robert Hunter, Andy Self and John Read, Sixth Edition, Shell Bitumen by ICE Publishing, London, 2015.

R4: Properties of Concrete by A.M. Neville, 5th Edition, Pearson Publications, 2012

R5: Highway Material Testing Laboratory Manual by Khanna S. K., Justo, C.E.G and Veeraragavan, A., Nem Chand & Bros.

R6: Relevant BIS, IRC, MoRT&H, AASHTO, ASTM and other relevant standards and codes of practices

Lecture No.	Topics to be covered	Learning Objectives	Reference
1-2	Soil as a subgrade, Flyash as an embankment and application of Geo-synthetics in pavement engineering	Overview of soils as subgrade material, grain size distribution, Density and CBR, modulus of subgrade reaction, Soil stabilization concepts, use of Fly ash as an embankment material, introduction to the application of Geo-synthetics in pavement engineering	R5 -Ch6
3-5	Aggregates and alternatives	Definition, strength, shape and stripping parameters of aggregates and their significance on pavement performance. Use of slags as alternative road construction materials	R1-Ch2
6-15	Straight run and modified bituminous binders	Bitumen Origin, Importance and functions of binders, tests on straight run and modified bituminous binders as per IRC, BIS, AASHTO and ASTM standards. Penetration, Viscosity and Superpave grading systems. Crumb Rubber Modified Bitumen, Polymer Modified Bitumen, Natural Rubber Modified Bitumen and Waste Plastic Modified Bitumen (dry and wet processes); Rheological characterisation of bituminous binders – Rotational viscometer (RV), Dynamic shear rheometer (DSR) - Performance grading, Multi stress creep and recovery (MSCR) testing protocols	R1-Ch2

16-18	Performance Tests on Bitumen for PG grading as per Super-Pave Protocols	Significance of binder aging, Aging simulation tests viz. Rolling thin film oven (RTFO), Pressure aging vessel (PAV); Performance testing methods viz. Bending beam rheometer (BBR)	Super Pave Series 1 (SP-1)
19-20	Straight Run Bitumen Emulsions and Polymer Bitumen Emulsions	Introduction to emulsions; application of emulsions for slurry seal and micro-surfacing as surface maintenance treatment.	R1-Ch4
21-25	Marshall's and Super Pave Mix Designs	Bituminous Mix Design as per Asphalt Institute Manual Series 2 (MS-2) and Super Pave Series 2	MS-2 and SP-2
26-30	Performance Tests on Bituminous Mixes	Rutting Tests, Fatigue Tests, Dynamic Modulus Tests, moisture resistance tests and the microstructural investigations	R1-Ch3
31-33	Special Mixes and Alternative materials	Stone Matrix Asphalt, Porous Asphalt, Warm Mix Asphalt, Half Warm Mix Asphalt and RAP based mixes	R1-Ch4
34-39	Cement and Cementitious Materials, Cement Concrete Mix Design	Concrete Mix Design for Road works as per IRC: 15-2011, IRC:44-2008, materials and mix design for low volume roads IRC: SP: 62-2014	R6
40-42	Cement concrete pavement Joints sealants and dowel bars	Testing of sealants, testing of Dowel bars, polythene sheets, materials for low volume roads IRC: SP: 62-2014	R4, R6

Note: Laboratory part includes tests on bitumen, aggregates and bituminous concrete mixtures and a few projects will be given involving the tests.

3. Course Plan:

4. Evaluation Scheme:

S.No.	Evaluation Component	Duration (Min)	Weightage (%)	Date & Time	Remarks
1	Mid semester Examination	90 min	25		CB
2	Comprehensive Examination	180 min	35		CB
3	Lab based Projects and Presentations	-	15	Throughout the semester	OB
4	Term Paper and Presentations	-	15	Throughout the semester	OB
5	Take home Assignments	-	10	Throughout the semester	OB

5. **Chamber Consultation Hour:** Will be announced during the first session

6. **Notices:** Notices will be displayed on CMS / Course Google class room

7. **Make Up Policy:**

- Make up requests received on social networking platforms / SMS / WhatsApp will be ignored and no further action is possible. Written makeup requests through email with the necessary proofs only will be accepted
- 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 referred to disciplinary committee for further necessary action.
- Make up policy is applicable for Midterm and Comprehensive examinations 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. Students are encouraged to use anti-plagiarism software to check reports before submission.

9. Notices:

Notices, if any, concerning the course will be displayed on the notice board of Civil Engineering Department and CMS

INSTRUCTOR-IN-CHARGE
CE G534