

Course Book

Course Description	<p>Progressive development, new initiatives and government directives to reduce fuel energy consumption in buildings by incorporating sustainable and energy efficient features is included. In support of these environmental issues, the companion volume Building Services Handbook should be consulted for applications to energy consuming systems, their design and incorporation within the structure.</p> <p>The diverse nature of modern construction practice, techniques and developments with new and synthetic materials cannot be contained in this subject alone. The content is therefore intended as representative and not prescriptive. Further reading of specific topics is encouraged, especially through professional journals, trade and manufacturers' literature, illustrative guides to the Building Regulations and the supplementary references given hereinafter.</p>			
Course objectives	<p>This course is prepared to provide a comprehensive understanding of the main principles of road design in such a way that the tutees will gain theoretical and practical experience for planning, designing, and implementing road related issues in real world application .</p>			
Student's obligation	<p>Missed classes will not be compensated including the quizzes and the scheduled assignments. The students will lose marks on unattended classes with quizzes unless a legal document or authorized leave is presented which should explain the excuse of the absence. However, the absent student should take the responsibility for making up the missed lecture.</p>			
Required Learning Materials				
Evaluation	Task	Weight (Marks)	Due Week	Relevant Learning Outcome
	Paper Review			

	Assignments	Homework	10%		
		Class Activity	2%		
		Report	8%		
		Seminar	8%		
		Essay			
		Project			
	Quiz	8%			
	Lab.				
	Midterm Exam	24%			
	Final Exam	40%			
	Total	100%			
Specific learning outcome:	<p>This Topic partly based on the scientific Road Engineering theories, on the latest approaches to Road Construction and Asphalt Technology, on the road problems observed in the tropics, and mostly on the results monitored during more than 15 years in the Netherlands. These factors are linked as much as possible to better understand road construction problems, and at the same time emphasize the techniques which are also applicable for the tropics. By using common explanations, and summarising short texts and many figures, the author* has tried to make the asphalt technology, as well as the road engineering easier to understand, bridging science and practice. Complicated formulas are avoided as much as possible, and only what is necessary is presented. This Topic is meant as a guide for improving Road Engineering in the tropics, at university level as well as in the field.</p>				
Course References:	<p>1-Asphalt Technology Integrated into Road Engineering for the Tropics .Bridging science and practice .By Associate Prof. Dr. Ir. Hendro SUBROTO, MSc., PhD. 2-ASPHALT TESTING LABORATORY MANUAL QATAR UNIVE RSITY DEPARTMENT OF CIVIL & ARCHITECTURAL ENGINEERING</p>				

**3-An Introduction to Asphalt Pavement Construction
.by John E. Kristensen PE., PLS., PMP**

Course topics (Theory)	Week	Learning Outcome
Introduction		
I. Asphalt Technology	1-4	
I.1. Bitumen		
I.1.1. Chemical Components		
I.1.2. Mechanical Behaviour of Bitumen		
I.2. Asphalt Mixtures		
I.2.1. Structure		
I.2.2. Mechanical Behaviour of Asphalt Mixtures		
I.3. Asphalt Mixtures in Road Construction		
I.3.1. Functions of Asphalt Mixtures in Road Construction		
I.3.2. Examples of Asphalt Mixtures		
I.4. Effects of Vibrations, High Stiffness and Shear on Asphalt Mixtures		
I.4.1. Effects of Vibrations		
I.4.2. Effects of High Stiffness (C-Fix, PMB, PR and Combi-Surf)		
I.4.3. Effects of Shear		
II. Asphalt Techno-Road Construction Design		
II.1. Theoretical Approach	5-8	
II.1.1. Construction Structure and Gradation of the Layers		
II.1.2. Stresses and Strains and Mohr's Circle		
II.1.3. Stepwise Downsizing of the Asphalt Layers Upwards		
II.2. Data for Construction Calculation		

II.2.1. Traffic		
II.2.2. Subgrade		
II.2.3. Applicable Materials for Base and Subbase Layers		
II.3. Construction Calculation Using Software		
II.3.1. BANDS 2.0		
II.3.2. SPDM 3.0		
II.3.3. BISAR 3.0		
II.4. Drainage and Maintenance		
II.4.1. Drainage		
II.4.2. Maintenance (small and big repair/reconstruction)		
III. Upgrading and Testing Asphalt Mixtures	9-12	
III.1. Theoretical Approach		
III.2. Examples - Upgrading Stone Mastic Asphalt (SMA)		
III.2.1. MODUS		
III.2.2. DESA		
III.3. Testing Asphalt Mixtures		
III.3.1. Marshall		
III.3.2. Four-Point Bending (4PB)		
III.3.3. Rolling Bottle		
III.3.4. Deflection (FWD)		
IV. Implementation in Tropical Road Engineering	13-16	
IV.1. Implementation		
IV.2. Quality Controlled Road Engineering		
IV.3. Example of Calculation and Application		

Course topics (Practical)	Week	Learning Outcome
DUCTILITY TEST OF BITUMINOUS MATERIALS	1	
PENETRATION OF BITUMINOUS MATERIALS	2	
SOFTENING POINT OF BITUMENT	3	
FLASH & FIRE POINTS TEST	4	
PREPARATION OF SPECIMENS FOR MARSHALL TEST	5,6,7	
FIELD SAMPLING BITUMINOUS MATERIAL AFTER COMPATION (OBTAINING CORES)	8	
ASPHALT EXTRACTION TEST	9	
ABRASION OF SURFACING AGGREGATES	10	
AGGREGATE IMPACT VALUE TEST	11	
AGGREGATE BLENDING TEST	12	

Questions Example Design

Q1) Fill The following blanks with suitable words .

A 70/100 bitumen will give an indentation between -----, a 40/60 bitumen around -----, etc. This means that a 70/100 bitumen is ----- than 40/60.

Usually, bitumen sorts harder than 40/60 are not used for road construction since they are more ----- sensitive.

SMA is actually between ----- and -----, and was invented by Germany some decades ago. Its structure is made up of a stone skeleton with *mastic* (a mix of bitumen, sand and filler) in between.

Due to the ----- skeleton, SMA possesses a relatively high resistance against deformation and is also less dependent on ----- . Therefore, it is very suitable for tropical areas.

Q2) Explain stone skeleton of asphalt mixture.

Q3)What are the problems which may occur with SMA ?

Q4)True or false type of exams:

In this type of exam a short sentence about a specific subject will be provided, and then students will comment on the trueness or falseness of this particular sentence. Examples should be provided

Q5) Multiple choices:

In this type of exam there will be a number of phrases next or below a statement, students will match the correct phrase. Examples should be provided.

Extra notes:

External Evaluator

