

Subject: HIGHWAY AND AIRPORT ENGINEERING
PART-I.

Time: Three hours

Different parts of the same question should be answered together.

Full Marks: 100

CO1 [25]	<p>Answer all questions in this block</p> <p>[1] (a) Describe the essential features of PERPETUAL PAVEMENT.</p> <p>(b) List few modern materials used in pavement construction with its impact on pavements.</p> <p>(c) Briefly narrate Plate Load test. OR Narrate the methodology of accepting a materials as an innovative road construction materials prior to put in application?</p> <p>(d) Brief note on HOT MIX OR COLD MIX.</p> <p>(e) Discuss about the design principle based innovative applications of road materials.</p> <p>[4+4+6+4+7]</p>
CO2 [25]	<p>Answer all questions in this block</p> <p>2. (a) Describe the significance of retained marshall stability test. What are the essential properties of bituminous mixes? Write a brief note on different types of bituminous mix. (10)</p> <p>(b) The results of a Marshall test is listed below. Table .1 (i) Find V_v, V_b VMA and VFB (ii) what will be the optimum bitumen content? (Assume relevant data if required)</p> <p style="text-align: center;">OR</p> <p>© (1) Establish a relationship between percentage air voids, percentage V.M.A, bulk specific gravity and theoretical specific gravity in a compacted bituminous specimen.</p> <p>(2) A mixture having the following composition had a compacted unit weight of 2.30g/cc. Calculate the void content of the mixture. Coarse aggregate = 65% with specific gravity of 2.72, fine aggregate = 30% with specific gravity of 2.66, asphalt = 5% with specific gravity 1.00.</p> <p style="text-align: right;">(15)</p>

The students of the course should be able to

CO1: Describe different Road Construction Materials and their applications in construction of flexible pavements (K2, A1).

CO2: Illustrate design of bituminous mix for use in flexible pavement. (K3).

CO3: Use Indian Standard Guidelines for obtaining thickness of overlay. (K3).

CO4: Use Indian Standard Guidelines for solving problems on Flexible and Rigid Pavements design (K3).

Table. 1

Bitumen content %	Weight in air g	Weight in water g	weight after wax coating air g	Volume cm ³	Unit weight (g/cm ³)	Bulk Sp Gravity Gmm	Theoretical Sp Gravity Gt	Marshall Stability (kg)		Flow (mm)
								Proving ring reading	Corrected Stability	
3.5	1228.40	678.56	1238.80	534.1	2.320	2.234	2.420	170	370.69	1.90
4	1250.88	691.50	1262.85	534.1	2.365	2.236	2.400	285	621.44	2.10
4.5	1241.44	687.49	1253.53	534.1	2.347	2.241	2.390	270	588.74	2.50
5	1243.73	679.55	1254.39	534.1	2.349	2.204	2.370	245	534.22	2.60
5.5	1244.85	681.74	1257.84	534.1	2.355	2.211	2.360	105	228.95	2.90

Ex/CON/T/325/2019

B.E CONSTRUCTION ENGINEERING 3rd YEAR 2nd SEMESTER EXAMINATION-2019

HIGHWAY ENGINEERING

PART-II

FULL MARKS: 50

Answer any two questions .[Assume relevant data wherever required]

Q-1. [CO4]

(a). Design a concrete road pavement for a two lane road in the district of Nadia with a c/c spacing of expansion joint as 4.2m slab resting on a subgrade with a modulus of sub-base reaction of 80 MPa / m with following data. (20)

Temperature difference in the slab during daytime = 0.5 degree centigrade per cm

Modulus of Concrete = 30000 Mpa

Design wheel load = 5000 kg [Assume suitable impact factor]

Bradbury's coefficient = 0.65

(b) Write notes on fatigue equation for cumulative damage analysis as recommended in IRC:37-2012.(5)

Q-2. [CO4]

(a) Explain the reasons behind BUC and TDC in concrete road pavement. (8)

(b) Describe the significance of DLC as referred in IRC-58-2015. (5)

© Describe the strength requirement of cement treated sub-base. Where it is recommended and why? (7)

(d) Illustrate the significance of DCPT test in pavement design. (5)

Q-3.

(a) Explain, why falling weight deflectometer data is considered a better indicator than Benkelmann beam rebound deflection data for structural evaluation of flexible road pavement. (8) [CO3]

(b) Design a two lane undivided road pavement in Midnapore with present traffic of 1250 CVPD resting on a subgrade with 5.0% CBR. If the road is widened as 4 lane divided carriageway, then find out the change in design thickness for the same traffic. [CO4] (10)

Given

Design load (msa)	BC(mm)	DBM (mm)	G.Base (mm)	GSB (mm)
20	40	100	250	300
50	40	115	250	300
100	50	130	250	300
150	50	145	250	300

(c) Benkelman rebound deflection data found from a survey conducted on a 2 lane state highway and the results are as following.

1.85, 2.10, 2.25, 1.42, 1.68, 2.58, 3.32, 3.41, 2.66, 2.40, 2.15, 2.65, 2.21, 3.16, 3.75, 3.1, 1.40, 1.65, 2.25, 1.65 in a sunny day with an air temperature 38 degree centigrade.

If the moisture correction factor is 1.18, then calculate the characteristic deflection [CO3] (7)