Roll No									

PRESIDENCY UNIVERSITY
BENGALURU

SCHOOL OF ENGINEERING
MID TERM EXAMINATION - DEC 2023

Semester : Semester III - B.Tech CIV - 2022   **Date :** Oct 31, 2023
Course Code : CIV2016   **Time :** 4:45 AM - 4:45 AM
Course Name : Sem III - CIV2016 - Transportation Engineering   **Max Marks :** 50
Program : B.Tech. Civil Engineering   **Weightage :** 50%

Instructions:
(i) Read all questions carefully and answer accordingly.
(ii) Question paper consists of 3 parts.
(iii) Scientific and non-programmable calculator are permitted.
(iv) Do not write any information on the question paper other than Roll Number.

PART A

ANSWER ALL THE QUESTIONS   (2 X 5 = 10M)

1.   a) What is Cutback Bitumen. Describe the same in brief (02 Marks)
b) Match the following lab tests to the aggregate properties determined from them (03 Marks)

Name of the Test	Aggregate Properties
Los Angeles abrasion test	Toughness
Aggregate impact test	Durability
Soundness test	Hardness

(CO1) [Knowledge]

Model Answer

*a) **Definition - 01 Mark***
Cutback Bitumen (Liquid Bitumen) is Bitumen that is dissolved in a solvent.
Brief description - 01 Mark
In cutback bitumen suitable solvent like Naptha, gasoline and kerosene, white spirit are used to lower the viscosity of the bitumen.
The solvent from the bituminous material will evaporate and the bitumen will bind the aggregate.

b) For each correct matching - 01 Mark (03 x 01 Mark = 03 Marks)

Name of the Test	Aggregate Properties
Los Angeles abrasion test	Hardness
Aggregate impact test	Toughness
Soundness test	Durability

2.   List the important surface characteristics of a pavement and discuss any two surface characteristics.

(CO1) [Knowledge]

Model Answer

List of important surface characteristics of pavement (04 x 0.5 Mark = 02 Marks)
1) Friction
2) Pavement Unevenness
3) Light Reflecting Characteristics
4) Drainage of Surface Water

Brief description or explanation of any two surface characteristics (02 x 1.5 Marks = 03 Marks)

PART B

ANSWER ALL THE QUESTIONS **(2 X 10 = 20M)**

3. Four alternate routes are proposed for a new State Highway project. The length of each of the route along with the villages served by the routes and the agricultural/ industrial productivity served by each route is presented below:

Route	Length (km)	No. of villages served with population of			Productivity (in 1000 tonnes)	
		<2000	2000-5000	> 5000	Agricultural	Industrial
Route 1	18	20	15	10	20	1.5
Route 2	17	19	10	12	25	1.2
Route 3	16	20	12	11	18	1.7
Route 4	18	17	16	10	15	1.2

Which route would you select considering the fact that there is not much difference in the length of the roads. Justify your answer

Adopt a utility unit of 0.5 for serving a village with population <2000, a utility unit of 1.0 for serving a village with population range 2000 to 5000 and a utility unit of 1.5 for serving a village with population >5000. Also, adopt a utility unit of 1.0 for catering 1000t of agricultural products/100t of industrial products.

(CO1) [Comprehension]

Model Answer

Computing utility for each road - 02 Marks (04 x 02 marks = 08 Marks)
Selecting the route and justification for same - 02 Marks

4. The Marshall stability test is a performance prediction measure for bituminous mixes. It's used in routine test programs for paving jobs. The weight and specific gravities for the ingredients required for one trial specimen of the Marshall test are as given below:

Item	Coarse Aggregate - 1	Coarse Aggregate - 2	Fine Aggregate	Filler	Bitumen
Weight (gm)	800	1200	300	180	150
Specific Gravity	2.60	2.56	2.45	2.40	1.05

The volume and weight of one Marshall specimen was found to be 450cc and 1000gm.

What properties of Marshall stability test can be determined from the data given above. Determine the requisite properties if the absorption of bitumen in aggregate is assumed to be zero.

(CO1) [Comprehension]

Model Answer .

PART C

ANSWER ALL THE QUESTIONS **(1 X 20 = 20M)**

5.   a) The road outside the university is being upgraded from an undivided two-lane pavement to a two-lane divided pavement.

If the design speed of the road is 60kmph, determine the existing stopping sight distance provided in the road. Compute the change in the Stopping sight distance required due to the road being converted to a two-lane divided pavement. Take braking efficiency as 70%

Also, compute the stopping sight distances for the existing undivided road and the proposed divided road in a portion of the road which is on an ascending gradient of 2%.

Coefficient of friction may be assumed as 0.36.   [10 Marks]

b) Sketch the overtaking zone for a two-lane divided pavement with a design speed of 80kmph. What will be the change in the desired length of the overtaking zone if the road was an undivided lane.
The acceleration during overtaking may be assumed to be 0.85 m/s²   [10 Marks]

                                                                        (CO2) [Application]

a)
Stopping sight distance for existing road (undivided two-lane pavement) - 02 Marks
Stopping sight distance for existing road (divided two-lane pavement) – 02 Marks
Change in stopping sight distance – 01 Mark
Stopping sight distance for existing road on an ascending gradient of 2% - 2.5 Marks
Stopping sight distance for proposed road on an ascending gradient of 2% - 2.5 Marks

Model Answer *b)*
Determining distances d1, d2 and d3 - 05 Marks
Overtaking sight distance for divided two-lane pavement - 01 Mark
Desired length of overtaking zone for divided two-lane pavement - 01 Mark
Sketch of Overtaking Zone - 01 Mark
Desired length of overtaking zone for undivided two-lane pavement - 01 Mark
Change in the desired length of the overtaking zone - 01 Mark