

Heaven's Light is Our Guide
Rajshahi University of Engineering and Technology
Department of Civil Engineering
Class Test on CE 4105

Full Marks: 20

Time: 20 mins.

- | | | |
|-------|---|----|
| Q. 1. | What is Sleeper? Write down the advantages and disadvantages of concrete sleeper. | 06 |
| Q. 2. | Define track alignment. Discuss briefly the various factors which control the alignment of a railway track. | 10 |
| Q. 3. | What are the requirements of ideal fastening? | 04 |

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Full Marks: 20

Time: 20 mins.

- Q. 1. Write short notes on ~~(i)~~ Coning of wheel, ~~(ii)~~ Construction Gauge, ~~(iii)~~ Density of sleeper, (iv) Wheel burns, and ~~(v)~~ Maglev principle 10
- ~~Q.2.~~ What is Gauge of a railway track? What are the factors on which the choice of gauge depends? 06
- Q.3. Estimate the quantity of rails, sleepers, fish plates and bearing plates required per km length of a BG railway track. 04

Class Test on CE 4105

Full Marks = 20

Time 25 minutes

- Q.1 Write the name of methods for the design of flexible pavement practiced by different organizations. (4)
- Q.2 Design a flexible pavement by IRC Standard axles Method with the following available data: (8)
- (i) CBR value of Subgrade soil = 2 % (for Odd Roll Numbers) and = 3 % (for Even Roll Numbers).
 - (ii) CVPD: $A = 200$, (iii) $r = 7\%$, (iv) $x = 10$ years and (v) Terrain is Rolling, pavement with thick surfacing.
- Q.3 Design a flexible pavement by IRC CBR Method with the following available data. (8)
- (i) CBR value: for Subgrade = 3 %, for Improved subgrade = 7 %, for Sub-base = 30 % and for Base = 80 %.
 - (ii) CVPD (in both directions): $P = 400$ (for Odd Roll Numbers) and = 600 (for Even Roll Numbers).
 - (iii) Annual growth rate of traffic = 7.5 % (iv) Construction period = 3 years (v) Design life of pavement = 10 yrs.

Class Test on CE 4051

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Full Marks = 20

Time 30 minutes

- Q.1 Explain the following terms: (i) PSI (ii) Failure of the pavement and (iii) Highway maintenance (9)
- Q.2 Write the economic benefits of a well-planned maintenance policy. Write the causes of (i) Rutting (ii) Cracks (iii) Potholes. (8)
- Q.3 A flexible pavement (20 ft x 1000 ft) is distressed. Rating the pavement for the following conditions:
- (i) Slope variance = 5.8 (ii) Rut depth = 0.25 inch (iii) Cracking area = $0.5 \text{ ft}^2 / 1000 \text{ ft}^2$ and (iv) Patched area = $2 \text{ ft}^2 / 1000 \text{ ft}^2$. (3)

23 -
12 -
01 - 39 -

20.29

Class Test on CE 4051

Full Marks = 20

Time 30 minutes

Q.1 With neat sketch, explain the influence of vertical stress and wheel load along the thickness of the pavement. (8)

Q.2 Define ESWL. Determine the ESWL for a dual wheel for thickness of 12, 18 & 24 cm when $d = 10$ cm, $S = 25$ cm and (6)

Each Wheel Load	2500 kg	2600 kg	2700 kg	2800 kg	2900 kg	3000 kg
Roll Numbers	001 - 020	021 - 040	041 - 060	061 - 080	081 - 100	101 - rest

Q.3 Define EWLF. Determine design repetition for 10 years equivalent to 2268 kg. Road is 2 lane and traffic condition is: (6)

Wheel load (kg)	2268	2722	3175	3629	4085
veh/day	2200	1800	1500	1200	1000

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Department of Civil Engineering
Class Test on CE 4105

Full Marks: 20

Time: 20 mins.

- Q. 1. Calculate the superelevation, maximum permissible speed, and transition length for a 3° curve on a high-speed BG section with a maximum sanctioned speed of 110 kmph. Assume the equilibrium speed to be 80 kmph and the booked speed of the goods train to be 50 kmph. 10
- Q. 2. Write short notes on: (i) Negative superelevation, (ii) Equilibrium superelevation, (iii) Cant excess, (iv) Creep of rail and (v) Coupled wheel 10

Heaven's Light is Our Guide
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Department of Civil Engineering
Class Test on CE 4105

02

Full Marks: 20

Time: 20 mins.

- Q. 1. Write short notes on (i) Coning of wheel, (ii) Construction Gauge, (iii) Density of sleeper, (iv) Capacity of a railway track, and (v) Maglev principle 10
- Q.2. What is Gauge of a railway track? What are the factors on which the choice of gauge depends? 06
- Q.3. Estimate the quantity of rails, sleepers, fish plates and bearing plates required per km length of a BG railway track. 04

TPC UPSC

CE 4105
Transportation Engineering - II

Full Marks: 72

Time: 3 Hours

- N.B.:-**
- (i) Answer SIX questions, taking THREE from each section.
 - (ii) Figure in the margin indicates full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Assume reasonable value for any data not given.

SECTION-A

- Q.1(a) Write down the functions of sub-grade course and surface course of a flexible pavement. 4.00
- (b) What are the bad effects of defective rolling on road? Discuss the objects of soil stabilization. 4.00
- (c) Discuss the methods of road constructions in swamps and water-logged areas. 4.00
- Q.2(a) Briefly discuss the traffic factors that affect the stability of a flexible pavement 5.00
- (b) Write down the causes of "pot hole" and "mud pumping" and describe their maintenance operations with neat sketch. 4.00
- (c) Write short notes on: (i) Prime coat, (ii) WBM road, and (iii) Soil stabilized road. 3.00
- Q.3(a) Briefly discuss the various joints provided in rigid pavement. Write down the construction steps of cement concrete pavement. 5.00
- (b) Define CBR. Write down the applications of CBR value. Explain the term "Stripping". 3.00
- (c) Write down the role of coarse aggregate and bitumen in bituminous mix. 4.00
- Q.4(a) Write down the functions of joint filler and sealer with neat sketches. Write down the properties of good joint filler and sealer materials. 5.00
- (b) Write short notes on: (i) OBC and (ii) VMA. 2.00
- (c) Calculate % V_a and % VMA of a compacted bituminous mix specimen for 6% BC from the following data: $G_b = 1.02$, $G_1 = 2.27$, $G_2 = 2.46$, $G_3 = 2.44$, $G_{mm} = 2.29$, dry weight = 1160 gm, weight in water = 639 gm, and absorbed water weight = 3 gm. 5.00

SECTION-B

- Q.5(a) Write the basic requirements of an ideal railway track. Suggest some measures to increase the capacity of a track. 4.00
- (b) Write short notes on: (i) Rail gauge, (ii) Length of rail, (iii) Sleeper density and (iv) Bending of rail. 4.00
- (c) Calculate the number of rails, sleepers, fish plates and fish bolts for 1300m B.G railway track. 4.00
- Q.6(a) What are the desirable properties of good sleepers? Explain the necessity of ballast in railway track. 4.50
- (b) State the factors that influence the selection of site for a railway station. 3.00
- (c) Write the advantages of water transportation. Explain the importance of inland water transportation in Bangladesh. 4.50
- Q.7(a) Draw a neat sketch of a Semaphore signal and explain its working principle. 4.00
- (b) Write short notes on: (i) Fouling mark (ii) Compensator (iii) Interlocking and (iv) Buffer stops. 4.00
- (c) Write the factors considered for the best location of a harbor. What are the requirements of a good port? 4.00
- Q.8(a) Calculate the lead and radius of a curve for a B.G track turn out for the given data: 4.00
- (i) Crossing number = 1 in 8.50 (ii) Heel divergence = 12 cm and (iii) Angle of switch = 1.2° .
- (b) What are the causes of railway accidents? List the various items of maintenance in railway track. 4.00
- (c) Write short notes on: (i) Break water (ii) Sea wall (iii) Docks and Litoral drift. 4.00

DEPARTMENT OF CIVIL ENGINEERING
RAJSHAHI UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering **FOURTH Year OED SEMESTER Examination, 2017**

CE 4105
Transportation Engineering - II

Full Marks: 72

Time: 3 Hours

- N.B.:-**
- (i) Answer any **SIX** questions, taking **THREE** from each section.
 - (ii) Figure in the margin indicate full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Assume reasonable value for any data missing.

SECTION-A

- Q.1 (a) Write short notes on: (i) Prime coat, (ii) WBM road, and (iii) Soil stabilized road. 4.50
 (b) Discuss the methods of road construction in swamps and water-logged areas. 4.00
 (c) Calculate the % V_a and %VMA of compacted bituminous mix specimen for 6% B.C. from the following data: $P_1 = 58\%$, $P_2 = 38\%$, $P_3 = 4\%$, $G_1 = 2.77$, $G_2 = 2.46$, $G_3 = 2.56$, $G_b = 1.63$, $G_{min} = 2.52$ and $G_{mb} = 2.42$ for compacted specimen with 6% B.C. 3.50
- Q.2 (a) Write the name of component parts of flexible pavement and the materials used in different parts. 4.50
 (b) Write short notes on: (i) Frost action, (ii) ESWL, and (iii) Pavement serviceability index. 4.50
 (c) Calculate the total thickness of flexible pavement by IRC Standard Axles method and IRC CBR method using the data: (i) Sub-grade CBR = 3%, (ii) CV/day = 300 (both direction), (iii) Annual growth rate = 7%, (iv) Design life = 10 years (including construction period), and (v) Terrain is plain; Pavement is thick bituminous surfacing. 3.00
- Q.3 (a) Define CBR and write the application of CBR value. Explain the term stripping. 3.00
 (b) Write down the role of coarse aggregate and bitumen in bituminous mix. 4.00
 (c) Briefly discuss the various joints provided in rigid pavement. Write the construction steps of cement concrete pavement. 5.00
- Q.4 (a) What are the causes of surface failure of bituminous road? Describe the procedure of pot hole repair. 4.00
 (b) Explain the precautions adopted for rolling of a road. Discuss the bad effects of defective rolling. 4.00
 (c) Using the following daily traffic count data, determine design repetition for 25 years for various wheel loads equivalent to 2268 kg wheel loads. Road is two lane and traffic counted in a day was 10000. 4.00

Wheel load in kg	% of total traffic volume
2268	25
2722	15
3175	15
4082	15
4536	9
4990	5
other minor type	rest percentage

SECTION B

- Q.5(a) Define railway track. What are the requirements of an ideal railway track? 4.00
 (b) Define gauge of a railway track. Discuss the factors which affect the choice of the railway gauge. 4.00
 (c) For 1 km length of BG railway track, estimate the (i) number of rails, (ii) number of sleepers, (iii) number of base plate, and (iv) number of fish plates. 4.00
- Q.6 (a) Write short notes on: Coating of wheel, (ii) Creep of rail, (iii) Hogging of rail, and (iv) Maglev principle. 4.00
 (b) Write down the desirable properties of good ballast. Explain the functions of sleepers in railway track. 4.00
 (c) Calculate various elements for BG track turn out for a crossing No. 1 in $8\frac{1}{2}$ and heel divergence 12 cm. 4.00
- Q.7 (a) Write short notes on: (i) Cant excess, (ii) Equilibrium superelevation, (iii) Buffer stops, and (iv) Fouling mark 4.00
 (b) Describe the factors which influence the selection of site for a railway station. 3.00
 (c) Calculate the superelevation and maximum permissible speed for a 3° curve on a high speed BG track with a maximum sanctioned speed of 130 kmph. Assume the equilibrium speed to be 85 kmph and the booked speed of the goods train to be 50 kmph. 5.00
- Q.8 (a) Explain the importance of inland water transport in Bangladesh. Write the activities of BIWTC 3.50
 (b) Distinguish between: (i) Jetty and Break water, (ii) Dry dock and Wet dock, and (iii) Seawall and Groyne. 4.50
 (c) Write the factors considered for the best location of a harbour. Write the requirements of a good port. 4.00

The End

Attendance = 10
 Class Test = 18.5
 Exam = 55
83.5
 AT

Full Marks: 70

Time: 3 Hours

- N.B.:-
 (i) Answer SIX questions, taking THREE from each section.
 (ii) Figure in the margin indicates full marks.
 (iii) Use separate answer script for each section.
 (iv) Assume reasonable value for any data not given.

27.00 SECTION-A

- 8.00 (a) Define 'soil stabilized road' and 'WBM road'. Briefly discuss the construction steps of WBM road. 4.00 3.5
- 8.00 (b) Write the causes of 'Pot hole' and 'Mud pumping' and describe their maintenance operations with neat sketches. 5.00 4.5
- 8.00 (c) Discuss the methods of road constructions in swamps and water-logged areas. 2.67 2
- 8.00 (d) Briefly discuss the functions of pavement courses in flexible pavement. 3.00 2
- 8.00 (e) Discuss briefly the traffic factors considered for the design of pavement thickness. 4.67 3.5
- 8.00 (f) Design a flexible pavement for single lane two-way from the following data: 4.00 4
- (i) Present ADT = 300 CV/day (both directions) (ii) Annual growth rate of traffic = 7%
 (iii) Construction period of road = 3 years (iv) Thickness of bituminous surface course = 4 cm (v) CBR value for sub-grade, improved sub-grade, sub-base and base are 3%, 10%, 20% and 95% respectively. Design period = 10 years.
- Q.3(a) Write short notes on: (i) Present Serviceability Index (ii) Surface dressing 4.00
- (b) With neat sketches explain the function of joint filler and sealer. Write the properties of good joint filler and sealer materials. 5.00
- (c) Calculate the radius of relative stiffness of a rigid pavement from the following data: (i) Pavement thickness = 7 inch (ii) Modulus of sub-grade reaction = 5 kg/cm³ (iii) Modulus of elasticity = 2.5×10^5 kg/cm². 2.67
- 8.00 (d) Define the terms: (i) CBR, (ii) OBC and (iii) Marshall stiffness. 3.00 2
- 8.00 (e) Soaked CBR value is considered for road design. Why? Write the functions of bitumen in the bituminous mix. 3.67 4
- 8.00 (f) Calculate the V_a and VMA of Marshall test specimen for 6% BC from the following data: 4.00 4

Constituents in Mix	CA	FA	MF	Bitumen
Percentage in Mix	55.1	36.1	3.8	5.0
Specific gravity	2.79	2.46	2.63	1.02

For 5% BC, $G_{mm} = 2.555$, for 6% BC $G_{mb} = 2.423$

28.00 SECTION-B

- 10.00 (a) Define gauge of a railway track. Discuss the factors which affect the choice of the railway gauge. 5.00 4
- 10.00 (b) Define railway track. What are the requirements of an ideal railway track? 3.67 3
- 10.00 (c) For 1 Km length of BG railway track, estimate the (i) number of rails, (ii) number of sleepers and (iii) number of fish plates. 3.00 3
- 10.50 (d) Define track alignment. Discuss the factors which control the alignment of a railway track. 3.67 3
- 10.50 (e) Calculate various elements for BG track turn out for a crossing No. 1 in $B\frac{1}{2}$ and haul divergence 12 cm. 4.00 4
- 10.50 (f) Write short notes on: (i) Compensators, (ii) Fouling mark, (iii) Cant excess and (iv) Equilibrium super elevation. 4.00 4
- 7.50 (g) Write short notes on (i) Coning of wheel, (ii) Creep of rail, (iii) Roaring of rail and (iv) Maglev principle. 1.00 2.5
- 7.50 (h) Describe the factors which influence the selections of site for a railway station. 2.67 2.5
- 7.50 (i) Calculate the super elevation, maximum permissible speed and transition length for a 3° curve on a high speed BG track with a maximum sanctioned speed of 130 Km/h. Assume the equilibrium speed to be 85 Km/h and the booked speed of the goods train to be 50 Km/h. 5.00 4.3
- Q.8(a) With neat sketches, discuss the function of the coastal structures. 5.67
- (b) Write short notes on: (i) Litoral drift (ii) Docks and (iii) Wave force. 3.00
- (c) Write the factors considered for the best location of a harbor. What are the requirements of a good port? 3.00

CE 451
Transportation Engineering-II

Full marks: 70

Time: 3 Hours

- N.B:-**
- (i) Answer any **SIX** questions, taking **THREE** from each section.
 - (ii) Figure in the margin indicate full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Assume reasonable value for any data missing.
 - (v) CBR Design chart should be supplied.

SECTION-A

- | | | |
|-----|--|------|
| Q.1 | (a) Define soil stabilization. Low-cost roads are preferred in developing countries, why? | 3.67 |
| | (b) Show the component layers of a flexible pavement and discuss the importance of sub-grade. | 3.50 |
| | (c) Write short notes on: (i) WBM road, (ii) ESWL, and (iii) Bituminous road. | 4.50 |
| Q.2 | (a) Briefly discuss the moisture factors and soil factors considered for the design of flexible pavement. | 4.00 |
| | (b) Design a flexible pavement from the data: (i) Present ADT = 500 CV (both direction) (ii) $r = 6\%$ (iii) Design life = 10 yrs. (iv) Bituminous surfacing < 5 cm (v) Sub-grade CBR = 3%, Sub-base CBR = 20%, Base CBR = 95%, $n = 2$ years. | 3.67 |
| | (c) Write short notes on: (i) Prime coat, (ii) Mud pumping, (iii) Frost action and (iv) PSI. | 4.00 |
| Q.3 | (a) Write Westergaard's stress equation for critical wheel loads on cement concrete pavement. | 3.67 |
| | (b) With sketches, explain the requirements of joint filler and sealer. Explain the phenomenon of mud pumping. | 4.00 |
| | (c) Briefly discuss the causes and remedial measures of the following surface defects: (i) Fatigue cracking (ii) Rutting (iii) Bleeding and (iv) Corrugations. | 4.00 |
| Q.4 | (a) Write short notes on: (i) CBR, (ii) OBC, and (iii) VMA. | 3.00 |
| | (b) Write down the role of CA and Bitumen in bituminous mix. | 2.67 |
| | (c) Calculate the %Va and %VMA of compacted bituminous mix specimen for 6% BC from the following data:
$G_b = 1.02$, $G_1 = 2.27$, $G_2 = 2.46$, $G_3 = 2.44$, $G_{min} = 2.29$, dry wt. = 1160 gm, wt. in water = 639 gm and absorbed water wt. = 3 gm. | 6.00 |
| | 58% , 38% , 4%
CA FA MF. | |

SECTION-B

- | | | |
|-----|---|----------|
| Q.5 | (a) Define gauge of a railway track. Discuss the factors which affect the choice of the railway gauge. | 3.00 |
| | (b) Write short notes on: (i) Capacity of a railway track, (ii) Construction gauge, (iii) Coning of wheel, (iv) Hogging of rail, and (v) Roaring of rail. | 5.00 |
| | (c) Discuss the merits and demerits of concrete sleeper and write down the functions of ballast in railway track. | 3.67 |
| Q.6 | (a) Calculate various elements for B.G. track turn out for a crossing No. 1 in $8\frac{1}{2}$ and heel divergence 12 cm. | 4.00 |
| | (b) Discuss the causes of accidents on railways. | 3.00 |
| | (c) Write short notes on: (i) Marshalling yard (ii) Interlocking and (iii) Compensator. | 4.67 (3) |
| Q.7 | (a) Write short notes on: (i) Compensator, (ii) Buffer stops, (iii) Fouling mark, (iv) Coupled wheel, and (v) Cant. | 5.00 (3) |
| | (b) Describe the factors which influence the selection of site for a railway station. | 2.00 |
| | (c) A 5° curve diverges from a 3° main curve in an opposite direction in the lay out of a B.G. yard. If the speed on the branch is restricted to 30 kmph, find out the speed on the main line. Assume permissible cant deficiency as 76 mm. | 4.67 |
| Q.8 | (a) Write the advantages of water transportation. Explain the importance of inland water transportation in Bangladesh. | 4.67 |
| | (b) Write the factors considered for the best location of a harbour. What are the requirements of a good port? | 4.00 |
| | (c) Write short notes on: (i) Break water (ii) Seawall and (iii) Docks. | 3.00 |

CE 451
Transportation Engineering-II

Full marks: 70

Time: 3 Hours

- N.B:-**
- (i) Answer any **SIX** questions, taking **THREE** from each section.
 - (ii) Figure in the margin indicate full marks.
 - (iii) Use separate answer script for each section.
 - (iv) Assume reasonable value for any data missing.

SECTION-A

- Q.1 (a) How subgrade is prepared? Briefly discuss the methods of soil stabilization? 4.0
(b) Explain in brief the construction procedure of BBM road. 4.0
(c) What are the causes of waves and corrugation formation in flexible pavement? Suggest remedial measures. 3.5
- Q.2 (a) Differentiate between: (i) ESWL and EWLF (ii) Flexible pavement and Rigid pavement and (iii) Contact pressure and Inflation pressure. 6.0
(b) Design the flexible pavement components by IRC CBR method for 10 years from the following data: (i) Sub-grade CBR = 3%, (ii) Sub-base CBR = 20%, (iii) Base course CBR = 95%, (iv) Minimum thickness of bituminous surfacing = 5 cm, (v) $n = 3$ years, (vi) Annual growth rate = 7% and (vii) Present ADT = 400. 4.0
(c) Explain the term 'Present Serviceability Index'. 1.5
- Q.3 (a) Write short notes on: (i) Prime coat (ii) Frost action and (iii) Mud pumping. 3.0
(b) What are the requirements of good joint filler and sealer materials? Explain with neat sketches. 4.0
(c) Calculate the thickness of rigid pavement using Westergaard's edge load stress equation from the following data: (i) Wheel load = Max. ESWL (ii) Tyre pressure = 7 kg/cm² (iii) Design flexural stress of concrete = 25 kg/cm² (iv) Poisson's ratio = 0.15 (v) $F_c = 2.5 \times 10^5$ kg/cm² and (vi) $K = 5$ kg/cm³. 4.5
- Q.4 (a) Define CBR. Why and how soaked CBR value is determined in the laboratory? 2.50
(b) Write the role of CA and Bitumen in bituminous mix. 2.50
(c) Briefly discuss the necessary steps of bituminous mix design. 6.0

SECTION-B

- Q.5 (a) Define railway track and state the requirements of an ideal railway track. 3.00
(b) Define gauge of a railway track. Discuss the factors which affect the choice of rail gauge. 3.00
(c) For a B.G railway track, estimate the no. of rails, sleepers, fish plates, fish bolts and bearing plates required for 1 km track. 5.00
- Q.6 (a) Write short notes on: (i) Coning of wheel, (ii) Hogging of rail, (iii) Roaring of rail, (iv) Construction gauge, and (v) Capacity of a railway track. 5.00
(b) Define track alignment. Discuss the factors which control the alignment of a railway track. 3.00
(c) Find out the angle of switch and theoretical length of switch from the following data: (i) Thickness of tongue rail at toe = 0.63 cm, (ii) Heel divergence = 13.3 cm, and (iii) Actual length of tongue rail = 6.4 m. 3.00
- Q.7 (a) Write short notes on: (i) Buffer stops, (ii) Compensator, (iii) Negative super-elevation, and (iv) Fouling mark. 4.00
(b) Describe the factors which influence the selection of site for a railway station. 2.00
(c) A 5° curve diverges from a 3° main curve in an opposite direction in the lay out of a B.G yard. If the speed on the branch is restricted to 30 kmph, find out the speed on the main line. Assume permissible cant deficiency as 76 mm. 5.00
- Q.8 (a) Why is the maintenance of a railway track necessary? What are the causes of accidents? 3.00
(b) Write short notes on: (i) Break water, (ii) Docks, (iii) Jetty, and (iv) Lateral drift. 4.00
(c) Explain the importance of waterway in our country. Why is shore protection necessary? 4.00

- N.D.:-
- (i) Answer SIX questions, taking THREE from each section.
 - (ii) Figure in the margin indicates full marks.
 - (iii) Use separate answer script for each section.
 - (iv) CBR design chart required for Q.2(b).

SECTION-A

- Q.1(a) Explain the importance of sub-grade course and wearing course of a flexible pavement. 3.67
 (b) Write the precautions adopted during rolling. Discuss the bad effects of defective rolling. 4.00
 (c) What are the causes of surface failure in case of bituminous road? Describe the procedure of pothole repair. 4.00
- Q.2(a) Briefly discuss the traffic factors that are considered for the design of flexible pavement. 5.57
 (b) Calculate the total thickness of flexible pavement by Standard Axles method and CBR method using the following data: (i) Sub-grade CBR value = 3%, (ii) Number of commercial vehicles per day (both direction) = 200, (iii) Design life including construction period = 10 years, and (iv) Annual growth rate = 8%. The terrain is plain, pavement with thin bituminous surfacing. 6.00
- Q.3(a) Calculate the thickness of cement concrete pavement using Westergaard's corner load stress formula using the following data: (i) Wheel load = Max. FSWL, (ii) Tyre pressure = 7 kg/cm², (iii) Impact load = 10% of wheel load, (iv) Safety factor = 2, (v) Modulus of rupture of concrete = 50 kg/cm², and (vi) $E_c = 3 \times 10^5$ kg/cm², $\mu = 0.15$, and $K = 5$ kg/cm². 4.00
 (b) Briefly discuss the various joints provided in rigid pavement. What are the desirable properties of joint filler and joint sealer used in joints? 4.67
 (c) Write short notes on: (i) Prime coat, (ii) Frost action, and (iii) Mud pumping. 3.00
- Q.4(a) Briefly discuss the techniques of soil stabilization. Why are low-cost roads preferred in developing countries? 3.67
 (b) Write short notes on: (i) CBR, (ii) OBC, and (iii) VMA. 3.00
 (c) Calculate the V_a and VMA of compacted bituminous mix specimen for 6% BC from the following data: 5.00

Constituents in mix	CA	FA	MF	Bitumen
Percentage in mix	55.1	36.1	3.8	5.0
Specific gravity	2.782	2.463	2.635	1.022

For 6% BC, $G_{mb} = 2.424$ and for 5% BC, $G_{mm} = 2.553$.

SECTION-B

- Q.5(a) Define railway track and state the basic requirements of an ideal railway track. 3.00
 (b) Define gauge of a railway track. Discuss the factors which affect the choice of the railway gauge. 3.67
 (c) Write short notes on: (i) Coning of wheel, (ii) Hogging of rail, (iii) Rearing of rail, (iv) Construction gauge, and (v) Capacity of a railway track. 5.00
- Q.6(a) What is a sleeper? What should be the requirements of ideal material of the sleeper? 3.00
 (b) Define track alignment. Discuss the factors which control the alignment of a railway track. 4.67
 (c) Write short notes on: (i) Sleeper density, (ii) Cant deficiency, (iii) Negative superelevation, and (iv) Ruling gradient. 4.00
- Q.7(a) Describe the factors which influence the selection of site for a railway station. 2.67
 (b) Write short notes on: (i) Buffer stops, (ii) Fouling mark, (iii) Interlocking, and (iv) Compensator. 4.00
 (c) Calculate various elements for B. G. track turn out for a crossing No. 1 in $\frac{1}{4}$ and heel divergence 12 cm. 5.00
- Q.8(a) Why is the maintenance of a railway track necessary? What are the causes of accidents? 3.67
 (b) Define harbor. What are the requirements of a good harbor? What are the factors which affect the site selection of a harbor? 5.00
 (c) Write short notes on: (i) Jetties, (ii) Docks, and (iii) Seawalls. 3.00

The End

Heaven's Light is Our Guide
DEPARTMENT OF CIVIL ENGINEERING
RAJSHAH UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering **FOURTH** Year **SEVENTH SEMESTER** Examination, 2012

CE 451
Transportation Engineering-II

Full Marks: 70

Time: 3 Hours

- N.B.:-**
- (i) Answer SIX questions, taking THREE from each section.
 - (ii) Figure in the margin indicates full marks.
 - (iii) Use separate answer script for each section.
 - (iv) CBR design curve required for Q.1 (c)
 - (v) Assume reasonable value for any data missing

SECTION-A

- Q.1(a) Write short notes on: (i) WBM road (ii) Stabilized road and (iii) Bituminous road. 3.00
- (b) Briefly discuss the traffic factors considered for the design of a flexible pavement. 5.00
- (c) Design a flexible pavement by CBR method using the following data: (i) Subgrade CBR = 4% 3.67
 (ii) Sub-base CBR = 25% (iii) Base CBR = 90% (iv) Bituminous surface = 5 cm (minimum)
 (v) $r = 6\%$ (vi) Present ADT = 500 V/day (vii) Design life = 10 yr & $n = 3$ yr.
- Q.2(a) Write short notes on: (i) Frost action (ii) Prime coat and (iii) Mud pumping. 3.00
- (b) Calculate the thickness of cement concrete pavement using Westergaard's corner load stress equation from the following data: wheel load = Max. ESWL, $a = 10$ cm, $E_c = 2.1 \times 10^4$ kg/cm², $K = 4$ kg/cm³, $\mu = 0.15$, modulus of rupture of concrete = 50 kg/cm², F.S. = 2 Allow 10% for impact load. 4.00
- (c) Briefly discuss the various joints provided in rigid pavement. Write the desirable properties of joint filler and joint sealer. 4.67
- Q.3(a) Discuss the techniques of soil stabilization. 3.00
- (b) Write the precautions adopted for rolling of WBM road. 3.67
- (c) What are the causes of development of pot holes and corrugation in bituminous road and how are they repaired? 5.00
- Q.4(a) Define the terms: (i) CBR (ii) OBC (iii) VMA and (iv) G_{min} . 4.00
- (b) Ascertain the accepted CBR value from the following data: 2.67

Penetration (mm)	Test load (kg)	
	Test (Initial)	Test (Repeated)
2.5	50	52
5.0	76	80

- (c) Calculate %V_s and %VMA for 6% B.C in mix from the data: $G_s = 2.75$, $G_c = 2.46$, $G_m = 2.62$, $G_{min} = 2.38$, dry wt. of specimen = 1250 gm, wt. in water = 700 gm and wt. of water absorbed by specimen = 2 gm. Ratio of MF : FA : CA is 1 : 7 : 12 in mix. 5.00

SECTION-B

- Q.5(a) Draw a typical single line track on embankment showing full details. 5.67
- (b) What are the basic requirements of good railway track? 3.00
- (c) Discuss the factors which affect the choice of rail gauge. 3.00
- Q.6(a) Find out the angle of switch and theoretical length of switch from the following data: Heel divergence = 13.65 cm, Thickness at toe of tongue rail = 0.65 cm and Actual length of tongue rail = 4.75 m. 3.00
- (b) Write short notes on: (i) Water column (ii) Buffer stop (iii) Fouling mark (iv) Interlocking and (v) Compensator. 5.00
- (c) For 1 km length of BG railway track, estimate the (i) number of rails (ii) number of sleepers and (iii) number of bearing plates. 3.67
- Q.7(a) Draw a neat sketch of a right hand turnout and show various parts on it. 1.67
- (b) Write short notes on: (i) Creep of rails (ii) Fastening of rails and (iii) Sleeper density. 3.00
- (c) What do you mean by signaling? Write down the objectives and classification of signaling which are based on the railway track. 5.00
- (d) Find out the number of sleepers required for 700 m long broad gauge railway track. 2.00
- Q.8(a) Define waterway transportation Write down the advantages and disadvantages of waterway transportation. 3.00
- (b) Define harbors. What are the requirements of a good harbor? Which factors affect the site selection of a harbor? 4.67
- (c) Write short notes on: (i) Break water (ii) Tidal dolt (iii) Docks and (iv) Canal structures. 4.00

CE 451
Transportation Engineering - II

Full Marks: 70

Time: 3 Hours

N.B.:

- (i) Answer SIX questions, taking THREE from each section.
- (ii) Figure in the margin indicates full marks.
- (iii) Use separate answer script for each section.
- (iv) CBR design curve required for Q.2 (b)

SECTION - A

- Q.1(a) Explain the precautions adopted for rolling of a road. Discuss the bad effects of defective rolling. 4.67
- (b) Write the causes of surface failure of bituminous road. Describe the procedure of patch repair. 4.00
- (c) Define low-cost roads. Why are low-cost roads preferred in developing countries? 3.00
- Q.2(a) With neat sketch, explain the significance of vertical stress and wheel load for structural design of road. 4.67
- (b) Calculate the total thickness of flexible pavement by Standard Axles Method and CBR method with the following data: (i) CBR of Sub-grade = 3% (ii) No. of commercial vehicles per day = 100 (iii) With construction period, design life = 12 years (iv) Annual growth rate of commercial vehicles = 8%. The terrain is plain; pavement with thin bituminous surfacing. 7.00
- Q.3(a) Calculate the stress due to interior load on rigid pavement using Westergaard's stress equation from the following data: Wheel load = Max. ESWL, $P_w = 3.5 \times 10^4 \text{ Kg/cm}^2$, $\mu = 0.15$, $K = 5 \text{ Kg/cm}^2$, $a = 12 \text{ cm}$, $h = 18 \text{ cm}$. Allow 10% for impact load. 4.00
- (b) For rigid pavement, explain the statement "Joint is nothing but it is design crack". What are the requirements of a good joint? Draw a neat sketch of expansion joint provided in rigid pavement. 4.67
- (c) Write short notes on: (i) Frost action (ii) Prime coat (iii) Mud pumping 3.00
- Q.4(a) Define the terms: (i) CBR (ii) OMC and (iii) Marshall Stability 3.00
- (b) Discuss the scope and techniques of soil stabilization. 4.00
- (c) Calculate the V_v and VMA of Marshall test specimens for 6% BC from the following data: 4.67

Constituents in Mix	CA	FA	MF	Timber
Percentage in Mix	55.1	36.1	3.8	5.0
Specific Gravity	2.70	2.46	2.67	1.02

For 5% BC, $G_{mm} = 2.55$; for 6% BC, $G_{mm} = 2.42$

SECTION - B

- Q.5(a) Define railway track. What are the requirements of an ideal railway track? 3.00
- (b) Define capacity of a railway track and suggest measures to increase it. 3.67
- (c) Define gauge of a railway track. Discuss the factors which affect the choice of the railway gauge. 5.00
- Q.6(a) Write short notes on: (i) Coning of wheel (ii) Corrugation of rail (iii) Hogging of rail and (iv) Check rail. 4.00
- (b) For 1 Km length of BG railway track, estimate the (i) number of rails (ii) number of sleepers and (iii) number of fish plates. 3.67
- (c) What are the desirable properties of good ballast? Explain the functions of sleepers in railway track. Define sleeper density. 4.00
- Q.7(a) Define track alignment. Discuss the factors which control the alignment of a railway track. 3.67
- (b) Write short notes on: (i) Negative super elevation (ii) Fouling marks (iii) Interlocking and (iv) Compensators. 4.00
- Q.8(a) Calculate various elements for BG track turnout for a crossing No. 1 in 8° and heel divergence = 12 cm. 4.00
- Q.9(a) Write short notes on: (i) Jetties (ii) Sea wall (iii) Bulkheads and (iv) Tidal duct 4.00
- (b) What are the factors to be considered before selecting a site for harbour? Differentiate between port and harbour. 4.00
- (c) Explain the importance of waterway in our country. Why is shore protection necessary? 3.67

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CE-451
 Transportation Engineering-II

Full Marks: 70
 N.B.

Time: 3 Hours

- (i) Answer Six questions, taking Three from each Section
- (ii) Figures in the margin indicate full marks
- (iii) Use separate answer script for each section
- (iv) Assume reasonable value for any missing data.
- (v) CBR curve necessary for the question no. 1(c)

SECTION-A

- Q.1 (a) Draw a neat sketch of flexible pavement cross-section and show its different component parts. Discuss their function also. 4.00
- (b) Describe the effects of climatic variations on the design of pavements and their performance. 3.67
- (c) A pavement is to be laid over the sub-grade soil with 4% CBR. Design life of the pavement is 10 years. The present ADT of commercial vehicles is 1350. The annual growth rate of the traffic is 7.5%. The pavement construction is to be completed in three years after the last count. Design the total pavement thickness using CBR curves. 4.00
- Q.2 (a) Using Westergaard's Corner stress equation, calculate the thickness of rigid pavement from the data: 4.00
 $P = 4100 \text{ kg}$, $a = 14 \text{ cm}$, $E = 3.5 \times 10^5 \text{ kg/cm}^2$, $\eta = 0.15$, $K = 5 \text{ kg/cm}^3$ & Flexural stress = 25 kg/cm^2 .
- (b) Briefly discuss the various joints provided in rigid pavement. What are the desirable properties of joint filler and joint sealer used in rigid pavement joints? 4.67
- (c) Write short notes on : (i) Prime coat (ii) Dowel bar and (iii) Mud pumping 3.00
- Q.3 (a) Explain the precautions adopted for rolling of a road. Discuss the bad effects of defective rolling. 4.67
- (b) Write the causes of surface failure of bituminous road. Describe the procedure of pot hole repair. 4.00
- (c) Define low-cost roads. Why low-cost roads are preferred in developing countries? 3.00
- Q.4 (a) Discuss the scope and techniques of soil stabilization. 4.00
- (b) Define CBR. What are the desirable properties of sub-grade soil? 3.00
- (c) Calculate % V_a and % VMA for 8% B.C in mix from the data: $G_s = 1.02$, $G_1 = 2.27$, $G_2 = 2.46$, $G_3 = 2.44$, $G_{mm} = 2.29$, dry wt. = 1160 gm, wt. in water = 639 gm & absorbed water wt. = 3 gm. 4.67

SECTION-B

- Q.5 (a) Define railway track and state the requirements of an ideal railway track. 3.00
- (b) Name the different components of a railway track and discuss the function of each component. 5.67
- (c) For a M.G railway track, estimate the quantity of materials required for one km track. 3.00
- Q.6 (a) What is coning of wheel? 2.5
- (b) Discuss the various causes of wear of rails and suggest suitable remedial measures. 3.67
- (c) Differentiate between (i) Hogged & check rail (2) Corrugated & corroded rail (3) Port & Harbor 4.50
- Q.7 (a) What are the requirements of an ideal ballast material? What material as ballast you would recommend for high speed track and why? 4.67
- (b) Write short notes on: (i) Sleeper density (ii) Concrete sleeper and (iii) Sea wall 3.00
- (c) What is rail joint? Describe the characteristics of a good rail joint. 4.00
- Q.8 (a) Define the terms : (i) Switch (ii) Crossing number (iii) Interlaced sleepers and (iv) Compensation. 4.00
- (b) Deduce an expression for the determination of degree of the curve in the field. 3.00
- (c) Explain the importance of waterway in our country. Why is shore protection necessary? 4.67