

Reg No.: _____

Name: _____

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION, APRIL 2018

Course Code: CE 308

Course Name: TRANSPORTATION ENGINEERING –I (CE)

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- | | | |
|---|--|------|
| 1 | a) What are the special considerations to be taken while aligning roads on hilly areas? | (5) |
| | b) What are the objectives of preliminary survey for highway alignment? | (5) |
| | c) Enumerate the factors governing the width of carriage way. State the IRC specifications for width of carriage way for various classes of roads. | (5) |
| 2 | a) Why are overtaking Zones provided? Draw a neat sketch showing the signs to be installed and their positions. | (5) |
| | b) A valley curve is formed by a descending gradient of 1 in 40 which meets a ascending gradient of 1 in 30. Design the total length of valley curve if the design speed is 100 km/hr so as to fulfil both comfort condition and head light sight distance requirements after calculating stopping sight distance required. Assume rate of change of change of centrifugal acceleration as 0.6m/sec^3 , reaction time 2.5 sec and coefficient of friction 0.35. | (10) |
| 3 | a) While aligning a highway in a built up area, it was necessary to provide a horizontal curve of radius 300 m for a design speed 65Km/hr, length of wheel base-6m and pavement width 10.5m. Assume rate of introduction of super elevation as 1 in 100 and super elevation is provided by rotating about centre line. Design super elevation, extra widening of pavement and length of transition curve. | (12) |
| | b) What are the points to be kept in view while selecting the alignment between two terminal stations? | (3) |

PART B

Answer any two full questions, each carries 15 marks.

- | | | |
|---|---|-----|
| 4 | a) Outline the IRC 37-2012 recommendations for determining the thickness of Flexible pavements. | (8) |
| | b) Explain with sketches the various types of failures and their causes in rigid pavements? | (7) |
| 5 | a) List out the desirable properties of aggregates to be used in pavement construction. Also specify various tests for judging the suitability of aggregates. | (3) |

- b) The soil subgrade sample was obtained from the project site and the CBR tests conducted at field density gave the following readings. Draw the load penetration curve and determine the CBR value and find the total thickness of the pavement by CBR method as recommended by IRC for commercial vehicles 1500 per day, with 7% growth rate. The pavement construction is to be completed in three years after last traffic count. **(Use design chart provided in the question paper, page 4)**

Penetration (mm)	Load (Kg)	Penetration (mm)	Load (Kg)
0.0	0.0	3.0	58.0
0.5	5.0	4.0	70.0
1.0	16.0	5.0	77.0
1.5	30.0	7.5	89.0
2.0	42.0	10.0	100.0
2.5	50.0	12.5	110.0

(12)

- 6 a) What is OD survey? List the methods of OD survey. Explain any one method in detail. (5)
- b) List out the various factors which affect the road user characteristics in traffic engineering. What are the effects of road user characteristics in traffic performance? (8)
- c) What are the requirements of a good highway drainage system? (2)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) What are the basic requirements of Intersection at Grade? (5)
- b) What are the advantages and disadvantages of traffic signals? (5)
- c) Explain with sketches the basic patterns of runway configurations. (10)
- 8 a) What is (i) Saturation flow, (ii) Lost time, and (iii) Phase in a signal design? (3)
- b) Enumerate the various factors which would be kept in view while selecting suitable site for an airport. (5)

- c) A fixed time 2-phase signal is to be provided at an intersection having four arms. The design hour traffic and saturation flow are

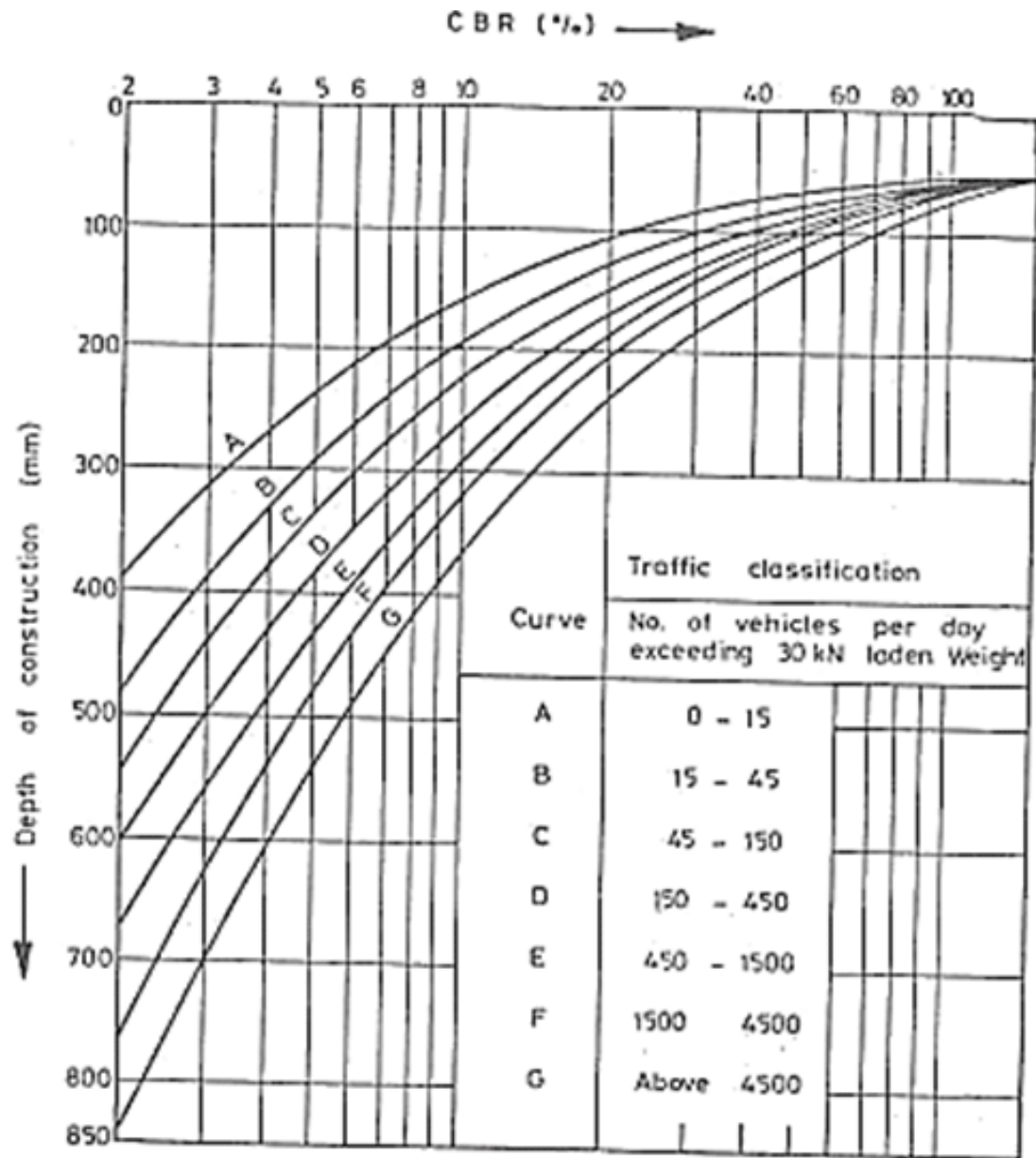
	North	South	East	West
Design hour flow (pcu/hr)	800	400	750	600
Saturation flow (pcu/hr)	2400	2000	3000	3000

Time lost per phase due to starting delay is 2 sec and All red period is 4 sec. (12)
Design two phase traffic signal using Webster's method. Draw the phase diagram also.

- 9 a) Describe the various markings on runways with sketches. (5)
- b) What are the primary functions of air traffic control? (3)
- c) The length of a runway under standard conditions is 1500m. The airport is to be provided at an elevation of 110m above mean sea level. The airport reference temperature is 32⁰C. Following data refers to the proposed longitudinal section of runway. Determine the corrected length of runway.

End to end of runway (m)	Grade(%)	End to end of runway (m)	Grade(%)
0 to 300	+1	1500 to 1800	+1
300 to 900	-0.2	1800 to 2100	-0.3
900 to 1500	+0.5		

(12)



CBR Design chart

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B.TECH DEGREE EXAMINATION(R&S), MAY 2019

Course Code: CE308

Course Name: TRANSPORTATION ENGINEERING - I

Max. Marks: 100

Duration: 3 Hours

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) Explain briefly the classification of highways by Nagpur Road Plan. How is this system of classification modified as per the Third Twenty Year Road Development Plan? (8)
- b) What are the requirements of an ideal alignment? What are the precautions to be observed while aligning hill roads? (7)
- 2 a) What are the factors influencing the geometric design of highways? Explain how these factors influence the geometric design standards of a highway. (8)
- b) Find safe over taking sight distance for a highway having a design speed of 80 kmph. Maximum acceleration of overtaking vehicle is 1.5 kmph per sec. (7)
- 3 a) Enumerate the steps for practical design of super elevation of a highway under mixed traffic conditions. (4)
- b) A National Highway passing through plain terrain (Design speed 100 kmph) in a heavily rainfall area has a horizontal curve of radius 500 m. Design the length of transition curve. Allowable rate of introduction of super elevation is 1 in 150. (6)
- c) A vertical summit curve is formed when an ascending gradient of 1 in 40 meets a descending gradient of 1 in 80. Find the length of summit curve to provide the required stopping sight distance for a design speed of 80 kmph. (5)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Explain the desirable properties of aggregates as a highway material. (9)
- b) State the major differences between flexible and rigid pavements. (6)
- 5 a) What are the factors to be considered in design of flexible pavements and indicate their significance. (8)

- b) Design the flexible pavement for the construction of a new highway with the following data (Follow guidelines as per IRC 37 2012): (7)

Category of road- Four lane dual carriageway

Number of commercial vehicles in the year of completion of construction- 2400

CVPD per direction

Annual growth rate of commercial vehicles-5%

Design life – 15 years

Design CBR value of subgrade soil – 5%

Vehicle damage factor – 3.5

Lane distribution factor – 0.75

For CBR 5%

Traffic msa	5	10	20	30	50	100
GSB(mm)	250	300	300	300	300	300
GB(mm)	250	250	250	250	250	250
DBM(mm)	55	70	100	120	125	130
BC(mm)	25	40	40	40	50	50

- 6 a) Briefly illustrate the various steps in construction of a bituminous pavement. (6)
 b) Mention the major failures in flexible pavements and their causes. (9)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) What are traffic characteristics? Explain the influence of different traffic characteristics on traffic performance. (10)
 b) The average normal flow of traffic on cross roads A and B during design period are 400 and 250 PCU per hour respectively. The saturation flow values on these roads are estimated as 1850 and 1400 PCU per hour respectively. The all red time required for pedestrian crossing is 16 seconds. Design a two-phase traffic signal by Webster's method. (10)
- 8 a) Explain following aircraft characteristics and their influence in planning and design of an airport: (12)
- (i) Type and size of aircraft
 - (ii) Weight and wheel configuration
 - (iii) Speed of aircraft
 - (iv) Minimum turning radius

- b) What is a wind rose diagram? How is it useful in fixing the best orientation of runway? (8)
- 9 a) Length of a runway at Mean Sea Level (MSL), standard temperature and zero gradients is 1500 m. The site has an elevation of 1000 m above MSL, with a reference temperature of 34⁰C. The runway has to be constructed with an effective gradient of 0.26%. Determine the actual length of the runway at the site. (10)
- b) What are the design considerations applicable to runway lighting? Explain with neat sketches. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
SIXTH SEMESTER B. TECH DEGREE EXAMINATION(S), DECEMBER 2019

Course Code: CE308

Course Name: TRANSPORTATION ENGINEERING -I

Max. Marks: 100

Duration: 3 Hours

Students are permitted to use IRC37-2012 in examination hall

PART A

Answer any two full questions, each carries 15 marks.

Marks

- 1 a) What are the basic requirements for an ideal highway alignment? Describe the factors considered in finalising the alignment. (5)
- b) Define stopping sight distance. Derive an expression for stopping sight distance on an ascending gradient. (5)
- c) Determine the super elevation required for a horizontal curve of radius 300 m with a design speed of 80kmph under mixed traffic condition in an urban area. (5)
- 2 a) List out the engineering surveys conducted in fixing the alignment of a highway. What are the different kinds of data that are collected in a detailed survey? (5)
- b) Determine the length of overtaking zone required for one-way traffic condition with design speed of 100kmph. Acceleration of overtaking vehicle is 0.9m/sec^2 and speed of slow-moving vehicle is 80kmph. Illustrate the details of overtaking zone with a neat sketch. (10)
- 3 a) Why are transition curves provided on a horizontal curve? What are the requirements for an ideal transition curve? Identify the steps for determining the length of transition curve? (7)
- b) A descending gradient of 1 in 30 meets an ascending gradient of 1 in 25. Determine the length of valley curve required for a design speed of 65 kmph, to satisfy stopping sight distance requirements. Assume coefficient of friction as 0.35. Assume data, suitably, if required. (8)

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) Explain the effect of various vehicular characteristics on traffic stream behaviour. (7)
- b) A flexible pavement is to be constructed with granular base and sub-base and bituminous surfacing for a state highway in rolling terrain. The existing soil has a

CBR value 5%. The borrow material has a CBR value of 12%. The traffic volume on a two lane single carriage way in both directions at last count is 1200 commercial vehicles per day. Design a flexible pavement as per IRC37 - 2012. Traffic growth rate is 6% .

- 5 a) Explain the procedure for determination of CBR value of a subgrade soil. (7)
- b) Discuss the various causes of failures in flexible pavements. With the help of sketches explain any five types of flexible pavement failures. (8)
- 6 a) Describe the specifications of materials and construction steps of bituminous concrete pavements. (7)
- b) Discuss any five properties of bitumen and their effect on the performance of bituminous mixes in pavements. Explain the laboratory tests to be conducted to assess these properties. (8)

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) With neat sketches, explain different at grade intersections. (6)
- b) What are the factors that are to be considered for site selection of an airport. (4)
- c) Two roads A and B meet at right-angles. The normal flow and saturated flow on road A are 750 PCU/hr and 3600 PCU/hr respectively. On road B normal flow is 550 PCU/hr and saturated flow is 2700 PCU/hr. The all red time is 10 sec. Design a two-phase isolated traffic signal for the intersection and sketch the phase diagram. (10)
- 8 a) With sketches, list out any six types of warning signs on highways. (6)
- b) What is wind rose diagram? Explain how Type 1 wind rose diagram is used for determination of runway orientation. (7)
- c) Discuss how various aircraft characteristics influence the planning of airport. (7)
- 9 a) What are the different systems of signal coordination? (4)
- b) Discuss the facilities to be provided and factors considered for planning an airport terminal building. (6)
- c) Runway of an airport is situated at an elevation of 250m and has an effective gradient of 0.3%. Airport reference temperature is 18°C. The basic runway length is 2500m. Determine the actual required length of runway. (10)

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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
Sixth semester B.Tech degree examinations (S), September 2020

Course Code: CE308
Course Name: TRANSPORTATION ENGINEERING – I

Max. Marks: 100

Duration: 3 Hours

Codes and charts not permitted

PART A

Answer any two full questions, each carries 15 marks.

Marks

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|---|--|------|
| 1 | a) Explain with sketches the various factors controlling the alignment of roads. Discuss the special care to be taken while aligning hill roads. | (10) |
| | b) What is the importance of highway geometric design? List the various geometric elements to be considered in highway design. | (5) |
| 2 | a) Find out the length of transition curve passing through plain terrain for a two-lane pavement with an extra widening on a horizontal curve of radius 200m. The design speed=60km/hr, Width of pavement on straight stretches is 7.0m and super elevation provided is 0.07. Assume that the pavement is rotated about centre line at the rate of 1 in 100. | (10) |
| | b) Derive an expression for finding the stopping sight distance at level and at grades. | (5) |
| 3 | a) A car travelling at 60km/hr is overtaking another car moving at 40 km/hr on a two-lane undivided highway. Assume the acceleration of overtaking car as 3.6km/hr/sec, and reaction time 2sec. Calculate (i) Overtaking sight distance (ii) Sketch the overtaking zone and show the position of signpost. | (10) |
| | b) Draw the typical cross sections of the following indicating the width of pavement, roadway and land (i) National highway in embankment in rural area (ii) Divided highway in urban area. | (5) |

PART B

Answer any two full questions, each carries 15 marks.

- 4 a) The soil subgrade sample was obtained from the project site and the CBR tests (10)
was conducted at field density gave the following readings. Loads at 2.5mm and
5mm penetration are 55kg and 78kg. Find the total thickness of the pavement by
CBR method as recommended by IRC for commercial vehicles 1500 per day,
with 7% growth rate. The pavement construction is to be completed in three
years after last traffic count. If the materials in different layers are compacted
soil with 7% CBR, poor graded gravel with 20% CBR and well graded gravel
with 95% CBR, find thickness of each layer and sketch the pavement section.
Assume thickness of bituminous layer as 50mm. **(CBR Design Chart
provided)**
- b) Explain the desirable properties of aggregates to be used in different types of (5)
pavement construction.
- 5 a) With sketches explain different types of failures in flexible pavements. Also (10)
discuss their causes
- b) Explain the vehicular characteristics which affects the traffic performance. (5)
- 6 a) What are the various factors to be considered in pavement design? Discuss the (10)
significance of each.
- b) Explain how spot speed data are presented and the results used in traffic (5)
engineering.

PART C

Answer any two full questions, each carries 20 marks.

- 7 a) What is wind rose diagram? Explain wind rose diagram and how it is being used (8)
for determination of runway orientation.
- b) The length of a runway under standard conditions is 2400m. The site for an (12)
airport is above 520m above mean sea level. The airport reference temperature
is 32°C. Following data refers to the proposed longitudinal section of runway.
Determine the corrected length of runway.

End to end of runway (m)	Grade (%)
0 to 400	+1
400 to 800	+0.5
800 to 1600	-1.0
1600 to 2400	-0.4

- 8 a) With neat sketches explain the basic patterns of runway configuration (10)
- b) Explain various types of road markings commonly used with the uses of each markings (10)
- 9 a) List the different characteristics of aircrafts. How do they influence the planning of airports? (10)
- b) A fixed time 2-phase signal is to be provided at an intersection having four arms. The design hour traffic flow and saturation flow are (10)

	North	South	East	West
Design hour flow (pcu/hr)	500	500	350	250
Saturation flow (pcu/hr)	1500	1200	1200	1250

Calculate the optimum cycle length based on Webster's equation and find the corresponding green times. Total loss per phase is 4 sec and yellow interval is 2 sec. Sketch the timing diagrams for each phase.

CBR Design Chart

