TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2080 Ashwin

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

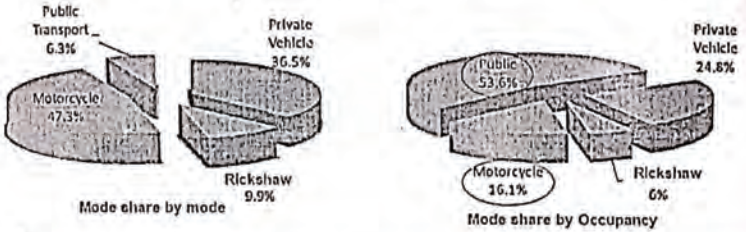
Subject: - Transportation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ *<u>Necessary figure is attached herewith</u>.*
- ✓ *Assume suitable data if necessary.*

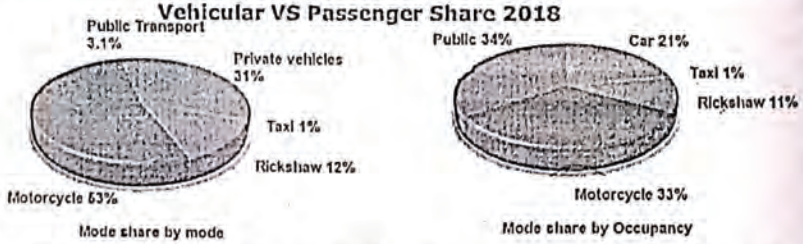
1. Discuss about constraints of Transportation. [3]

2. Comparatively analyze the following result of mode share by mode and occupancy. [3]

Vehicular VS Passenger Share 2008



Vehicular VS Passenger Share 2018



3. Two cases of Infrastructure construction (i) Under pass at Kalanki and (ii) Overpass at Gwarko. Give your views on appropriateness and effectiveness of these transport system supply management in dealing with congestion problems. Give your opinion based on the existing traffic situation and possible future traffic situation. Also critically analyze the recent installation of speed camera on ring road. [5]

4. Discuss the mobility and accessibility functions of different highways. What are the principles of access management? [5]

5. A minor (North-South) road of design speed 60 kmph intersects a major (East-West) four-lane divided highway with a design speed of 80kmph. The major road lanes are 3.6 m wide and the median is 2 m wide. The minor road approach grade is 1%. The design vehicle is a single-unit truck, coefficient of lateral friction is 0.35. Calculate the minimum intersection sight distance required for the design vehicle stopped on the northbound approach of the minor road to safely turn right onto the major road for (i) Condition of No control, (ii) Yield condition and (iii) Stop condition. Prepare a neat sketch of the sight distance triangle for the design vehicle for all three cases. Your sight triangle should be based on the calculations you made. [8]

6. Due to frequent crashes at rail-road junction, two-lane highway underpass that connects -2% grade to a +1.5% grade at station 00 +740 being built under the existing railway. The elevation of the point of intersection (PVI) is 738 m. If the design speed of the highway is 70 km/h: a) Determine the minimum required stopping sight distance. b) Determine the minimum length of the vertical curve that satisfies stopping sight distance requirements. c) Determine the vertical clearance under the railway if the station and elevation of the lowest point of railway are 00+760 and 744 m, respectively. Assume perception reaction time= 2.5 s, longitudinal friction= 0.32, headlight height= 0.6 m, and beam angle= 1° [8]

7. Design a flexible pavement structure for the Taxiway of a medium-size airport by the FAA procedure (AC 150/5320-6C) for the following aircraft mix:

Aircraft	Wheel load, W	Annual Departures
A (Dual Tandem)	150,000	6,335
B (Dual)	120,000	6,000
C (Single)	75,000	5,000

The crushed stone (CBR = 20%) and granular materials (CBR = 7.5%) are available for base and subbase, respectively. Determine the flexible pavement structure, if design aircraft is aircraft A. Draw the final pavement structure. [6]

Gear type of actual aircraft	Gear type of aircraft design	Conversion factor
Single wheel	Dual wheel	0.8
Single wheel	Dual tandem	0.5
Dual wheel	Dual tandem	0.6
Double dual tandem	Dual tandem	1.0
Dual tandem	Single wheel	2.0
Dual tandem	Dual wheel	1.7
Dual wheel	Single wheel	1.3
Double dual tandem	Dual wheel	1.7

8. Define apron taxiway and Holding apron. Explain about different method of air demand forecasting techniques for the planning of the airport. [6]

9. What is the required curve radius for a normal gauge rapid speed track with a design speed of 140 km/h, if the allowed cant is 120 mm and the allowed cant deficiency is 75 mm? What would be the length of transition curve? [6]

10. What are the differences between station and yard? Explain briefly different types of train station with their special characteristics and suitable sketch. [5]

11. Describe the main characteristics of BRT to show it distinct from the conventional bus. [5]

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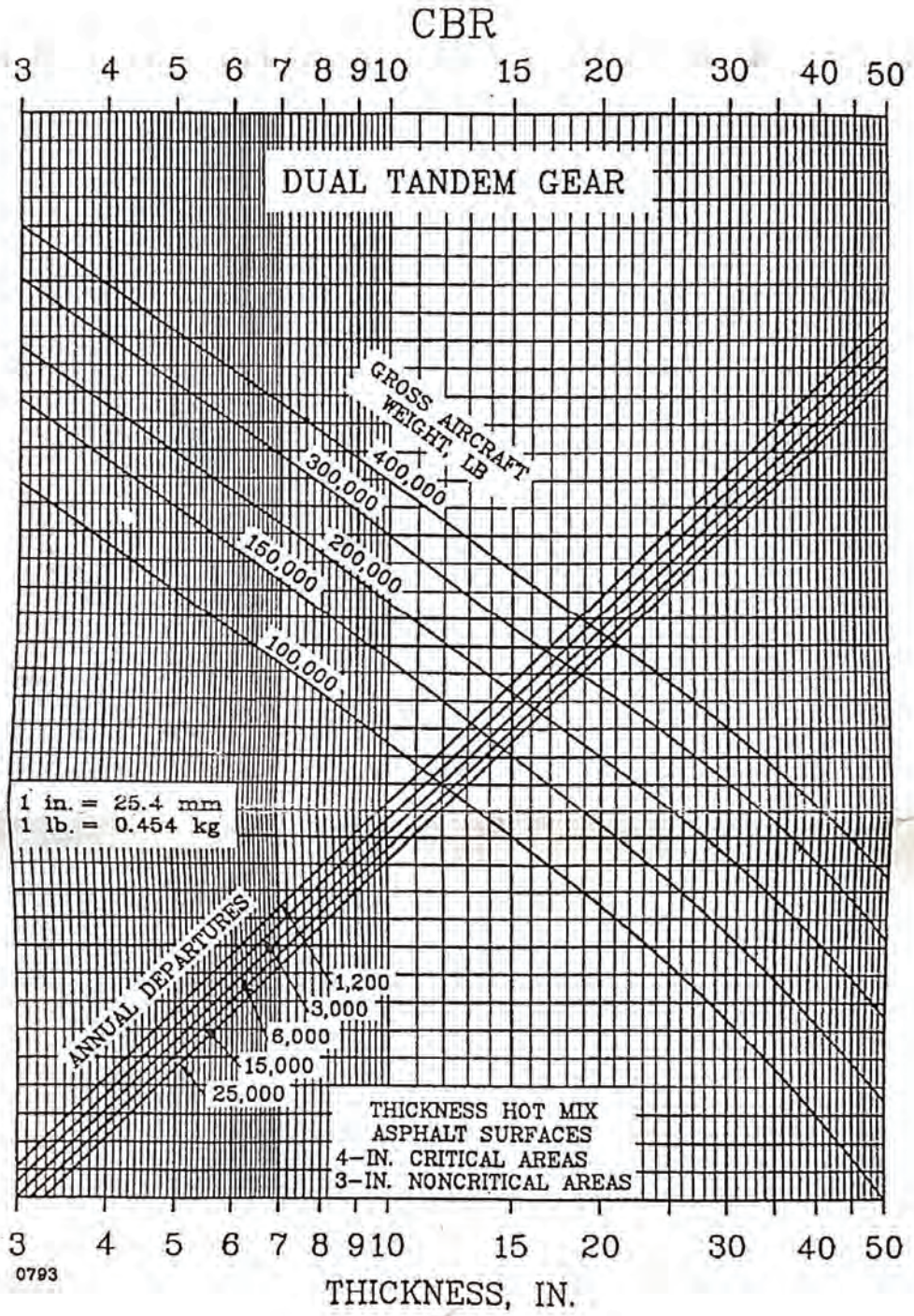

CBR
3 4 5 6 7 8 9 10 15 20 30 40 50
DUAL TANDEM GEAR
GROSS AIRCRAFT WEIGHT, LB
300,000
400,000
200,000
150,000
100,000
1 in. = 25.4 mm
1 lb. = 0.454 kg
ANNUAL DEPARTURES
1,200
3,000
6,000
15,000
25,000
THICKNESS HOT MIX ASPHALT SURFACES
4-IN. CRITICAL AREAS
3-IN. NONCRITICAL AREAS
3 4 5 6 7 8 9 10 15 20 30 40 50
0793
THICKNESS, IN.

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2079 Jestha

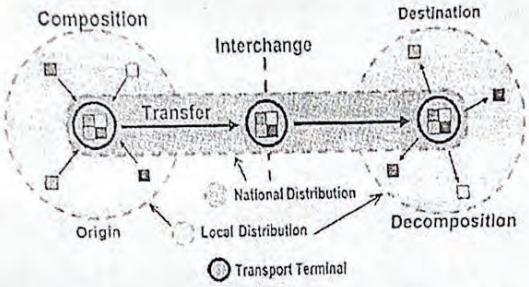
Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Transportation Engineering

- Candidates are required to give their answers in their own words as far as practicable.
- *Attempt <u>All</u> questions.*
- *The figures in the margin indicate <u>Full Marks</u>.*
- *Assume suitable data if necessary.*
- *<u>Necessary chart is attached herewith</u>.*

1. Compare road and rail mode of transportation with respect to ubiquity, mobility and efficiency. [3]

2. Explain the following figure with reference to intermodal transportation of freight transport. [3]



3. How far do you agree/disagree with odd/even rule (demand management) and construction of fly over (supply management) is appropriate and effective in transport system management? Give your views. [6]

4. Define Provincial Transport Master Plan. What are the principle and stage of preparation of provincial transport master plan? [6]

5. Two reverse curves of A and B of a flat roadway needs to be connected by a tangent section. Designed super elevation for Curve A is 4% whereas and curves B has full super elevation of 5%. The chainage of EC of curve A is 85 + 005. Design the Super elevation transition if the road is of a 2 – lane highway with cross-section rotated about centerline. Design speed is 60 kmph. Determine the minimum length of the tangent section between curves for super elevation transition. Show your calculations as well as on the diagram. The relative gradient is 0.6 and original normal crown slope is 2.5%.

$$\left\{ b_w = \frac{[1 + 0.5(n-1)]}{n} \right\}$$ [8]

6. Due to sever traffic jam, an overpass is being planned on an existing level highway over the minor road. The design speed of existing highway is 80 km/hr. The overpass structure is 60 m length, is to be level, centered above the existing minor road, and at height of 8 m. Design the vertical alignment to connect overpass with the existing highway. Show the chainage and elevation of silent points of this vertical alignment, if the beginning of vertical alignment to be at chinage of 11 + 425 and at elevation of 1024 m. [8]

7. Design a flexible pavement structure for the Taxiway of a medium-size airport by the FAA procedure (AC 150/5320-6C) for the following aircraft mix: [6]

Aircraft	Wheel load, W	Annual Departures
A (Dual Tandem)	30,000	800
B (Dual Wheel)	22,500	2,000
C (Single Wheel)	20,000	5,000

The crushed stone and granular material are available for base and subbase, respectively. Design CBR values for the subbase and subgrade are 20 and 6, respectively. Determine the flexible pavement structure, if design aircraft is aircraft B. Draw the final pavement structure.

8. Explain about aircraft characteristics important to airport planner and designer. Explain about different types of airport apron. [5]

9. An 6° curve track diverges from a main curve of of 3° in a B.G. yard. Calculate the super elevation and the speed on the branch line, if the maximum speed permitted on the main line is 50 Km/hr. [5]

10. Explain briefly different component of rail tracks with suitable sketch. [5]

11. Describe the main characteristics of express way that make expressway different from highway. Explain about different safety barriers to be used in expressway. [5]

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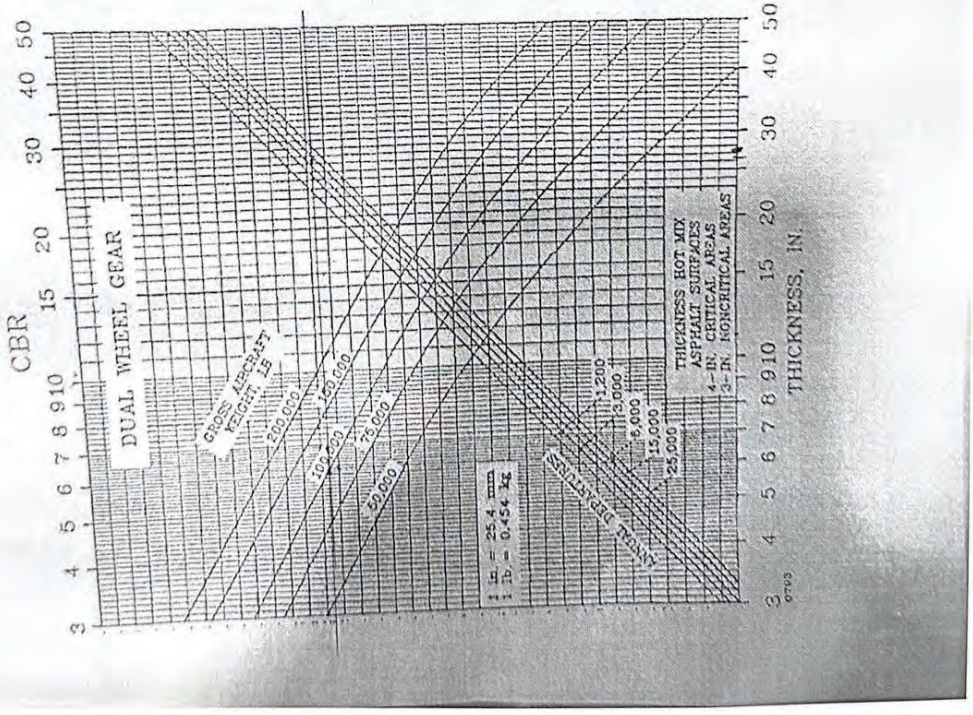

TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2076 Bhadra

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	MSTrE	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Transportation Engineering *(CE 805-C04)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>Full Marks</u>.*
- ✓ ***<u>Necessary figures are attached herewith.</u>***
- ✓ ***FAA Airport Pavement design chart is allowed to use.***
- ✓ *Assume suitable data if necessary.*

1. Define Intermodal Transportation with suitable example. Compare Mesh, Hub-and-spoke, Linear and Tree type of transport networks in terms of path length and network length. [6]
2. What are the different factors affecting transportation demand. What is the transportation demand management? Will flexible work hour be able to reduce traffic congestion in Kathmandu? Justify your answer. [6]
3. What are the operating principle of gravity ropeway? How can its benefit be grabbed by Rural Communities of Nepal. [4]
4. A two lane highway goes from normal crown with 2% cross slope to 7% super elevation by means of spiral transition curve. Determine the minimum length of the transition if the rate of providing super elevation is 1 in 200. Round up to the next largest 20 m interval. Draw the super elevation diagram for the transition. Provided that the station of TS is 10+500. [8]
5. Write down the condition where pipe, box, arch and slab culverts are applicable. Write down the points to be considered when causeway has been planned to install. [4]
6. A vertical curve joins -0.5% grade to a -1.5% grade. The PI of the vertical curve is at station 20+000 and elevation 150.00 m above sea level. The centre line of the roadway must clear a pipe located at station 20+070 by 0.75 m. The elevation of the top of the pipe is 150.4 m above sea level. What is the minimum length of vertical curve that can be used? [8]
7. Write down characteristics of expressway. What are the special elements used in excess way which are not used in normal highways. [6]
8. Calculate the maximum permissible speed on a curve of a high speed BG group route having the degree of the curve = 1.5°, superelevation = 80 mm, length of transition curve = 120 m, maximum speed likely to be sanctioned for the section = 150 km/hr. [6]
9. Explain the various points to be considered while looking for the site for new airport construction. What are the functions of Airport Terminal and Apron? [6]
10. Design an concrete pavement runway to be built on an area with sub grade soil of CBR value of 5% and concrete of 25 MPa. Design Aircraft is Aircraft A. The conversion factor from Dual Tandem to Single and Dual are 2.0 and 1.7 respectively. The forecasted air traffic for the airport is as follows: [6]

Aircraft	Gear Type	Average Annual Departures	Maximum Takeoff Weight (lb)
A	Dual	10000	160,000
B	Dual Tandem	2000	304,000

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22 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2075 Bhadra

Exam.	Regular / Back		
Level	M.Sc.	Full Marks	60
Programme	Transportation Engineering	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Transportation Engineering *(CE805-C04)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt <u>All</u> questions.*
- ✓ *The figures in the margin indicate <u>**Full Marks**</u>.*
- ✓ *Assume suitable data if necessary.*

1. Compare the road, railway and air transport in terms of ubiquity, mobility and efficiency with suitable examples for each. [6]
2. Describe how parking management measure can be done to improve traffic operation in Kathmandu. Explain with suitable site example. [6]
3. Explain how direct access to National Highway can be managed to reduce impact on traffic flow. [4]
4. Due to crashes at a major and minor road crossing, an overpass is to be constructed 7 m above an existing minor level road. The major road has a design speed of 80 kmph. The overpass structure is to be level, centered above the minor, and 60 m long. Calculate length of sag and crest vertical curve at both end and total length of road to be reconstructed? [8]
5. Write down BRT characteristics with respect to vehicle, station and fare collection. [6]
6. Two roads each with a design speed of 60 km/hr (major) and 40 km/hr (minor) cross at right angles in flat terrain. Building is situated at distance of 12 m from major and 18 m from minor road. What unobstructed sight triangle is desirable to provide safe traffic operation at intersection? If it proved to be impracticable to provide this unobstructed sight triangle, suggest other options to maintain traffic safety. [6]
7. Write down the function of switch and neat sketch of typical switch? What are the differences between junction station and terminal station? [6]
8. On a MG route involving high speed, the degree of curve is 8° and the maximum sanctioned speed for the curved section is 120 km/hr. The equilibrium speed is 70 km/hr, maximum speed of goods train = 50 km/hr, what will be super elevation to be provided. [6]
9. What do you mean by wind rose diagram? How wind rose diagram II can be used to locate orientation of runway. [6]
10. Basic runway length under standard conditions is 2300 m. The airport is to be provided at an elevation of 1210 m above mean sea level. The mean of maximum and average daily temperatures of the hottest month are 31°C and 15°C respectively. The construction plan includes the following data. [6]

End to end of runway, m	0 – 500	500 – 1000	1000 to 1500	1500 to 2000	2000 to 2500
Grade (%)	+ 0.70	- 0.30	+0.50	+1.00	- 0.40

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142 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division

2074 Bhadra

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	Transportation Engineering	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Transportation Engineering *(CE821)*

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt **All** questions.*
- ✓ *The figures in the margin indicate **Full Marks**.*
- ✓ ***Necessary Chart is attached herewith.***
- ✓ *Assume suitable data if necessary.*

1. (a) What do you mean by intermodal transportation? Explain about the conditions favorable for Intermodal transportation option. [6]

   (b) Describe about three measures of advance traffic control measures along with their possible benefit and disbenefits. [6]

2. (a) Explain about the cross section elements which can primarily be seen in Urban roads along with their functions. [4]

   (b) Among the stakeholders of transportation an vertical curve is to be constructed between grades of -2% (initial) and 1% (final). The PVI is at station 10 + 000.000 and at elevation 400 m. Due to a street crossing the roadway, the elevation of the roadway at station 10 + 071.000 must be at 401.5m. Design the curve. [8]

3. (a) Why should BRT be developed instead of other mass transit system in country like Nepal? Give reasoning. Explain briefly the components of BRT that make it different from normal public bus services. [6]

   (b) A two lane two way highway goes from normal crown with 2% cross slopes to 10% super elevation by means of a spiral transition curve. Determine the minimum length of the transition if the difference in grade between the centerline and edge of travel way is limited to 1/200. Round up to the next largest 20 m interval. Draw the super elevation diagram for the road. [6]

4. (a) What are the requirements of a good permanent way? Why do you think ballast is used in Permanent way. Draw a typical section of a permanent way. [4]

   (b) Determine super elevation, maximum permissible speed on the curve for a high speed MG route having 2.5° horizontal curve. (Equilibrium speed = 70 km /hr, maximum sanctioned speed = 90 km/hr, length of transition curve = 100m) [8]

5. (a) What are the different factors affecting airport runway orientation? Write down different parameters of Runway geometric design. [4]

   (b) A Flexible pavement is to be designed for a dual gear aircraft (727-200) having a gross weight of 190,500 lbs. Air demand forecasting shows present annual departure of 8,000 (dual gear 727-200 aircraft) and 6,000 (dual tandem 707-320B aircraft, gross weight = 330,000 lbs). Design CBR values for the sub grade and sub base are 8 and 15 respectively. Design a flexible pavement Draw a designed section of pavement layers if minimum surfacing is 3 inch. [8]

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Year / Part	I / I	Time	3 hrs.

2073?

Subject: - Transportation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt All questions.*
- ✓ *All questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1. Define geometric elements of road. Also explain various cross-sectional elements of national highway with the help of diagram showing cycle track and BRT provision.
2. Critically compare the suitability and limitations of the various modes of transportation in different region of the Nepal.
3. Explain the causes of moisture variation in sub grade soil. How seepage flow and capillary rise control can be done in road construction.
4. For a newly proposed Regional Airport at Terai region of Nepal, the required length of runway under standard conditions is 1500m. The airport site has an elevation of 110m. The mean of maximum and the mean of average daily temperature of the hottest month are 32.8 and 16.5 degree centigrade respectively and the runway is to be constructed with an effective gradient of 0.20%, determine the corrected runway length as per FAA and ICAO.
5. What are the characteristics of an ideal airport layout? Explain briefly about ICAO and CAAN.
6. What do you mean by Master Planning of Airport? List out the various factors to be considered for the Master Planning process.
7. A 6 degree curve branches off from the 3 degree main curve in an opposite direction in the layout of a BG yard. If the speed on the branch line is restricted to 36 kmph, determine the speed restriction on the main line. Assume cant deficiency as 75 mm.
8. Explain the component parts of a railway track with their functions. Also explain the requirements of an ideal track.
9. Describe the component parts of ropeway. Explain the advantages and limitations of gravity goods ropeways.
10. Explain the use of Intelligent Transportation System (ITS) for the operation and control of highway vehicles.

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131 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2071 Chaitra

Exam.	**Regular**		
Level	M.Sc.	**Full Marks**	60
Programme	Transportation	**Pass Marks**	30
Year / Part	I / I	**Time**	3 hrs.

Subject: - Transportation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any **Five** questions.*
- ✓ *All questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

Q.No.1.

A. What are the challenges that are to be faced in transportation planning? Write down the scenario of historical and planned Development of Roads in Nepal.

B. What is Public Road Act, 2031 expedient to? What are the bases that the act has taken into account to classify the roads? Write down the provisions that have been made in this act for the land acquisition.

Q.No.2

A. Write down the factors that should be considered while analyzing the slope stability. How can the potentiality of the slope failure be analyzed based on the analysis of discontinuities?

B. Is the grade compensation compulsory in hill roads? Why? What are the provisions that the Nepal Road Standard has mentioned in this regard?

Q.No.3.

A. Define an aerial rope way. Mention the types of a rope way? How does a gravity rope way function? Explain technical point of view.

B. What are the general guidelines for the design of a rope way? Write down the factors that have to be considered while designing the tower and anchor block for a rope way.

Q.No.4.

A. What are the differences between an airport and an aerodrome? How do the physical characteristics of aircraft affect the design of airport? Mention the factors relating to the sitting, orientation and number of runways.

B. What is an apron in an airport? Write down its design requirements. Mention, how the size of an apron is fixed.

Q.No.5

A. What is the objective of reconnaissance survey in railway engineering? Mention the areas that have to be covered in the preliminary survey of a rail way. Write down the factors that have to be considered while designing the rails.

B. What are conditions that are demanding the switching of public transport system into mass transit system in Kathmandu? Mention the components of operational and physical design of Mass Transit System.

Q.No.6

Write short notes on:

1. Development trend of automobile
2. Components of an automobile
3. Runway length correction
4. Airport design guidelines

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133 TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
Examination Control Division
2070 Chaitra

Exam.	Regular		
Level	M.Sc.	Full Marks	60
Programme	Transportation Engineering	Pass Marks	30
Year / Part	I / I	Time	3 hrs.

Subject: - Transportation Engineering

- ✓ Candidates are required to give their answers in their own words as far as practicable.
- ✓ *Attempt any Five questions.*
- ✓ *All questions carry equal marks.*
- ✓ *Assume suitable data if necessary.*

1 a. What are the key actors for the preparation of Planning? Write down the roles of each key actor.

b. What is the planning scenario of Road planning in Nepal? Write down the strategies of Nepal Government in the Road construction sector as envisaged in 20 years Plan.

2 a. What is a survey in infrastructure development sector? What are the areas that should be incorporated while carrying out the survey work for Road Construction? Explain, how do the discontinuities in the rock mass affect in the selection of the alignment?

b. Generally hairpin bends are inevitable in hill roads. What are the reasons? Justify this. Write down the challenges that have to be faced while designing a hairpin bend?

3 a. what is an aerial rope way. Write down the components that have to be designed for a ropeway. List out the factors that are considered while designing the wire rope.

b. what is the provision of vertical and lateral clearance in rope way? Write down the general principle of rescue in the ropeway.

4 a. What do you understand by the geometric of runway? Explain in detail the procedure of determining the actual runway length required at the selected site.

b. What are the functions of Taxiway? Write down the type of taxiways with explanation of three segment method.

5 a. What is philosophy for the development of automobile? How is the development of vehicles affecting the selection of infrastructure in each mode of transportation? Write down the present status of the development in the automobile sector.

b. What are parameters that are leading to Mass Transit system in Kathmandu Metropolitan City? Mention the design parameters of different components of BRT system. If you are assigned to prepare a project proposal how would you proceed?

6 Write short notes on:

a. Airport classification
b. Railway Stations and yards
c. Engineering survey for railways
d. Rail fastening techniques

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TRIBHUVAN UNIVERSITY
INSTITUTE OF ENGINEERING
DEPARTMENT OF CIVIL ENGINEERING
MSc TRANSPORTATION ENGINEERING
2080 Bhadra

Exam	INTERNAL ASSESSMENT		
Level	M.Sc.	F.M.	20
Programme	TrE	P.M.	10
Year / Part	I/I	Time	1:30 hrs.

Subject : Transportation Engineering (EG611CE)

- ✓ *Candidates are required to give their answers in their own words as far as practicable.*
- ✓ *Attempt **ALL** questions. The figure in the margin indicates Full Marks.*
- ✓ *Assume suitable data if necessary.*

1. Compare the mobility and accessibility of different types of roads in Nepal. What are the full access control roads and their importance. [4]
2. A two lane two-way highway goes from normal crown with 2.5% cross slopes to 10% super elevation by means of a spiral transition curve. Determine the minimum length of the transition if the difference in grade between the centerline and edge of travel way is limited to 1/200. Round up to the next largest 25 m interval. Draw the super elevation diagram for the road. (Assume other data if necessary) [4]
3. A two lane highway has a posted speed limit of 70 km/hr and, on one section, has both horizontal and vertical curves. For horizontal curve, BC at (16+000) and EC at (16+510). The deflection angle is 50°, superelevation provided = 7%, Lateral friction coefficient = 0.15. Similarly, for the vertical curve, BVC at (16+000) and PVI at (16+050) and EVC at (17+000), G1=-2.5% and G2=+3.5%). The recent day time crash resulted in a fatality and a lawsuit alleging that the 80 km/hr posted speed limit is an unsafe speed for the curves in question and was a major cause of the crash. Evaluate and comment on the roadway design. [4]
4. Find out the required length for the aircraft which required basic runway length of 1200 m. The airport is located at 450 m above mean sea level. The difference between highest point and the lowest point of the runway is 0.005 per meter of the runway. The monthly mean maximum and mean daily temperatures of the hottest month of the year are 27°C and 18°C, respectively. [4]
5. What are the function of terminal? Write down about the method and importance of air demand forecasting? [4]

THE END

Stat

MSc in Transportation Engineering

Internal Assessment 2074

Subject: Applied Research Methodology & Statistics

F.M. - 20
P.M. - 10

Attempt any FOUR questions.

1. If 20% of the bolt produced by machine are defective, determine the probability that out of 4 bolts chosen at random (i) exactly one bolt will be defective (ii) NO defective bolt (iii) less than 2 bolts will be defective.

2. At a checkout counter customers arrive at an average of 1.5 per minute. Find the probability that (a) at most 4 will arrive in any given minute (b) at least 3 will arrive during an interval of 2 minutes (c) at most 15 will arrive in an interval of 6 minutes.

3. The mean elongation of steel bar under a particular tensile load has been established to be normally distribution with parameters $\mu = 0.06''$ and $\sigma = 0.008''$. Find the probability that mean elongation falls (a) above $0.08''$ (b) some where between $0.05''$ & $0.07''$ (c) ~~[illegible]~~ below $0.045''$

4. An electrical firm manufactures light bulbs that have a length of life that is approximately normally distributed with a standard deviation of 40 hours. If a sample of 30 bulbs has an average life of 780 hours. Find a 96% confidance interval for the population mean of all bulbs produced by this form.

5. The following table shows the respective heights x & y of a sample of 12 fathers & their oldest sons.

x:	65	63	67	64	68	62	70	66	68	67	69	71
y:	68	66	68	65	69	66	68	65	71	67	68	70

Find the least square regression line of y on x.