KATHMANDU UNIVERSITY
End Semester Examination
January 2025

Marks Scored:

Level : B.E.
Year : IV

Course : CIEG 401
Semester : I

Exam Roll No. :

Time: 30 mins.

F. M. : 10

Registration No.:

Date : 19 JAN 2025

SECTION "A"
[20Q. × 0.5 = 10 marks]

Choose the most appropriate answer and **encircle**.

1. An undesirable element to be avoided while fixing the alignment of the highway is_____.
   a. straight and short route.
   b. proximity to a place of worship.
   c. right angle crossing for bridges culverts and level crossing
   d. rising ground and high embankments.

2. Minimum value of super elevation provided is _____.
   a. not less than camber at the section. b. 7%.
   c. 10%. d. not less than the grade of the road.

3. The road which connects east to west, north to south and serve greater portion of the longer distance travel is_____.
   a. district road b. national highway c. feeder road d. urban road

4. Calculate the mechanical widening required for a pavement of width 7 m on a horizontal curve of radius 200 m, if the longest wheelbase of vehicle expected on the road is 6.1 m.
   a. 0.031 m b. 0.33 m c. 0.42 m d. 0.186 m

5. While aligning a hill road with a ruling gradient of 6%, a horizontal curve of radius 60 m is encountered. Find the compensated gradient at the curve.
   a. 1.5% b. 4.75% c. 1.25% d. 7.25%

6. The maximum design gradient for vertical profile of road is_____.
   a. ruling gradient b. average gradient
   c. exceptional gradient d. limiting gradient

7. The maximum number of vehicle can be parked with_____.
   a. parallel parking b. 45^0 angle parking
   c. 90^0 angle parking d. 75^0 angle parking

8. Design of horizontal and vertical alignment, super elevation, sight distance and grades are worse affected by_____.
   a. width of the vehicle. b. height of the vehicle.
   c. length of the vehicle. d. speed of the vehicle.

9. The drain which is provided parallel to roadway to intercept and divert the water from the hill slopes is known as_____.
a. side drain b. cross drain c. catch water drain d. sloping drain

10. The minimum design speed for hairpin bends in hill road is taken as_____.
a. 50 kmph b. 40 kmph c. 30 kmph d. 20 kmph

11. The diagram which shows the approximate path of vehicle and pedestrians involved in accidents is known as _____.
a. collision diagram b. spot maps c. pie charts d. condition diagram

12. The most suitable equipment for compacting clayey soil is_____.
a. smooth wheeled roller b. sheep footed roller
c. pneumatic tyred roller d. vibrator

13. Tie bars in cement concrete pavements are provided across_____.
a. expansion joints b. contraction joints c. longitudinal joints d. warping joints

14. The critical combination of stresses at edge regions in a cement concrete pavement during summer is_____.
a. load stress - warping stress - frictional stress
b. load stress - warping stress + frictional stress
c. load stress + warping stress - frictional stress
d. load stress + warping stress + frictional stress

15. The bottom most layer of road pavement is_____.
a. Sub-base b. Sub grade c. surface course d. tack coat

16. Softening point of bitumen to be used for road construction at a place where the maximum temperature is 40^0 C should be_____.
a. equal to 20^0 C b. Less than 40^0 C c. equal to 40^0 C d. greater 40^0 C

17. Traffic studies required for deciding the speed limit for traffic regulation control is_____.
a. spot speed b. accident studies
c. origin and destination d. classified traffic volume

18. Which of the following is not a distress in cement concrete pavements?
a. Paunch out. b. Spalling. c. Rutting. d. Shrinkage cracking.

19. In a bituminous pavement, alligator cracking is mainly due to_____.
a. inadequate wearing course
b. fatigue arising from repeated stress applications
c. inadequate thickness of sub base course of pavement
d. use of excessive bituminous material

20. When a volatile material is added to the bitumen for changing its viscosity, the final product is called_____.
a. cutback b. emulsion c. asphalt d. tar

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SECTION "B"
[40 marks]

Attempt *ALL* questions. Assume suitable data if necessary. Necessary design chart is attached herewith.

1.

a. Describe briefly why Macadam's method of road construction is considered better and more scientific compared to the previous methods of road construction. Explain briefly different types of radial pattern of road developed in modern urban area. [2+2]

b. What are objectives of providing transition curve? Derive the expression for calculating the overtaking sight distance with neat sketch. [1+3]

2.

a. Define hill road. Explain briefly factors affecting hill road alignment. [1+3]

b. Design the timing of traffic and pedestrian signals of an isolated signals to be installed at a right angle intersection when road P and Q cross. The peak traffic volumes per hour for road P and road Q are 250 and 200 respectively. The data available are: [4]

Description	Road P	Road Q
Width (m)	13.5	10.50
Approach speed (kmph)	55	45

Assume all necessary data if required as suitably

3.

a. A pavement has to be designed for a certain length of existing single lane carriage way road from the following consideration:

i. Current traffic of 80kN equivalent single axle load = 0.95×10^5 ESAL/year
ii. Design period = 10 years
iii. Construction period = 18 months from the last traffic count
iv. Traffic growth rate = 7.0%
v. CBR value of sub-grade soil = 5%
vi. Elastic modulus of asphalt concrete for surface course = E_{ac} = 2500 MPa
vii. Elastic modulus of emulsified stabilized base = E_b = 1200 MPa
viii. Elastic modulus of granular sub-base = E_{sb} = 120 MPa

Draw the cross section of final pavement layers considering the thickness of asphalt concrete on surface course is not less than 75mm. [4]

b. Write short notes on (***ANY TWO***) [2×2=4]

i. Classification of bridge.
ii. Highway alignment and its requirement.
iii. Impact test on aggregate.

P.T.O.

4.

a. Explain briefly the causes of moisture variation in sub-grade soil. Describe briefly the requirement of a good highway drainage system. [2+2]

b. A valley curve is formed by descending grade of 1 in 20 meeting an ascending grade of 1 in 25. Design the length of valley curve to fulfill both comfort condition and head light sight distance requirement for a design speed of 80 kmph. The head light beam angle and height of head light from road surface are 1^0 and 0.75m respectively. Assume allowable rate of change of centrifugal acceleration 'C' as 0.6 m/s^3, reaction time as 2.5 seconds and coefficient of friction as 0.35 for given design speed. [4]

5.

a. Define interface treatment. Explain briefly the construction procedure of grouted or penetration macadam. [1+3]

b. What are various causes of the pavement failure? Explain briefly various types of pavement maintenance with suitable examples. [1+3]

Full-Depth Asphalt Concrete