ADVANCED LEVEL NATIONAL EXAMINATIONS, 2016, TECHNICAL AND PROFESSIONAL STUDIES

EXAM TITLE: Topography and Road Construction
OPTION: Public Works
DURATION: 3 hours

INSTRUCTIONS:

The paper is composed of three (3) main Sections as follows:

Section I: Sixteen (16) compulsory questions. 55 marks
Section II: Attempt any three (3) out of five questions. 30 marks
Section III: Attempt any one (1) out of three questions. 15 marks

Allowed materials:
- Ruler and square
- Graph paper inside answers booklet
- Calculator

Note:
Every candidate is required to carefully comply with the above instructions. Penalty measures will be applied on their strict consideration.
Section I. Sixteen (16) Compulsory questions

01. The downhill end of a 30 m tape is held 90 cm too low. What is the horizontal distance measured? 5marks

02. While measuring the distance on a sloping ground, it was found that the ground rises by 3.20 m for each 20 m chain length. Find the angle of slope (θ). 2marks

03. It is required to connect two stations on the top and the other on the foot of the hill. If the scale of the map is 1/2000, ruling gradient is 1 in 20, calculate the length of the road between 2 consecutive contour lines. 3marks

04. In road construction technology, carry out the classification of curves. 6marks

05. What are the three (3) methods of attainment of super elevation? 3marks

06. What are the three (3) tests used to evaluate the strength of properties of soil? 3marks

07. Name the types of pavement structures based on the structural behavior. 2marks

08. List any five (5) elements of geometric design of highway. 5marks

09. In surveying, what are the two (2) kinds of ranging? 2marks

10. Define the following terms in topography:
    a) Chainage  
    b) Offset  
    c) Clinometer  3marks

11. For road construction, what are the five (5) advantages of asphaltic concrete? 5marks

12. Calculate the value of:
    a) Head light sight distance (stopping sight distance SSD) and
    b) Intermediate sight distance on a highway with design speed (V) of 65 km PH. Assume skid resistance (f) = 0.36 and total reaction time (t) = 2.5 seconds. 5marks

13. What are the three (3) major methods of interpolation during road project study on a topographic map? 3marks

14. What are the two (2) types of longitudinal profiles (profile leveling)? 2marks

15. Mention the three (3) types of sight distances. 3marks

16. If the figure below shows a part of longitudinal profile of the project, calculate the elevation of P3. 3marks
Section II. Choose and answer any three (3) questions. 30 marks

17. The figure below shows different types of forces acting on a vehicle negotiating a horizontal curve on a level carriage way. What is the meaning of following parameters?

(1) m  (8) R
(2) f  (9) V
(3) Ff  (10) W
(4) g
(5) h
(6) N
(7) d  10 marks

18. Discuss two (2) reasons why an extra widening of the road on horizontal curve is required. 10 marks

19. (a) How does the final road location survey differ from the preliminary one? Describe the final road location survey by highlighting different five (5) activities involved.
(b) Discuss four (4) considerations of engineering survey during final road location survey. 10 marks

20. Classify different types of road intersections according to:
   a) Functions  b) Geometric features  c) Shape. 10 marks

21. Make use of neat sketches to differentiate between the following:
   (a) Cross-section for rural roads on embankment
   (b) Cross-section for rural roads in cut terrain. 10 marks

Section III. Choose and answer any one (1) question. 15 marks

22. (a) Briefly explain steps involved in generating a longitudinal profile from a topographic map.
(b) Given below portion of a topographic map, generate a longitudinal profile as shown by line AA' (elevations in meters). 15 marks
23. Make observation of the graph below about different levels of service of a highway.

![Graph Showing Levels of Service](image)

**Required:**

(a) Briefly discuss about levels of service A, B, C, D, E and F.

(b) With respect of the above graph, what are six (6) factors affecting capacity and service volume of a highway?

15marks

24. Shown below are images of types of flexible pavement road failure. In a tabular format, name them and mention different cases under each type.

![Image of Flexible Pavement Failures](image)

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15marks