



THE PAPUA NEW GUINEA UNIVERSITY OF TECHNOLOGY
DEPARTMENT OF CIVIL ENGINEERING - 4TH YEAR DEGREE
SECOND SEMESTER EXAMINATIONS - 2022
CE 423 – BRIDGE ENGINEERING

DATE: TUESDAY, 25TH OCTOBER 2022 – 08:20 A.M

VENUE: STRUCTURES LECTURE THEATRE (SLT)

TIME ALLOWED: 3 HOURS

INFORMATION FOR CANDIDATES

1. You have 10 minutes to read the paper before the examination starts. You must **not** begin writing during this time.
2. **There are Three Parts in this Exam with FIVE (5) Questions. Part A – General Questions, Part B – Deck Design, and Part C – Steel Girder Design. Answer any 2 Questions in Part A. You will answer FOUR (4) questions which shall give a total of 100 points.**
3. Use only ink. Do not use pencils for writing except for drawings and sketches.
4. Only Calculator is allowed in the examination room. **MOBILE PHONE**, Notes and textbooks are **NOT ALLOWED** except the PNG and Australian Bridge Design Standards/Specifications.
5. All answers must be written in the ANSWER SHEET provided. Start each question on a new page and show all your calculations in the answer sheet. No other material will be accepted.
6. **Write your NAME and Student NUMBER clearly on the front page.**
Do it now.
7. **Marking Scheme:** As shown in each Questions.

PART A – GENERAL BRIDGE QUESTIONS

Answer Any two full questions, each carry 15 marks.

Question One

- a) State and discuss on the factors to be considered while selecting suitable site for a bridge. (5 Marks)
- b) Discuss the importance of Hydraulic design in Bridge Engineering. (5 Marks)
- c) State and discuss how Bridge Engineers can prevent bridge disasters. (5 Marks)

Question Two

- a) Explain the longitudinal forces action on bridges. (5 Marks)
- b) Write a note on the importance of impact factor in the design of bridges? (5 Marks)
- c) Write the PNG and AS Specifications for Road bridges. (5 Marks)

Question Three

- a) Briefly discuss elastomeric bearings. (4 Marks)
- b) With neat sketch, explain well foundation and its components (3 Marks)
- c) Discuss bearing, and state the main functions of bearings. (4 Marks)
- d) State and discuss the forces that are considered during the design of piers and abutments? (4 Marks)

PART B- BRIDGE DECK DESIGN**Question Four**

[Bridge Deck Design]

(25 marks)

A reinforced concrete simply supported slab forms the deck of a road bridge, having the following data:

Clear span = 7.0 m	Width of bearing = 400 mm
Carriage way = 2 Lane	Materials = 25MPa Grade Concrete and Fe 415 Steel
Width of kerb = 500 mm on either side	Concrete = 500 Mpa
	Type of loading = W70 Wheel Load (A14 Axle Load)
	Pedestrian walkway = 1.2 m on both sides.

Perform the following design calculations for concrete deck in accordance with AS5100 Bridge Design Codes, and show the reinforcement details.

- (i) Select concrete deck thickness and cover
- (ii) Calculate unfactored Dead Load Moments
- (iii) Calculate unfactored Live Load Moments
- (iv) Calculate Factored Moments – Strength Limit state
- (v) Design for Positive Flexure
- (vi) Check for Service Limit State
- (vii) Determine the Slab Reinforcement detailing requirements.

PART C – STEEL GIRDER DESIGN**Question Five**

[Steel Girder Bridge – Analysis & Design]

(45 marks)

A Steel Girder bridge (Figure Q5) on a National Road in PNG, having the following data:

Concrete: $f'_c = 30$ MPa	Carriage way width = 7.5 m
$F_{sy} = 500$ MPa	Carriage way = 2 Lane
Concrete Depth = 180 mm, Concrete Cover = 30 mm	Pedestrian Footpath (1.2 m wide) on RHS only
Top wearing surface = 10 mm	
Cross beams at 4000 mm interval	2 x T44 Vehicle Load
	Assume $SDL = 2$ kPa
	Construction Load = 4kPa, Pedestrian Load = 5kPa

Analyze the bridge and design its Steel Girders for W70 Wheel Loads according to AS5100.

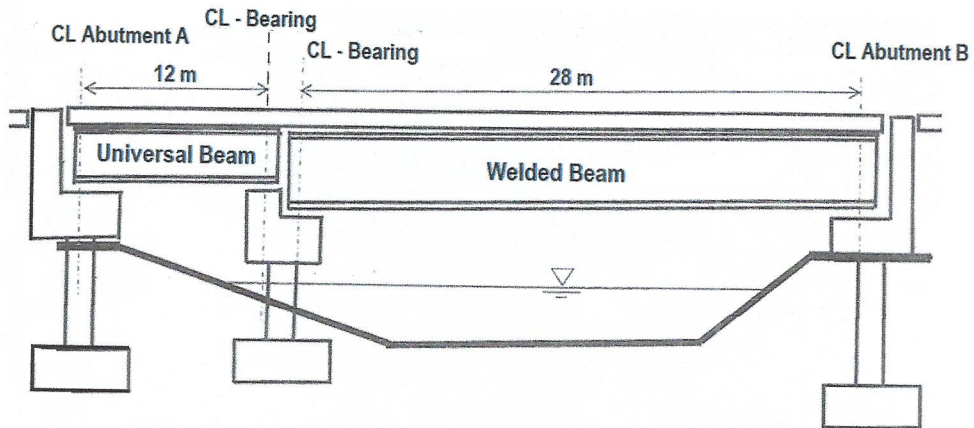


Figure Q5a: Elevation of Steel Girder Bridge

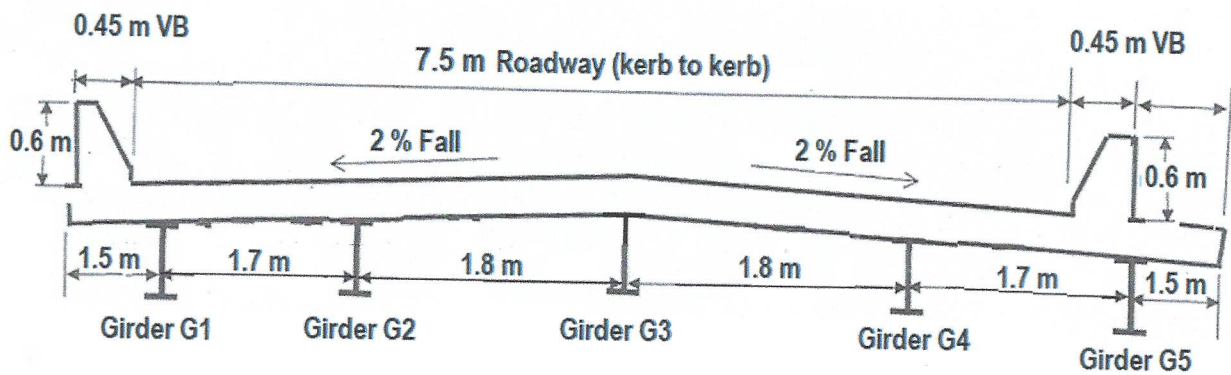


Figure Q5b: Cross-section of the bridge showing deck layout

END OF EXAMINATION!!!! ALL THE BEST!!!!!!