

University of Asia Pacific
Department of Civil Engineering
Mid-Examination Spring 2024
Program: MSc in Civil Engineering (MSc/M.Eng)

Course Title: Repair and strengthening of concrete structures
 Time: 1 hour

Course Code: CE 6204
 Full Marks: 60

QUESTION 1 [12 MARKS]

State the five most advanced repair and strengthening materials and methods of reinforced concrete structure. Explain the debonding mechanisms of externally bonded method for flexural and shear strengthening of RC beam. [12 Marks]

QUESTION 2 [24 MARKS]

The floor slab layout plan of a 10-storeyed office building (Live load 2.4 kN/m^2) is shown in Figure 1. The structure is constructed with frame structure where the slabs are supported by beams. The slab having the thickness of 150 mm and consists of 10 mm @ 175 mm c/c bottom bar, and 10 mm @ 150 mm c/c (top bar). Concrete compressive strength of the slab is 20 N/mm^2 , yield strength of steel bar is 275 N/mm^2 .

If the building needs to be used for warehouse of a garment (Live load 6 kN/m^2), through proper structural assessment of **short span** of **panel S4**, evaluate and justify whether the slab need to be retrofitted / strengthened for both mid-span and support moments. [24 marks]

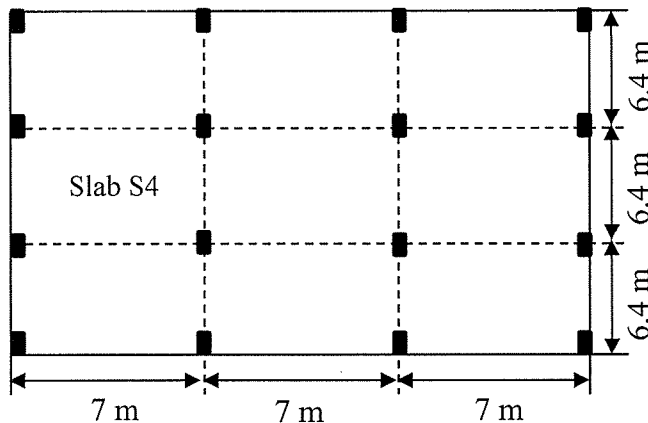


Figure 1. Slab floor plan

Span Ratio	Positive Moment		Negative Moment
	Live load	Dead Load	
0.8	0.042	0.029	0.075

QUESTION 3 [24 MARKS]

Design the short span of the slab (S4) of Question 2 for flexural strengthening (mid-span and support) using externally bonded carbon fibre reinforced polymer (CFRP) laminate. [24 Marks]

University of Asia Pacific
Department of Civil Engineering
Midterm Examination – Spring 2024
Program: M.Sc. Engineering (Civil)

Course Title: Groundwater Hydraulics
Time: 1.0 hour

Credit Hour: 3:00

Course Code: CE 6606
Full Marks: 30

Answer any three questions.

- 1 (a) Derive Darcy's equation for groundwater flow. (5)
(b) When Darcy's law is valid? (2)
(c) Define 'hydraulic head' and 'fluid potential'. (3)
- 2 (a) What are the differences between saturated and unsaturated zones? (4)
(b) Define 'compressibility', 'transmissivity', 'Leaky aquifer'. (6)
- 3 (a) What are the difference between fully penetrating and partially penetrating well? (5)
(b) A 30-cm diameter well completely penetrates a confined aquifer of permeability 45 m/day. The length of the strainer is 20 m. Under steady state of pumping the drawdown at the well was found to be 3.0 m and the radius of influence was 300 m. Calculate the discharge. (5)
- 4 (a) What is meant by Recuperation test? (4)
(b) During the recuperation test of a 4.0 m open well a recuperation of the depression head from 2.5 m to 1.25 m was found to take place in 90 minutes. Determine the (i) specific capacity per unit well area and (ii) yield of the well for a safe drawdown of 2.5 m (iii) what would be the yield from a well of 5.0 m diameter for a drawdown of 2.25 m? (6)

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2024
Program: M.Sc. in Civil Engineering

Course Title: Earth Dams and Stability of Slopes
Time: 1 hour

Credit Hour: 3.0

Course Code: CE 6405
Full Marks: 100

Answer the following questions:

1. (a) State the principal uses of an earth dam. Also mention the major advantages of an earth dam. (8)
- (b) Mention the factors affecting the design of an earth dam. (7)
- (c) Derive Laplace's equation in two dimensions. (10)
- (d) Draw neatly the conditions for the point of entrance and point of discharge of the line of seepage (phreatic line) of an earth dam. (10)
2. (a) Explain with neat sketches how flow lines are deflected at the boundary (vertical and inclined) separating soils of dissimilar permeabilities with particular emphasis on the effect of flow net configuration. (13)
- (b) What are the detrimental consequences of uncontrolled seepage in an earth dam? (5)
- (c) Mention the recommended criteria of core width for a zoned dam. (6)
- (d) With neat sketches show the effect of embankment stratification on the required width of horizontal or longitudinal drains in homogeneous earth dams. (6)
3. (a) Show with neat figures show the effect of stratification, and relative values of coefficient of permeability of symmetrical central clay core and downstream shell on the position of the line of seepage (phreatic line) at the downstream shell of a zoned dam. Assume coefficient of permeability of upstream shell to be infinite. (10)
- (b) Using Leo Casagrande's Method, derive an expression for the rate of seepage through a homogeneous earth dam with inclined discharge face and without any filter. The base of the dam rests on an impervious foundation. Also using this method state the procedure of plotting the line of seepage (phreatic line). (15)
- (c) A homogeneous embankment of height 12 m was constructed on an impervious foundation with side slopes 3 : 1 (horizontal : vertical). The embankment retains water to a height of 10 m. The crest width of the embankment is 3 m. The coefficient of permeability of embankment soil is 4×10^{-5} m/sec. Calculate the rate of seepage through the embankment using Schaffernak and Van Iterson's method. (10)

University of Asia Pacific
Department of Civil Engineering
Mid-Term Examination, Spring 2024
Program: M.Sc. in Civil Engineering

Course Title: GIS and Remote Sensing in
Transportation
Time: 1 hour

Credit Hour: 3

Course Code: CE6513
Full Marks: 50

Note: Numbers in parentheses next to the questions indicate their full marks.

1. Write a chronological list of events leading to cholera prevention in London. Mention the names of relevant persons and places, the year, and the source of your information. (10)
2. Topology
 - a. What is topology in GIS? (1)
 - b. How is the topology of a vector GIS dataset organized? (i.e., how points, lines, and polygons are connected to each other to form the dataset.) Explain with diagrams. (3)
 - c. What is a topology error? List the different topology errors and draw diagrams to describe them. (3)
 - d. What is a special type of vector data? Draw a figure to explain. (3)
3. Projection
 - a. What is a projection system in GIS and RS? (2)
 - b. What map aspects are distorted by projection systems? (2)
 - c. What are the three basic ways to transfer a curved surface to a plane? (2)
 - d. What are the 4 different projection systems commonly used in Bangladesh? (2)
 - e. Which projection system is used to prepare Bangladesh's Mouza maps (land ownership maps)? (2)
4. Suppose you are a Highway Engineer designing a national highway. The alignment goes through private lands, and land acquisition maps are needed. Your manager wants you to prepare it with GIS.
 - a. What kinds of data will you need to do this job? (4)
 - b. What is the sequence of activities to prepare the land acquisition maps? You may draw figures to explain your answer. (6)
5. Remote Sensing:
 - a. Your organization is conducting agricultural mapping for a large area to prepare NDVI maps for 10 years (July and December for each year). Your manager has no idea about Remote Sensing, so you decide to show him how you can complete the job with Landsat images.
 - i. What will be your data source? (2)
 - ii. What will the formula be for the NDVI calculation? (3)
 - iii. Which software can you use to prepare NDVI datasets? (1)
 - iv. How would you prepare a time series of vegetation changes for a given area? (4)