Bangladesh Army University of Science and Technology (BAUST)

Department of Civil Engineering

Final Examination, Summer 2023

Course Code: CSE 2123 | **Level-2** | **Term-I**

Time: 03 (Three) hours | **Full Marks: 180**

Course Title: Introduction to Computer Programming

N.B.
- The questions are of equal value.
- Figures in the margin indicate full marks allotted to each question.
- Symbols and abbreviations bear their standard meanings.
- Use separate answer scripts for each PART.
- The corresponding course learning outcomes (CLOs) are given in the rightmost column.

PART- A (Marks: 90)

(Answer any three questions including Question No. 1)

			Marks	CLOs
1.	a)	Write a C program to print the following output:	10	CLO2

```
HelLo World\n
15 15.99 M
select:%c
```

	b)	Write an algorithm to check whether a number is odd or even based on user given input.	10	CLO1
	c)	Describe different data types with examples. Write some importance of data types.	10	CLO3
2.	a)	Write a C program to take 10 float numbers and calculate their average.	10	
	b)	Describe some format specifier and escape sequences with examples.	10	
	c)	Write the output of the following C program:	10	

```
#include<stdio.h>
int main()
{
      int a;
      a = 90.9;
      float b = (float)a;
      printf("TheValue: %f",b);
      return 0
}
```

3.	a)	Write a C program that takes marks of five different courses of 10 students. Calculate the average marks of each student.	10	
	b)	Discuss different types of operators with examples.	10	
	c)	Write a C program that will show all numbers between 1 to 100 that are divisible by 7.	10	
4.	a)	Define type casting. Give some examples.	10	
	b)	Write a C program that takes a String and displays it in reverse order.	10	
	c)	Write some differences between character array and string.	10	

PART- B (Marks: 90)

(Answer any three questions including Question No. 5)

			Marks	CLOs
5.	a)	Create a function that takes 4 numbers: a(int), b(float), c(int), d(float) that evaluates the following expression: (a*b) + (a/c) + (c*d) – (d*a)	10	CLO3
	b)	Write the output of the following code:	10	CLO2

```
#include<stdio.h>
void A(){
      printf("I'm A.\n");
      B();
}
void B(){
      C();
      printf("I'm B.\n");
}
void C(){
      printf("I'm C.\n");
}
int main()
{
      A();
}
```

			Marks	CLOs
	c)	Discuss four features of Object Oriented Programming (OOP) with examples.	10	CLO4
6.	a)	Write a function that swaps value between two variables.	10	
	b)	Implement Bubble Sort algorithm using C programming language.	20	
7.	a)	Write a C program that shows the first 12 numbers in the Fibonacci Series using Recursion.	10	
	b)	Using Recursion display all numbers from 44 to 19.	10	
	c)	Discuss call by value and call by reference with examples.	10	
8.	a)	Write a C program that takes 5 courses marks as input and calculate the average of them using Malloc() function.	10	
	b)	Design a Class that best describe a car.	05	
	c)	Create five objects of Student Class. Take input for each object and display then at the end.	15	

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2023

Course Code: CE 2111 Level-2 Term-I

Time: 03 (Three) hours Full Marks: 180

Course Title: Mechanics of Solids I

N.B.
- The questions are of equal value.
- Figures in the margin indicate full marks allotted to each question.
- Symbols and abbreviations bear their standard meaning.
- Use a separate answer script for each PART.
- The corresponding course learning outcomes (CLOs) are given in the right most column.
- Assume any missing data if necessary.

PART- A (Marks: 90)

(Answer any three questions including Q. No. 1)

			Marks	CLOs
1.	a)	Draw the stress-strain diagram of Mild Steel describing all components. Also define strain hardening and rupture according to your drawing.	(10)	1
	b)	An aluminum rod is rigidly attached between a steel rod and a bronze rod as shown in Fig. 1. Axial loads are applied at positions indicated. Find the maximum value of P that will not exceed a stress in steel of 140 MPa, in aluminum of 90 MPa or in bronze of 100 MPa.	(20)	1

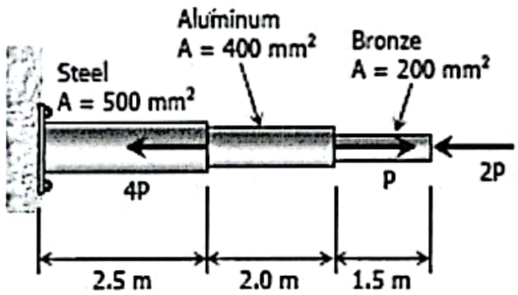
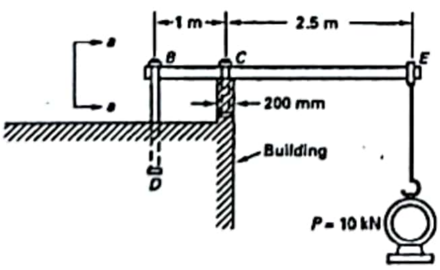
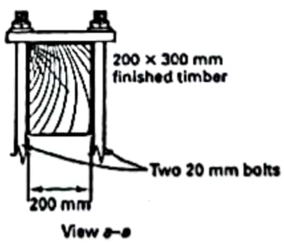


Fig. 1

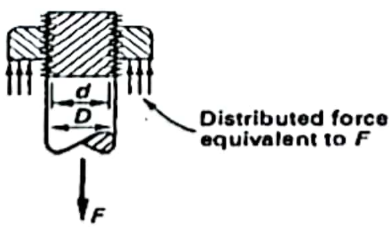
		Marks	CLOs
2.	The beam as shown in Fig. 2 (a), (b), (c) is used for hoisting instruments. It is anchored by two bolts at B. At C it rests on parapet wall. The necessary details are given in the Fig. 2. Note that bolts are threaded with d = 16 mm at the root of the threads as shown in Fig. 2 (c). If this hoist can subject to a force of 10 kN, determine the stress in bolts at BD and the bearing stress at C. Assume the weight of the beam is negligible.	(30)	1



(a)



(b)



(c)

Fig. 2

3. a) Explain the following terms briefly: (12) 1
i) Axial Deformation ii) Yield Point iii) Modulus of Elasticity iv) Ultimate Strength.

b) Find the smallest diameter bolt that can be used in the clevis as shown in Fig. 3, if P = 400 KN. The shearing strength of the bolt is 300 MPa. (18) 1

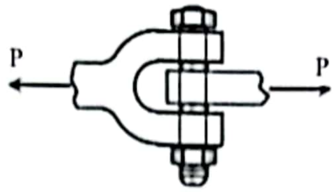


Fig. 3

4. a) An aluminum bar having a cross sectional area of 0.5 in^2 carries the axial loads applied at the position shown in Fig. 4. Compute the total change in length of the bar if $E = 10*10^6$ psi. Assume the bar is suitably braced to prevent lateral buckling. (15) 1

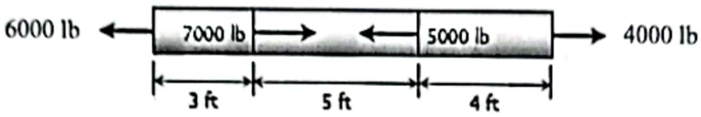


Fig. 4

b) A cylindrical pressure vessel is fabricated from steel plating that has a thickness of 20 m. The diameter of the pressure vessel is 450 mm and its length is 2.0 m. Determine the maximum internal pressure that can be applied if the longitudinal stress is limited to 140 MPa, and the circumferential stress is limited to 60 MPa. (15) 1

PART- B (Marks: 90)

(Answer any three questions including Q. No. 5)

Marks CLOs

5. a) A beam is loaded as shown in Fig. 5. Draw the shear force diagram (SFD) and bending moment diagram (BMD) for this beam. (20) 3

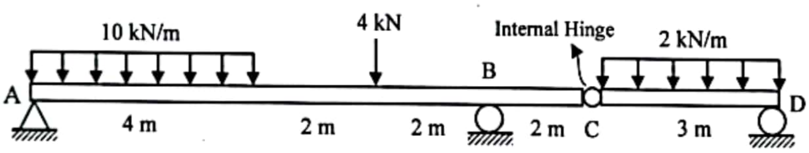


Fig. 5

b) Determine the flexural stress in the mid span of CD using b = 250 mm, h = 400 mm. (10) 2

6. a) Identify the beam AC in Fig. 5 and using necessary diagram illustrate the mechanism of the support provided at C. (10) 1

b) A simply supported beam of span length 4 m is subjected to a uniformly distributed load (UDL) of magnitude 1 kN/m throughout its length. (20) 3

Due to this load, a particular fiber AB is contracted by an amount of 60×10^{-3} mm and at the same time another fiber CD is elongated by an amount of 100×10^{-3} mm. The locations of the fibers are illustrated in Fig. 6. Using E = 25 GPa, determine the amount of flexural stress at the top and bottom fibers. The gage length of the fibers is 200 mm.

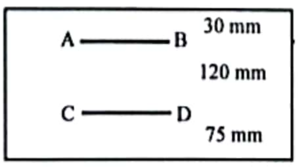


Fig. 6

7. a) Illustrate, with figures, the type of static loads that a structural member might be subjected to throughout its lifetime. (10) 2

b) A simply supported beam shown in Fig. 7 is subjected to static loading as given. For the shear force at support A calculate the shear stress along the depth of the cross-section at every 50 mm interval and show the variation of the shear stress in a neat sketch. The values in cross-section are given in mm. (20) 3

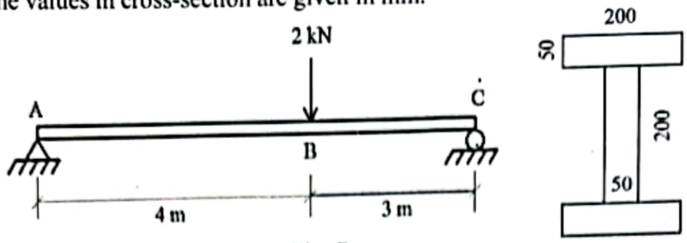


Fig. 7

8. a) Draw the load diagram of a simply supported beam for which the shear force diagram is given in Fig. 8. (10) 2

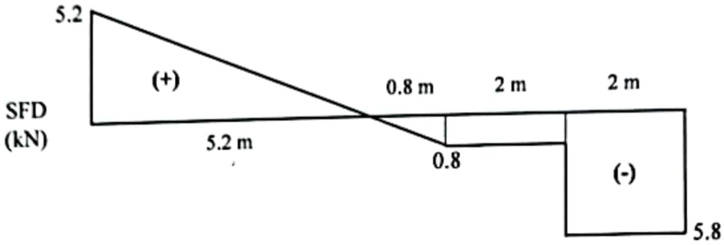


Fig. 8

b) For a beam carrying an arbitrary loading, show that the flexural stress can be expressed by the following equation where the notations bear their usual meanings: (20) 3

$$\sigma = \frac{Mc}{I}$$

OR,

For a rectangular beam section, show that the maximum horizontal shear stress equals to 1.5 times the average shear stress.

$$\tau_{max} = 1.5\ \tau_{avrg.}$$

Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final Examination, Summer 2023

Course Code: CE 2105 — **Level-2 Term-I**

Time: 03 (Three) hours — **Full Marks: 180**

Course Title: Engineering Materials

N.B.
- The questions are of equal value.
- Figures in the margin indicate full marks allotted to each question.
- Symbols and abbreviations bear their standard meaning.
- Use separate answer script for each PART.
- The corresponding course learning outcomes (CLOs) are given in the right most column.
- Assume reasonable value if any data is missing.

PART- A (Marks: 90)

(Answer any three questions including Q. No. 1)

			Marks	CLOs
1.	a)	Briefly explain any five important properties of engineering materials.	(10)	1
	b)	In a building, the slab is spalling due to bad weather condition. As a civil engineer, explain the process of repairing this slab using ferrocement with neat sketch.	(20)	3
2.	a)	As a Project Engineer of a construction project, you must ensure the quality of engineering materials. Therefore, explain the tests you need to carry out in the field to determine the quality of good bricks.	(10)	1
	b)	State the objectives of seasoning of timber. Explain any method of natural seasoning of timber.	(20)	1
3.	a)	Explain any two defects on brick masonry.	(10)	3
	b)	Write explanatory notes on the following (sketch required if any): i. Flash setting of cement; ii. Bulking of sand; iii. Timber rot; iv. Gradation of aggregate	(20)	1
4.	a)	With the help of a flow chart briefly explain the wet process of manufacturing of cement.	(10)	1
	b)	For a bridge construction project, sand sample was collected and sent to BAUST Materials Laboratory for sieve analysis. The sieve analysis data are given below:	(20)	1

Sieve	Sieve Opening, (mm)	Materials Retained, (gm)
# 4	4.75	15
# 8	2.36	24
# 12	1.7	36
# 16	1.19	60
# 30	0.59	135
# 40	0.425	105
# 50	0.3	90
# 100	0.15	60
# 200	0.075	30
Pan	0	0

Calculate the fineness modulus (FM), draw the gradation curve and identify the type of gradation of the soil. (Semi log graph paper is added with the question paper. Use the graph paper and submit it with the answer script.)

PART- B (Marks: 90)

(Answer any three questions including Q. No. 5)

Q.		Question	Marks	CLOs
5.	a)	Explain corrosion. Discuss main causes of corrosion in RC element.	(5)	3
	b)	Design a concrete mix following ACI 211.1 mix design method and find the ingredients required for a trial mix of a set of cylinders. The concrete is required for an exterior column (10" x 10") located above ground. Specified strength is 35 MPa at 28 days, with slump between 1 to 2 in. Max. aggregate size is ¾ in.	(25)	2

Refer to the tables in the attachment for any required value.

Specifications: Cement type: Ordinary Portland cement, Specific gravity = 3.15

Coarse aggregate:	Fine aggregate:
Bulk sp. Gravity (OD) = 2.7	Bulk sp. Gravity (OD) = 2.65
Adsorption capacity = 1.5%	Adsorption capacity = 1.9%
Unit-weight (dry-rodded) = 1600 kg/m^3	Fineness modulus = 2.7
Moisture content = 0.7%	Moisture content = 3.5%

Q.		Question	Marks	CLOs
6.	a)	Explain spalling of concrete.	(05)	1
	b)	Describe the corrosion prevention mechanism in reinforcement concrete (RC) element and steel member with relevant sketches.	(10)	3
	c)	Suppose a sheet pile is used in bridge construction. Determine the additional thickness to be provided in steel sheet pile section to prevent corrosion if the required thickness of the member is 12 mm, the corrosion rate of steel is 0.05 mm/yr. and design life of the structure is 50 years.	(15)	3
7.	a)	Explain segregation of concrete. Discuss the causes and remedial measures of segregation of concrete.	(10)	3
	b)	Compare between – i. Thermo-setting plastic and thermo-plastic; ii. Paints and varnishes.	(20)	1
8.	a)	Explain the process of distempering on the wall.	(10)	1
	b)	Discuss different types of defects of paints.	(10)	3
	c)	List the tests used for measurement of workability of concrete. Explain any of them.	(10)	1

CLOs

Table 1 (a): Overdesign necessary to meet strength requirements.

Number of Tests	Standard Deviation, psi				
	300	400	500	600	700
15	470	620	850	1120	1390
20	430	580	760	1010	1260
30 or more	400	530	670	900	1130
	Standard Deviation, MPa				
	2.0	3.0	4.0	5.0	
15	3.1	4.7	7.3	10.0	
20	2.9	4.3	6.6	9.1	
30 or more	2.7	4.0	5.8	8.2	

Table 1 (b): Required average compressive strength when data are not available to establish a standard deviation.

Specified Compressive strength, f'_c, MPa	Required average compressive strength, f'_{cr}, MPa
Less than 21	$f'_c + 7.0$
21 to 35	$f'_c + 8.5$
Over 35	$1.10f'_c + 5.0$

Table 2: Relationship between water to cementitious material ratio and compressive strength of concrete.

Compressive strength at 28 days, MPa	Water-cementitious materials ratio by mass	
	Non-air-entrained concrete	Air-entrained concrete
45	0.38	0.30
40	0.42	0.34
35	0.47	0.39
30	0.54	0.45
25	0.61	0.52
20	0.69	0.60
15	0.79	0.70

Table 3: Bulk volume of coarse aggregate per unit volume of concrete

Nominal Maximum size of aggregate, mm (in.)	Bulk volume of dry-rodded coarse aggregate per unit volume of concrete for different fineness moduli of fine aggregate			
	2.4	2.6	2.8	3.0
9.5 (3/8)	0.50	0.48	0.46	0.44
12.5 (1/2)	0.59	0.57	0.55	0.53
19 (3/4)	0.66	0.64	0.62	0.60
25 (1)	0.71	0.69	0.67	0.65
37.5 (1.5)	0.75	0.73	0.71	0.69
50 (2)	0.78	0.76	0.74	0.72
75 (3)	0.82	0.80	0.78	0.76
150 (6)	0.87	0.85	0.83	0.81

Table 4: Approximate mixing water in kg/m3 and target air content for different slumps and nominal maximum aggregate sizes*

Slump, mm	Water, Kg/m³ of concrete, for indicated sizes of aggregate							
	9.5mm	12.5mm	19mm	25mm	37.5mm	50mm*	75mm*	150mm*
	Non-air-entrained concrete							
25 to 50	207	199	190	179	166	154	130	113
75 to 100	228	216	205	193	181	169	145	124
150 to 175	243	228	216	202	190	178	160	-
Approximate amount of entrapped air in non-air-entrained concrete, %	3	2.5	2	1.5	1	0.5	0.3	0.2
	Air-entrained concrete							
25 to 50	181	175	168	160	150	142	122	107
75 to 100	202	193	184	175	165	157	133	119
150 to 175	216	205	197	184	174	166	154	-
Recommended avg total air content, % for level of exposure.								
Mid exposure	4.5	4.0	3.5	3.0	2.5	2.0	1.5	1.0
Moderate exposure	6.0	5.5	5.0	4.5	4.5	4.0	3.5	3.0
Severe exposure	7.5	7.0	6.0	6.0	5.5	5.0	4.5	4.0

Table 5: Recommended slum values for various types of construction

Concrete Construction	Slump, mm (in.)	
	Maximum*	Minimum
Reinforced foundation walls and footings	75 (3)	25(1)
Plain footings, Caissons and Substructure walls	75 (3)	25(1)
Beams and Reinforced walls	100 (4)	25(1)
Building Columns	100 (4)	25(1)
Pavements and slabs	75 (3)	25(1)
Mass Concrete	75 (3)	25(1)

Note: May be increased 25 mm (1in.) for consolidation by hand methods such as rodding and spading.

Table 6: First estimate of density (unit weight) of fresh concrete

Nominal Maximum size of aggregate, mm	First estimate of concrete unit mass, kg/m^3	
	Non-air-entrained concrete	Air-entrained concrete
9.5	2280	2200
12.5	2310	2230
19	2345	2275
25	2380	2290
37.5	2410	2350
50	2445	2345
75	2490	2405
150	2530	2435

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