4-1

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2019
Program: B.Sc. Engineering (Civil)

Course code: CE 461
Course title: Irrigation and Flood Control

Time: 60 Minutes — Total marks: 20

Answer all questions [Assume any missing data.]

1. Explain the following: i) Artesian flow; ii) Integrated water resources management (IWRM); iii) Haor; iv) Cropping pattern. — 5

2. Explain how soil moisture stress and soil moisture tension effects irrigation water requirement. — 3

3. Estimate depth of ground water evaporation that may turn a 33 cm depth of soil saline over a period of 5 months. The electrical conductivity of groundwater is 5 mmhos/cm. The electric conductivity (EC) value of saturated extract of soil is 1 mmhos/cm. The soil has a mean bulk density of 1.45 g/cm^3 and saturation point of 40 percent. The density of water is assumed as 1 g/cm^3. — 2.5

4. Calculate the irrigation requirement of a maize crop when the leaching requirement of a maize soil is 18% and the soil water has been depleted 72%. The available water holding capacity of the root zone is 15 cm. — 2.5

5. You are a newly appointed engineer of Bangladesh Water Development Board (BWDB) and posted in coastal region of Bangladesh that is regularly affected by flood. After joining the office, you have noticed that majority of the works of your department are focusing on managing *flood disaster*. However – you are thinking that managing *flood hazard* would be most effective approach to reduce the *probability of disaster* in the long run and increase *coping capacities* and *vulnerabilities* of the local communities. — 3

   Identify and explain three points based on which you will convince your department to focus on *hazard management* rather than *disaster management*.

6. Explain the need for international water cooperation to ensure irrigation water and reduce flood hazards in Bangladesh. — 4

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Fall 2019
Program: B.Sc. Engineering (Civil)

Course Title: Transportation Engineering II — Course Code: CE 451
Time: 1 Hour — Full Marks: 60

[Assume any reasonable values if necessary]

1. You have to construct a flexible pavement for highway from Dhaka to Sylhet. The construction of the pavement will start in the month of May (length 290 km). You need to find out the suitability of soil using AASTHO soil classification system. The results in table 1 were obtained by a mechanical analysis. **Classify the soil according to the AASHTO classification system and give the group index. Also comment whether you can use the soil as subgrade material in its natural state.** 15

Table 1:

Sieve Analysis, % Finer				
No. 10	No. 40	No. 200	Liquid Limit	Plastic Limit
84	58	8	-	N.P.

2. What laboratory tests of soil will you conduct for the construction of pavement in question 1? Explain the significance of the test. 5

Answer 3 or 4

3. State the type of bitumen you will use for the construction of pavement specified in question 1. Justify your answer. 5

Or

4. State the type of bitumen mixture you will use for the construction of pavement specified in question 1. Justify your answer. 5

5. Table 2 gives the specifications for the aggregates and mix composition for the pavement that you need to construct (question1) and Table 3 shows the results of a sieve analysis of samples from the materials available. **Determine the proportions of the separate aggregates that will give a gradation within the specified limits.** 25

Table 2:

Passing Sieve Designation	Retained on Sieve Designation	Percent by Weight
3⁄4 in. (19 mm)	1⁄2 in.	0–5
1⁄2 in. (12.5 mm)	3⁄8 in.	8–42
3⁄8 in. (9.5 mm)	No. 4	8–48
No. 4 (4.75 mm)	No. 10	6–28
No. 10 (2 mm)	No. 40	5–20
No. 40 (0.425 mm)	No. 80	9–30
No. 80 (0.180 mm)	No. 200	3–20
No. 200 (0.075 mm)	-	2–6

Table 3:

Passing Sieve Designation	Retained on Sieve Designation	*Percent by Weight*		
		Coarse Aggregate	Fine Aggregate	Filler
3/4 in. (19 mm)	1/2 in.	5	-	-
1/2 in. (12.5 mm)	3/8 in.	35	-	-
3/8 in. (9.5 mm)	No. 4	38	-	-
No. 4 (4.75 mm)	No. 10	17	8	-
No. 10 (2 mm)	No. 40	5	30	-
No. 40 (0.425 mm)	No. 80	-	35	5
No. 80 (0.180 mm)	No. 200	-	26	35
No. 200 (0.075 mm)		-	1	60

6. Explain the Stability and Flow value of Marshal Mix Design. 5

University of Asia Pacific
Department of Civil Engineering
Mid-Semester Examination Fall 2019
Program: B.Sc. in Civil Engineering

Course Title: Professional Practices & Communication — Course Code: CE 403
Credit Hours: 2.0 — Time: 1.00 Hour — Full Mark: 40

PART – A

Answer the following Questions.

1. Company 'X' has submitted plans, designs and all other relevant documents of a project to the appropriate authority of the respective municipality for approval. The submitted documents are forwarded to a team of four engineers, who will perform as 'The Project Approval Committee' for this project.

a. What should be the role of the approval committee? **[4]**

b. What should be given the highest priority in the process of approving any engineering design, product or system? **[4]**

c. The case is "Some errors exist in the submitted design documents". **[4]**
Compare the state of responsibility between the engineers of Company 'X' and those of 'The Project approval Committee' about identification/elimination of the errors in design.
Express your expectation being a part of the engineering profession.

d. What type of documents may be referred to enable the public to understand the degree of safety related to the use of a design, product or system? **[4]**

e. As an engineer, you are committed to improve the environment and enhance the quality of life. You are approving to construct and operate a Dyeing Industry, which will need to discharge its effluents during operational period. **[4]**
Due to the operation process of the industry, will it have any effect on quality of life? What should you review before approving that project?

PART - B

There are **Three** Questions. Answer any **Two.**

2. a. In which Phase of a project the issues of feasibility and justification are addressed? Which types of studies are required to conduct to address these issues properly? **[5]**

b. A Project Proposal has the following components: [5]

i. Record of the original project proposal details
ii. Report of the results of the project
iii. Detail of the problem that will be solved with the renewal
iv. Predictions

To which category does this specific Project belong? Justify your answer.

3. a. How do the Civil Engineers become client's source of "free" insurance? How to avoid this increased risk? [5]

b. Suppose you are a proud Project Manager who has successfully completed an engineering project. Now you are aiming to conduct a lessons-learned study regarding your completed project. Why do you think that this type of study is so important? [5]

4. a. How will you make the objectives of a project proposal "SMART"? [5]

b. Your 15-year old brother, who looks older, has just signed a contract on behalf of your company to supply mobile concrete mixer. Is this contract valid? Explain with reference to the essential requirements of a legally binding contract. [5]

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University of Asia Pacific

Department of Civil Engineering

Mid-Semester Examination Fall-2019

Program: B.Sc. Engg. (Civil)

Course Title: Geotechnical Engineering I Course No. CE 341 Credit: 3.00

Time: 1.00 Hour. Full Mark: 60

There are **two** Questions. **Answer all of them.**

1. a. Mention four major purposes of geotechnical subsurface exploration. **4**

b. An RC column with dimension of 12 in by 12 in is having an induced load of 100 kips. Justify why knowledge of geotechnical engineering is essential in resting the column in the ground. You may utilize an example in doing so. **7**

c. Write a short note on degree of disturbances during sampling. **6**

d. Information obtained from a geotechnical site investigation conducted at a site in Bangladesh is summarized below. Standard sampler was used. Determine corrected SPT N-values at corresponding depths of 15 ft, 20 ft and 25 feet below EGL. Use hammer efficiency 45%. **13**

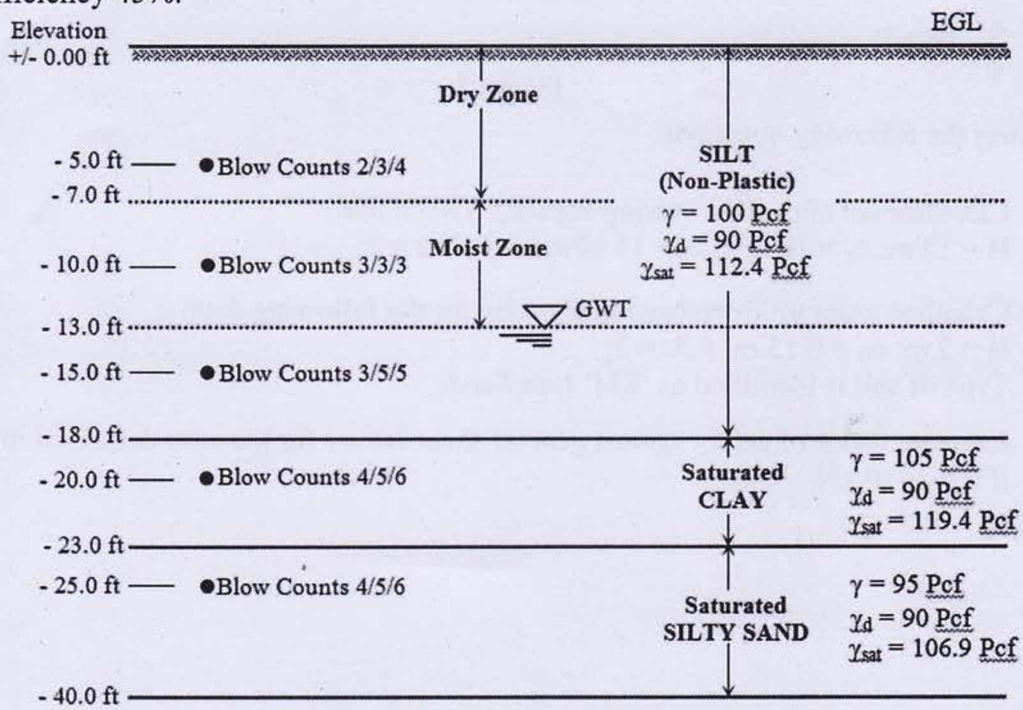


Figure 1: Subsurface Stratigraphy

2. A rectangular individual footing, placed at a depth 1.8 m below the ground level, will transfer loads to soil (Figure 2).

[Footing size: 3 m x 4m]

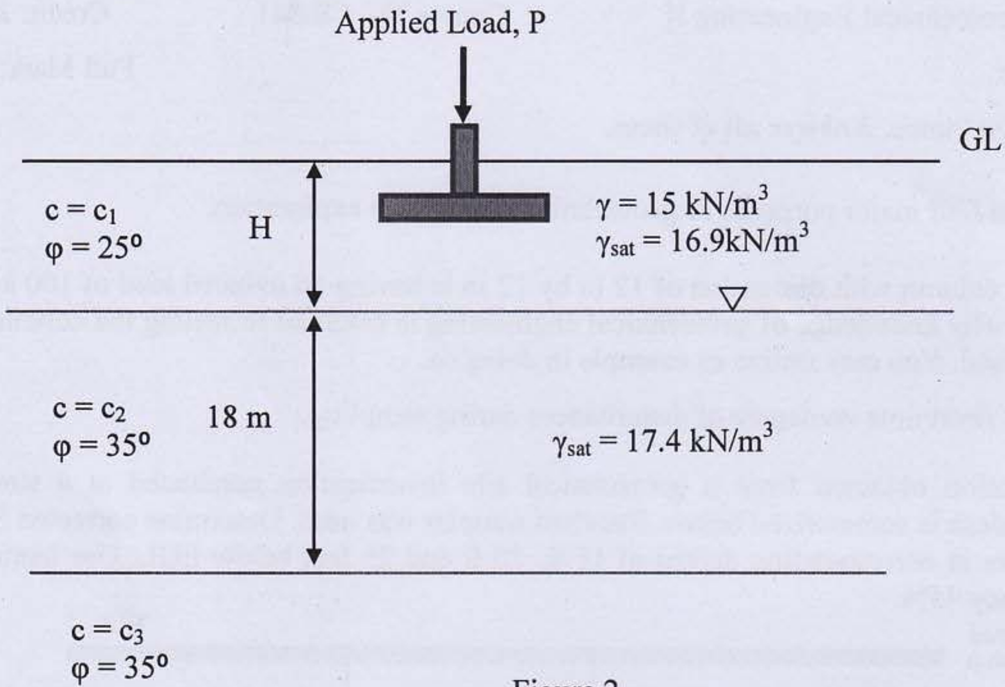


Figure 2

Answer the following questions.

a. Calculate net allowable bearing capacity. Given that $H = 12$ m; $c_1 = 10$ kPa; $c_2 = 15$ kPa; $e = 0$; F.S = 2. **12**

b. Calculate gross ultimate bearing capacity for the following data: $H = 2$ m; $e_B = 0.15$ m; F.S. = 2; Type of soil is identified as 'SM' type Sand. **12**

c. Estimate factor of safety against general shear failure for the case described in 'b', if $P = 1450$ kN. **6**

Appendix A

Factor	**Condition**	**Equation**
Shape	φ = 0°	$F_{cs} = 1 + 0.2\,(\frac{B}{L})$ $F_{qs} = F_{\gamma s} = 1$
	φ ≥ 10°	$F_{cs} = 1 + 0.2\,(\frac{B}{L})tan^2(45^\circ + \frac{\varphi}{2})$ $F_{qs} = F_{\gamma s} = 1 + 0.1\,(\frac{B}{L})tan^2(45^\circ + \frac{\varphi}{2})$
Depth	φ = 0°	$F_{cd} = 1 + 0.2\,(\frac{D_f}{B})$ $F_{qd} = F_{\gamma d} = 1$
	φ ≥ 10°	$F_{cd} = 1 + 0.2\left(\frac{D_f}{B}\right).tan(45^\circ + \frac{\varphi}{2})$ $F_{qd} = F_{\gamma d} = 1 + 0.1\left(\frac{D_f}{B}\right).tan(45^\circ + \frac{\varphi}{2})$
Inclination	Any φ	$F_{ci} = F_{qi} = (1 - \frac{\alpha^\circ}{90^\circ})^2$
	$\varphi > 0^\circ$	$F_{\gamma i} = (1 - \frac{\alpha^\circ}{\varphi^\circ})^2$
	$\varphi = 0^\circ$	$F_{\gamma i} = 0$

ϕ	N_c	N_q	N_γ (Meyerhof)	ϕ	N_c	N_q	N_γ (Meyerhof)	ϕ	N_c	N_q	N_γ (Meyerhof)
0°	5.10	1.00	0.00	17°	12.34	4.77	1.66	34°	42.16	29.44	31.15
1°	5.38	1.09	0.00	18°	13.10	5.26	2.00	35°	46.12	33.30	37.15
2°	5.63	1.20	0.01	19°	13.93	5.80	2.40	36°	50.59	37.75	44.43
3°	5.90	1.31	0.02	20°	14.83	6.40	2.87	37°	55.63	42.92	53.27
4°	6.19	1.43	0.04	21°	15.81	7.07	3.42	38°	61.35	48.93	64.07
5°	6.49	1.57	0.07	22°	16.88	7.82	4.07	39°	67.87	55.96	77.33
6°	6.81	1.72	0.11	23°	18.05	8.66	4.82	40°	75.31	64.20	93.69
7°	7.16	1.88	0.15	24°	19.32	9.60	5.72	41°	83.86	73.90	113.99
8°	7.53	2.06	0.21	25°	20.72	10.66	6.77	42°	93.71	85.37	139.32
9°	7.92	2.25	0.28	26°	22.25	11.85	8.00	43°	105.11	99.01	171.14
10°	8.34	2.47	0.37	27°	23.94	13.20	9.46	44°	118.37	115.31	211.41
11°	8.80	2.71	0.47	28°	25.80	14.72	11.19	45°	133.87	134.87	262.74
12°	9.28	2.97	0.60	29°	27.86	16.44	13.24	46°	152.10	158.50	328.73
13°	9.81	3.26	0.74	30°	30.14	18.40	15.67	47°	173.64	187.21	414.33
14°	10.37	3.59	0.92	31°	32.67	20.63	18.56	48°	199.26	222.30	526.46
15°	10.98	3.94	1.13	32°	35.49	23.18	22.02	49°	229.93	265.50	674.92
16°	11.63	4.34	1.37	33°	38.64	26.09	26.17				

Appendix B

Parameter for 60% Energy & Drilling System Correction For Field SPT-N Value

E_m = Hammer Efficiency (Donut + Cathed) = 0.55 to 0.60

C_B = Correction for Borehole Diameter
= 1.0 (For Dia 2.5" – 4.5")
= 1.05 (For Dia of 6")
= 1.15 (For Dia 8")

C_S = Correction for Sampler
= 1.0 Standard Sampler
= 1.2 Sampler Without Liner

C_R = Correction for Rod Length
= 0.75 for L = (3-4) m
= 0.85 for L = (4-6) m
= 0.95 for L = (6-10) m
= 1.0 for L > 10 m

$$CF_1 = \sqrt{\frac{2000}{\sigma_{v0}'}}$$

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Fall 2019
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering III		Course Code: CE 411
Time: 1 hour	Credit Hour: 3.0	Full Marks: 4 x 10

ANSWER ALL QUESTIONS. Any missing data can be assumed reasonably.

1. Use stiffness method to calculate rotations of joint ***c*** of the grid system ***abcdef*** loaded as shown in ***Fig.1*** [Given: $EI = 20\times10^3$ $k\text{-}ft^2$ *and* $GJ = 5\times10^3$ $k\text{-}ft^2$].

2. Ignore zero-force members and apply boundary conditions to form the stiffness matrix of the space truss ***abcdefghij*** shown in ***Fig.2***
[Given: S_x *= constant = 500 kip/ft, Nodal Coordinates (ft) are a(5,12,-5), b(5,12,0), c(2.5,6,0), d(2.5,6,-5), e(7.5,6,-5), f(7.5,6,0), g(0,0,-5), h(0,0,0), i(10,0,-5), j(10,0,0)*].

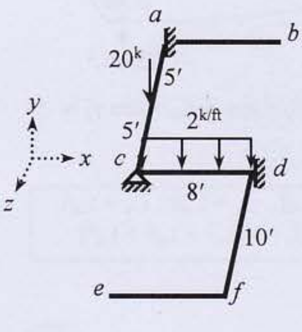


Fig.1

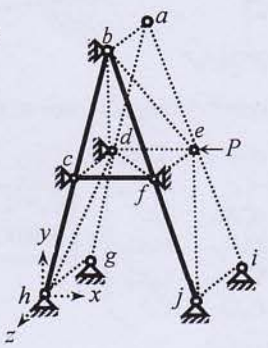


Fig.2

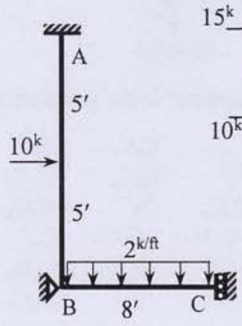


Fig.3

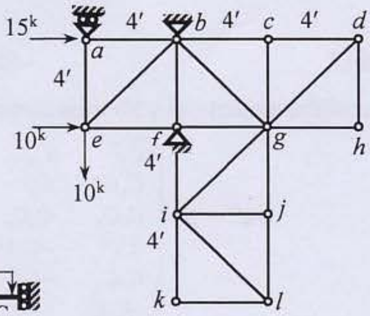


Fig.4

3. Use stiffness method (neglect axial deformations) to calculate rotation of joint ***B*** and displacement of joint ***C*** of the frame ***ABC*** loaded as shown in ***Fig.3*** (support **C** is a guided roller)
[Given: $EI = 40\times10^3$ $k\text{-}ft^2$].

4. Identify zero-force members of the truss loaded as shown in ***Fig.4***. Determine the displacements of joint ***a*** and ***e***. Also calculate member forces
[Given: *EA/L =1000 k/ft*].

List of Useful Formulae for CE 411

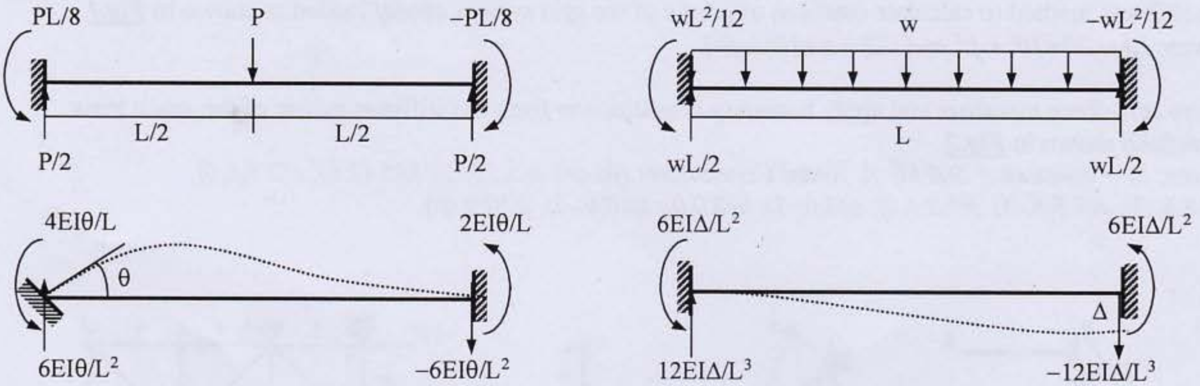
* The stiffness matrix K_m^G of a 2D truss member in the global axis system is given by

$$K_m^G = S_x \begin{pmatrix} C^2 & CS & -C^2 & -CS \\ CS & S^2 & -CS & -S^2 \\ -C^2 & -CS & C^2 & CS \\ -CS & -S^2 & CS & S^2 \end{pmatrix}$$

and Truss member force, $P_{AB} = S_x [(u_B - u_A) C + (v_B - v_A) S]$

[where $C = \cos\theta$, $S = \sin\theta$]

Fixed End Reactions for One-dimensional Prismatic Members under Typical Loadings



* The stiffness matrix of a 3D truss member in the global axes system [using $C_x = \cos\alpha$, $C_y = \cos\beta$, $C_z = \cos\gamma$] is

$$K_m^G = S_x \begin{pmatrix} C_x^2 & C_xC_y & C_xC_z & -C_x^2 & -C_xC_y & -C_xC_z \\ C_yC_x & C_y^2 & C_yC_z & -C_yC_x & -C_y^2 & -C_yC_z \\ C_zC_x & C_zC_y & C_z^2 & -C_zC_x & -C_zC_y & -C_z^2 \\ -C_x^2 & -C_xC_y & -C_xC_z & C_x^2 & C_xC_y & C_xC_z \\ -C_yC_x & -C_y^2 & -C_yC_z & C_yC_x & C_y^2 & C_yC_z \\ -C_zC_x & -C_zC_y & -C_z^2 & C_zC_x & C_zC_y & C_z^2 \end{pmatrix}$$

$C_x = L_x/L$, $C_y = L_y/L$, $C_z = L_z/L$
where $L = \sqrt{[L_x^2 + L_y^2 + L_z^2]}$

* Member force $P_{AB} = S_x [(u_B - u_A) C_x + (v_B - v_A) C_y + (w_B - w_A) C_z]$

* Ignoring axial deformations, the matrices K_m^L and G_m^L of a frame member in the local axis system are

$$K_m^L = \begin{pmatrix} S_1 & S_2 & -S_1 & S_2 \\ S_2 & S_3 & -S_2 & S_4 \\ -S_1 & -S_2 & S_1 & -S_2 \\ S_2 & S_4 & -S_2 & S_3 \end{pmatrix} \qquad G_m^L = (P/30L) \begin{pmatrix} 36 & 3L & -36 & 3L \\ 3L & 4L^2 & -3L & -L^2 \\ -36 & -3L & 36 & -3L \\ 3L & -L^2 & -3L & 4L^2 \end{pmatrix}$$

where $S_1 = 12EI/L^3$, $S_2 = 6EI/L^2$, $S_3 = 4EI/L$, $S_4 = 2EI/L$

*The general form of the stiffness matrix for any member of a 2-dimensional frame is

$$K_m^G = \begin{pmatrix} S_xC^2+S_1S^2 & (S_x-S_1)CS & -S_2S & -(S_xC^2+S_1S^2) & -(S_x-S_1)CS & -S_2S \\ (S_x-S_1)CS & S_xS^2+S_1C^2 & S_2C & -(S_x-S_1)CS & -(S_xS^2+S_1C^2) & S_2C \\ S_2S & S_2C & S_3 & S_2S & -S_2C & S_4 \\ -(S_xC^2+S_1S^2) & -(S_x-S_1)CS & S_2S & S_xC^2+S_1S^2 & (S_x-S_1)CS & S_2S \\ -(S_x-S_1)CS & -(S_xS^2+S_1C^2) & -S_2C & (S_x-S_1)CS & (S_xS^2+S_1C^2) & -S_2C \\ -S_2S & S_2C & S_4 & S_2S & -S_2C & S_3 \end{pmatrix}$$