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

Course Title: Professional Practices & Communication
Credit Hours: 2.0

Time: 1.00 Hour

Course Code: CE 403

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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List of Useful Formulae for CE 423

* $M_L \approx 2I_0/3 + 1$

$\log(E_S) = 1.8 + 1.5M$

$E_S = M_0/20,000$

$M_W = \log(M_0)/1.5 - 4.0$ [where M_0 is in kN-m]

* Governing equation of motion of SDOF system for ground motion $\Rightarrow m d^2u_r/dt^2 + c du_r/dt + k u_r = -m d^2u_g/dt^2$

* For SDOF system, $\omega_n = \sqrt{k/m}$, and $\xi = c/(2\sqrt{km})$

* Eigenvalue problem (to calculate natural frequencies and modal vector)

$$[\mathbf{K} - \omega_{nr}^2 \mathbf{M}] = 0 \quad \text{and} \quad [\mathbf{K} - \omega_{nr}^2 \mathbf{M}] \phi_r = 0$$

* BNBC-1993

$V_b = ZICW/R$, where $C = 1.25S/T_n^{2/3} \leq 2.75$

* Proposed New BNBC-2015

$V_b = (2/3) ZICW/R$, where

$$C = S [1 + (T_r/T_B) (2.5\eta - 1)] \quad \text{for } 0 \leq T_n \leq T_B$$

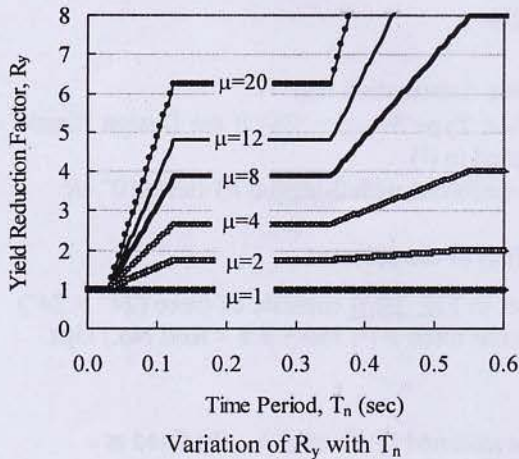
$$= S (2.5\eta) \quad \text{for } T_B \leq T_n \leq T_C$$

$$= S [(2.5\eta) (T_C/T_n)] \quad \text{for } T_C \leq T_n \leq T_D$$

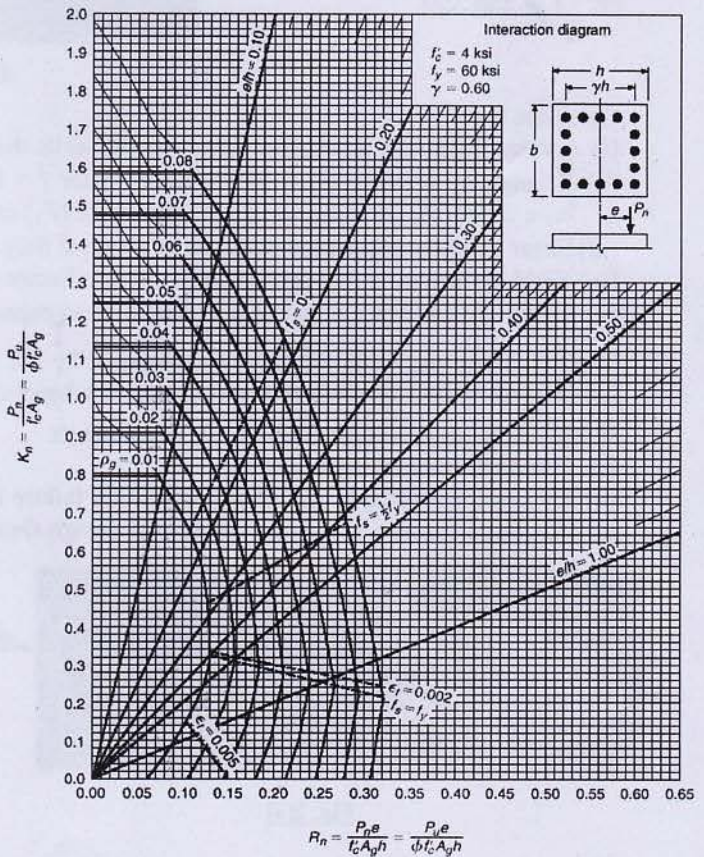
$$= S [(2.5\eta) (T_C T_D / T_n^2)] \quad \text{for } T_D \leq T_n$$

$\eta = \sqrt{\{10/(5+\xi)\}} \geq 0.55$

* $R_y = f_0/f_y \quad \mu = u_m/u_y$



Soil Type	S	T_B	T_C	T_D
S_A	1.20	0.15	0.40	2.00



* Kent-Park (1971) model

$\epsilon_0 = 0.002 \quad \epsilon_{50c} (= \epsilon_u) = \epsilon_{50u} + \epsilon_{50h}$
with $\epsilon_{50u} = (3 + 2f_c')/(f_c' - 1) \times 10^{-3}$

$\epsilon_{50h} = 0.75 \rho_{st} \sqrt{(b_c/S_t)}$

where $\rho_{st} = \text{Vol}_{st}/\text{Vol}_{con}$
 $= 2(b'' + h'')A_{st}/(b_c h_c S_t)$ for rectangular section

* Shear vs. Flexural Failure

$V_{Des} \geq 1.4 (M_{ul} + M_{u2})/L_n + V_{vert}$

* Weak-Beam Strong-Column: $\sum M_{c,ult} \geq 1.2 \sum M_{b,ult}$

* $V_u = V_c + V_s = 2\sqrt{f_c'} bd + A_v f_y d/S$

* Special confining reinforcement ($S_t \leq b_c/4, 4''$)

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

Course Title: Environmental Engineering III
Time: 1 hour

Course Code: CE 431
Full Marks: 40

There are Four Questions. Answer All the Questions. Assume any missing data (If any).

1. Explain the term "Solid waste management (SWM)". As a municipal engineer [5+5]
comment on the importance of the solid waste generation rate for designing an
efficient SWM system.

2. A cannery (where food/fruits are canned) receives on a given day: [10]
 - i. 15 tons of raw produce
 - ii. 5 tons of cans
 - iii. 0.6 tons of cartons
 - iv. 0.4 tons of miscellaneous materials.As a result of internal activity
 - i. 12 tons of product are produced, remainder discharged to a disposal facility
 - ii. 3 tons of cans are stored, remainder used
 - iii. 3% of cans used are damaged and recycled
 - iv. 4% of cartoons are incinerated
 - v. 75% of miscellaneous materials become paper waste and incinerated, remainder
is disposed of.Determine the generation rate of solid wastes.

3. Collection of solid waste is a multi-phase process in any SWM system---justify this [10]
statement with figure.

4. Determine the break-even time for a stationary-container system and a separate [10]
transfer and transport system for transporting solid wastes collected from a
metropolitan area to a landfill disposal site having the following data:
 - i. Transportation cost for Stationary-container system using a 20 m³ compactor =
Tk 25/h
 - ii. Cost for Tractor-trailer transport unit with a capacity of 120 m³ = Tk 30/h
 - iii. Transfer station operating cost, including amortization = Tk 5/m³
 - iv. Extra cost for unloading facilities for Tractor-trailer transport unit = Tk 5/m³
 - v. Density of wastes in compactor = 320 kg/m³
 - vi. Density of wastes in transport units = 175 kg/m³

OR

A transfer station handling 350 tons/day, 5 days per week, costs Tk 7.5 million to build and Tk 0.2 million per year to operate. An individual tractor-trailer costs Tk 5.5 million and carries 25 tons/trip. Annual operation and maintenance costs (including fuel) of the truck are Tk 0.15 million; the driver makes Tk 0.25 million per year (including benefits). The capital costs of the building and transfer trucks are to be amortized over a 15-yr period using a 12% discount factor.

Suppose, it takes 1 hour to make a one-way trip from the transfer station to the disposal site and 7 round trips per day are made.

Find the transfer station and hauling cost (BDT) per ton.

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

Course Title: Structural Engineering V (Prestressed Concrete)
 Time: 1 hr

Course Code: CE 415
 Full Marks: 60

[Answer All the questions. Assume value for any missing data]

1. A prestressed-concrete beam is continuous over two spans, as shown in **Figure 1** and its curved cable is to be tensioned from both ends. The coefficient of friction is 0.30 and the length effect is $K = 0.0026$ per meter. Compute the percentage loss due to friction of the entire beam by exact method. (20)

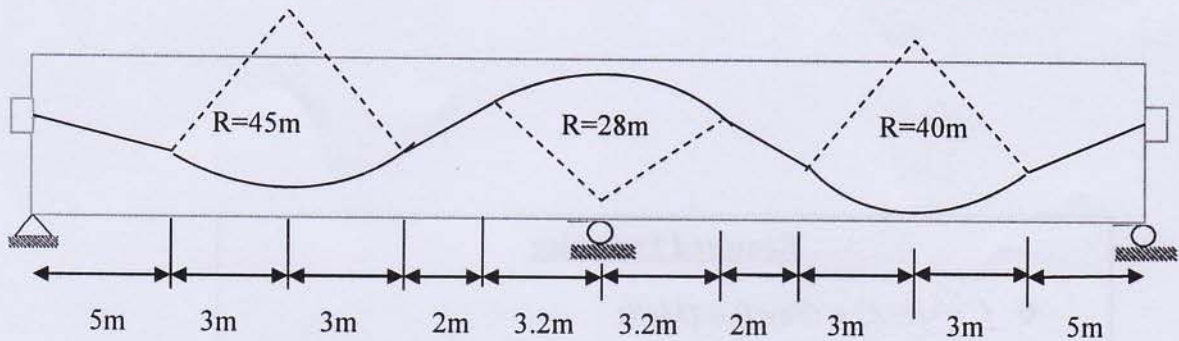


Figure 1: Prestressed concrete beam

2. A post tensioned bonded concrete beam as shown in **Figure 2** has a prestress of 1650kN in the steel. Immediately after prestressing the stress eventually reduces to 1450kN due to losses. The beam carries two live loads of 50 kN each in addition to its own weight (W_G) of 6.72 kN/m. Analyze the section to calculate the extreme fiber stresses at midspan for the following conditions. (14)
- (a) Under the initial condition with full prestress and no live load
 (b) Under the final condition, after the losses have taken place, and with full live load.

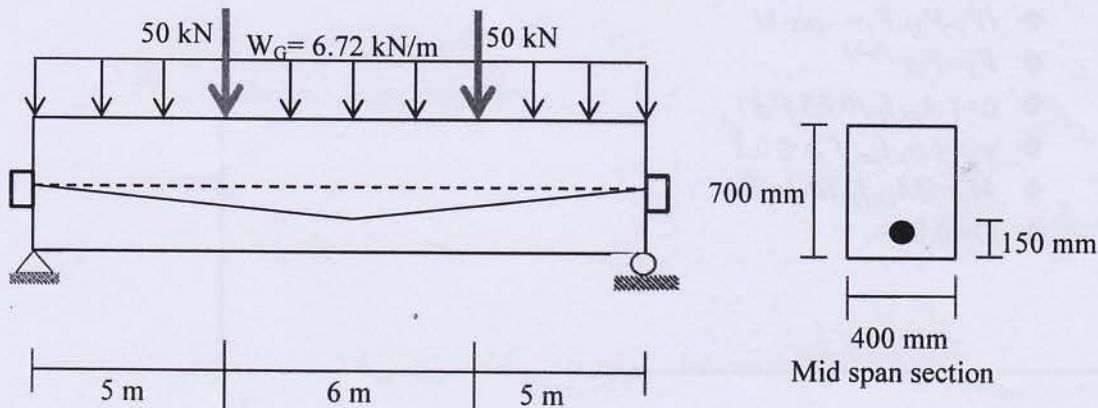


Figure 2: Post tensioned bonded beam

3. (a) A concrete beam is post tensioned by a cable carrying an initial stress of 1500N/mm^2 . The slip at the jacking end was observed to be 5mm . The modulus of elasticity of steel is 210 kN/mm^2 . Estimate the percentage loss of stress due to anchorage slip if the length of the beam is (i) 20m and (ii) 2m . Also make comments on how this loss of stress can be overcome? (14)

(b) State the differences between prestressed concrete and reinforced concrete in terms of serviceability, safety and economy. (6)

(c) What are the differences between partial prestressing and full prestressing? (6)

Required Formulae

- ❖ $f_c = -(F/A) \pm (Fey/I) \pm (My/I)$
- ❖ $f_c = -(F/A) \pm (M_wy/I)$
- ❖ $\Delta f_s = n [-(F/A) \pm (Fe^2/I) \pm (Me/I)]$
- ❖ $\Delta f_s = n f_c$
- ❖ $f_c = -(F/A) \pm (Fey/I)$
- ❖ $f_c = -(F/A) \pm (Fey/I)$
- ❖ $\Delta = (PL)/(AE_s)$
- ❖ $f_{ps} = f_{pu} \{1 - 0.5\rho_p (f_{pu}/f_c)\}$
- ❖ $\rho_p = A_{ps}/bd$
- ❖ $(F_1 - F_2)/F_1 = -\mu\alpha - kL$
- ❖ $F_2 = F_1 e^{-\mu\alpha - kL}$
- ❖ $\alpha = (A_{ps} f_{ps} / 0.85 f_c b)$
- ❖ $w_p = (\rho_p f_{ps} / f_c) \leq 0.3$
- ❖ $M_u = \phi A_{ps} f_{ps} \{d - (a/2)\}$
- ❖ $\phi = 0.9$

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

Course Title: Structural Engineering VI (Design of Steel Structures)
 Time: 1 hour

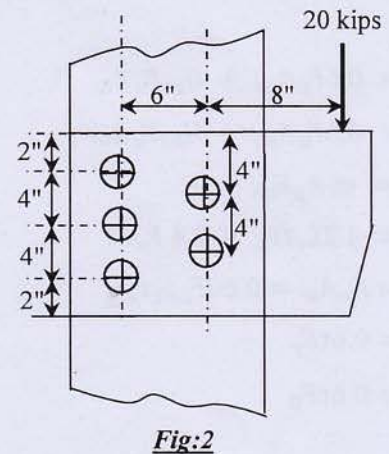
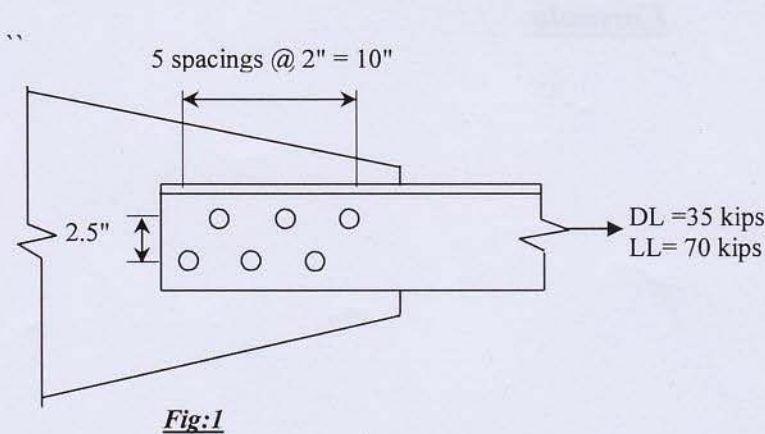
Course Code: CE 417
 Full Marks: 3×10=30

Answer all 03 (Three) questions
 [Assume Reasonable Values for Any Missing Data]

1. From the following table, select the lightest unequal-leg angle for a tension member (which is 15 feet long), to resist a service dead load of 35 kips and a service live load of 70 kips. Use A36 steel ($F_u=58$ ksi). The tension member shall be connected to a gusset plate using 6 nos. 5/8-inch dia. bolts with standard holes in two rows as shown in **Fig:1**. Consider block shear failure mode and follow **AISC-LRFD** principle. [10]

Assume, $U=0.8$ and check preferable $L/r \leq 300$.

Shape	A_g (in ²)	r_x (in)	r_y (in)	r_z (in)
L6×4×5/8	5.86	1.89	1.13	0.859
L6×4×9/16	5.31	1.90	1.14	0.861
L6×4×1/2	4.75	1.91	1.14	0.864
L6×4×7/16	4.18	1.92	1.15	0.867



2. (a) Define "Limit States" design approach. [02]
- (b) Write the advantages and disadvantages of structural steel as building material. [03]
- (c) Use the elastic (vector) method to compute the resultant bolt shear forces for the eccentrically loaded bolt group of **Fig:2**. All bolts are 3/4 in diameter and A490 ($F_{by}=130$ ksi, $F_{bu}=150$ ksi). [05]

3. (a) Define hot rolled and cold formed structural shapes with examples. [02]
- (b) Mention different types of welded joints with neat sketches. [03]
- (c) Use LRFD Method to design the fillet welds to develop the full strength of the angle shown in **Fig.3** [05] minimizing the effect of eccentricity. Assume that the gusset plate does not govern. [Material A572-GR50: $F_y=50$ ksi, $F_u=65$ ksi. Use E70XX electrode.].

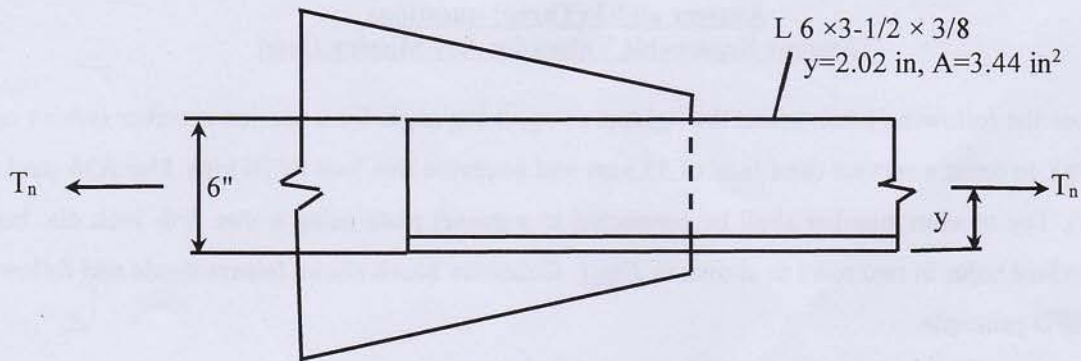


Fig:3

Formula

1. $R_n = 0.6F_y A_{gv} + U_{bs} F_u A_{nt}$
2. $R_n = 0.6F_u A_{nv} + U_{bs} F_u A_{nt}$
3. $R_n = m A_b F_{nv}$
4. $R_n = 1.2L_c t F_u \leq 2.4 F_u d t$
5. $R_n = F_w A_w = 0.60 F_{Exx} t_e$
6. $R_n = 0.6 t F_y$
7. $R_n = 0.6 t F_u$

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

Course Title: Environmental Engineering IV
 Time- 1 hour

Course Code: CE 433
 Full marks: 40

Answer all the questions (20 +20 = 40).[Assume reasonable data if any]

- 1.(a) Classify air pollutants according to origin, chemical composition, and state of matter giving two examples of each class. Which of the air pollutants are termed 'Criteria Pollutants'? Why? [12]

OR

What do you mean by PM₁₀ and PM_{2.5}? What adverse health effects are associated with these two air pollutants? Which one is more critical? Why?

- (b) On a particular day, the following air quality data have been recorded at a monitoring station in Dhaka: PM_{2.5} =220 µg/m³ (24-hr); PM₁₀ = 280µg/m³ (24-hr); SO₂ = 0.50 ppm (24-hr); CO =13 ppm (8-hr); O₃ =0.095 ppm (8-hr). [8]

Calculate AQI and prepare the AQI report for the day in Dhaka.

The breakpoint values of 5 criteria pollutants in the following table are used for calculating AQI:

Breakpoints							AQI
O ₃ (ppm) 8-hr	O ₃ (ppm) 1-hr (i)	PM _{2.5} (µg/m ³) 24-hr	PM ₁₀ (µg/m ³) 24-hr	CO (ppm) 8-hr	SO ₂ (ppm) 24-hr	NO ₂ (ppm) Annual	
0.000-0.064	--	0.0-15.4	0-54	0.0-4.4	0.000-0.034	(ii)	0-50
0.065-0.084	--	15.5-40.4	55-154	4.5-9.4	0.035-0.144	(ii)	51-100
0.085-0.104	0.125-0.164	40.5-65.4	155-254	9.5-12.4	0.145-0.224	(ii)	101-150
0.105-0.124	0.165-0.204	65.5-150.4	255-354	12.5-15.4	0.225-0.304	(ii)	151-200
0.125-0.374	0.205-0.404	150.5-250.4	355-424	15.5-30.4	0.305-0.604	0.65-1.24	201-300
(iii)	0.405-0.504	250.5-350.4	425-504	30.5-40.4	0.605-0.804	1.25-1.64	301-400
(iii)	0.505-0.604	350.5-500.4	505-604	40.5-50.4	0.805-1.004	1.65-2.04	401-500

(i) In some cases, in addition to calculating the 8-hr ozone index, the 1-hr ozone index may be calculated, and the maximum of the two values reported

(ii) NO₂ has no short-term air quality standard and can generate an AQI only above 200

(iii) 8-hr O₃ values do not define higher AQI values (≥301). AQI values of 301 or higher are calculated with 1-hr O₃ concentrations

Bangladesh AQI, adopted from USEPA, is similar and can be described as given in the following table:

<u>AQI Categories:</u>		
<u>AQI Value</u>	<u>Descriptor</u>	<u>Color Code</u>
0 – 50	Good	Green
51 – 100	Moderate	Yellow
101 – 150	Unhealthy for for sensitive Group	Orange
151 – 200	Unhealthy	Red
201 – 300	Very unhealthy	Purple
> 300	Hazardous	Maroon

2. (a) Explain the advantages of Chemical Assessment Methods compared to the Biological Assessment Methods of water quality contaminants. Demonstrate your understanding on “Pollutant discharge limits/standards” in a short note. [5+5]

OR

A textile industry is located beside River Modhumoti and an agricultural field is also present nearby. Employ your knowledge on classification of contaminants and sources to identify which contaminants would be expected from these two sources to pollute the river. Also provide a prediction on the adverse effects to be expected in the river ecosystem due to those contaminants in brief.

- (b) 22 mL wastewater is mixed with dilution water to fill 300 mL BOD bottle. The drop of DO after 5 days is 4.8 mg/L. For a BOD bottle filled with only dilution water, DO drop is 1.2 mg/L after 5 days. Again, the total concentration of organic and ammonia nitrogen in wastewater is 3.5 mg/L. If $k = 0.21 \text{ d}^{-1}$ at 20°C , estimate the ultimate strength of the sample. [10]

OR

A municipal wastewater treatment plant ($Q_w = 15000 \text{ m}^3/\text{d}$ and $T = 25^\circ\text{C}$) discharges $0.17 \text{ m}^3/\text{s}$ of treated effluent having BOD_5 of 50 mg/L and DO of 2 mg/L into a stream ($Q_T = 0.5 \text{ m}^3/\text{s}$ and $T = 24^\circ\text{C}$) that has a BOD_5 of 3 mg/L and DO of 8 mg/L . The deoxygenation constant for the mixture of river water and wastewater k_d is $0.23/\text{day}$. The stream has a depth of 2.6 m and the average stream velocity is 0.2 m/s . Estimate DO_{\min} , x_c , t_c .

$$\text{BOD}_m \cdot V_m = \text{BOD}_w \cdot V_w + \text{BOD}_d \cdot V_d \quad \text{BOD}_t = L_0 (1 - e^{-kt})$$

$$\text{Ultimate NBOD} = 4.57 \cdot \text{TKN} \sim 4.6 \cdot \text{TKN}$$

$$D = \frac{k_d L_0}{k_r - k_d} (e^{-k_d t} - e^{-k_r t}) + D_0 e^{-k_r t}$$

$$k_r = \frac{3.9u^{1/2}}{H^{3/2}} \quad t_c = \frac{1}{k_r - k_d} \ln \left[\frac{k_r}{k_d} \left(1 - \frac{D_0 [k_r - k_d]}{k_d \cdot L_0} \right) \right]$$

$$D_{\max} = \frac{k_d L_0}{k_r - k_d} (e^{-k_d t_c} - e^{-k_r t_c}) + D_0 e^{-k_r t_c}$$

$$D_c = \frac{k_d}{k_r} L_0 e^{-k_d t_c}$$

$$\text{DO}_{(\text{sat})} = 14.62 - 0.39 T + 0.007714 T^2 - 0.0000646 T^3$$

$$\text{DO}_{\min} = \text{DO}_{\text{sat}} - D_c$$

$$k_d (\text{at } T^\circ\text{C}) = k_{20^\circ\text{C}} \cdot (1.047)^{T-20}, \quad k_r (\text{at } T^\circ\text{C}) = k_{r20^\circ\text{C}} \cdot (1.024)^{T-20}$$

- University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Fall 2019
Program: B.S. Engineering (Civil)
- (e) Write down the path of Graduated symbols in GIS.
- (f) Where is the create Graph option in GIS.
- (g) What are the components of GIS?
- (h) Suppose you have the number of male, female and children.
What should you do to get the total population?
- (i) You want to add particular location of some entities. What should be the add field type?
- (j) Define GIS

2. Road map of ward 36 has been given. Prepare a shape file of Secondary road from the given file. Now select the buildings which are less than or equal to 12 storied. Classify the building according to their use. Label the building with storied number. Now due to some emergency incident you need to extend your secondary road by 10 m on each side. do you think this decision will disturb the existing buildings (which you have selected)for this extension? [2+2+2+1+3]
3. (a) Geo-reference the image of Khagrachari Sadar Upazila and then convert the file as Google earth format. [4]
(b) Digitize the geo-referenced image of Khagrachari Sadar Upazila boundary along with Natural features, Physical infrastructure and Socio-economic infrastructure. [6]
4. (a) Points shape file is given. Select the location **Rangamati City Corporation**. Select the features which are within 200 m from Rangamati City Corporation. Create a new shape file of Hotels from that and label the name of the Hotels. Change the symbol of the Hotels. [3+1+1+1]
(b) Khagrachari district file is given. Prepare individual thana file. [4]

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- (j) Define GIS

2. Road map of ward 33 has been given. Prepare a shape file of Secondary road from the given file. Now select the buildings which are less than or equal to 8 storied. Classify the building according to their use. Label the building with storied number. Now due to some emergency incident you need to extend your secondary road by 7 m on each side. do you think this decision will disturb the existing buildings (which you have selected)for this extension? [2+2+2+1+3]
3. (a) Geo-reference the image of Panchari Upazila and then convert the file as Google earth format. [4]
(b) Digitize the geo-referenced image of Panchari boundary along with Natural features, Physical infrastructure and Socio-economic infrastructure. [6]
4. (a) Points shape file is given. Select the location **Dighinala Upazila Health Complex**. Select the features which are within 500 m from **Dighinala Upazila Health Complex**. Create a new shape file of Hospitals from that and label the name of the Hospitals. Change the symbol of the Hospitals. [3+1+1+1]
(b) Rangamati district file is given. Prepare individual thana file. [4]