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University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2016
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering III
Time- 1 hour

Course Code: CE 431
Full marks: 50

There are **THREE** questions. Question 1 is mandatory. In addition, answer any **ONE** between questions 2 and 3. $(25*2 = 50)$

1. (a) Define Solid Waste. Discuss the risks associated with poor management of solid waste. (2+4)
- (b) Why is it important to know the nature and composition of solid waste? Mention the physical and chemical properties of solid waste that are important to evaluate. Also mention the analytical methods for the chemical properties. (2+5)
- (c) A summary table for the chemical components of a solid waste sample is given below. Determine approximate chemical formulas with and without sulfur. Also calculate the energy content of the waste using Dulong's formula. (12)

Component	Moisture	Carbon	Hydrogen	Oxygen	Nitrogen	Sulfur	Ash
Mass (kg)	25.60	50.20	5.56	35.00	0.45	0.26	7.14
Molar Mass (kg/mol)	-	12.00	1.00	16.00	14.00	32.00	-

2. (a) What is source reduction/waste minimization? List the beneficial consequences of source reduction in relation to climate change issues. (2+4)
- (b) Discuss the hauled and stationary container systems with figures. (6)
- (c) For a stationary container system, 20 numbers of containers are emptied per trip, each having a volume of 3.75 m^3 . The container utilization factor and collection vehicle compaction ratio are 0.8 and 2.75 respectively. Determine the approximate truck capacity. (5)
- (d) Estimate the overall moisture content and energy content of a solid waste with the following composition (8)

Component	% by Mass	Moisture Content (%)	Energy Content (KJ/Kg)
Paper	31.5	4.2	16900
Plastics	10.2	2.3	31300
Wood	4.6	18.7	19800
Textiles	8.8	9.5	18100
Leather	7.6	10.2	16800
Rubber	5.2	1.9	23400
Metals	12.1	1.3	27000
Food waste	13.6	82	4200
Miscellaneous	6.4	3.4	600

3. (a) Mention the key concepts around on-site processing. What are the factors that influence on-site storage? (6)
- (b) Classify the collection system of solid waste based on availability of services. Compare these systems with respect to “level of service”, “collection cost” and “Susceptibility of scavenging”. (5)
- (c) Solid wastes from a newly build up area is to be collected in large containers (drop boxes to be replaced). Based on traffic studies in similar type of areas, it is estimated that the average time to drive from the garage to the first container and from the last container to the garage each day will be 25 minutes and 40 minutes respectively. If the average time required to drive between containers is 5 minutes and the one way distance to the disposal site is 20 km (speed limit 72 km/h), determine the number of containers that can be emptied per day, based on 8-hr working day. Assume Off-route factor 0.15 for this case. (11)
- (d) What are the considerations to predict future waste quantities? (3)

Given Formula:

$$\text{Energy Content (KJ/Kg)} = 338.2C + 1430 (H - O/8) + 95.4S$$

Haul Container System	Stationary Container System
$T_{hcs} = (PT_{hcs} + q + m + nx)$ $PT_{hcs} = pc + uc + dbc$ $Md = \{(1-W)L - (t_1 + t_2)\} / Thcs$	$T_{scs} = (PT_{scs} + q + m + nx)$ $PT_{scs} = C_i uc + (S-1)(dbc)$ $C_i = \frac{V_d z}{V_f}$ $M_{dc} = \frac{V_d}{V_z}$ $L = \frac{(t_1 + t_2) + M_{dc}(PT_{scs} + q + m + nx)}{1 - W}$

Type of haul	Speed limit	m	n
	km/h		
Communal	88	0.016	0.011
Block	72	0.022	0.014
Kerbside	56	0.034	0.018
Door-to-door	40	0.050	0.025

Vehicle	Collection		Pick up loaded container and deposit empty container, h/trip	Empty contents of loaded container, h/container	At-site time q, h/trip
	Loading method	Compaction ratio, z			
Hauled container (Tilt-frame)	Mechanical	2.0-4.0	0.50		0.129
Stationary container (Compactor)	Mechanical	2.0-4.0		0.050	0.15

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2016
Program: B.Sc. Engineering (Civil)

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

Course Code: CE 415
 Full Marks: 45

[Answer all three questions and assume reasonable values for any missing data]

1. (a) State the three basic principles of prestressed concrete. Explain each briefly. (5)

(b). Calculate the maximum fiber stresses for a rectangular beam of 10m , which is simply supported and loaded by uniform load of 50KN/m(self weight is already included). An effective prestress of 1500KN is provided. For computation purposes employ first concept of prestressing. The beam section is shown below (Fig. 1) (10)

Also sketch the stress distribution for first concept.

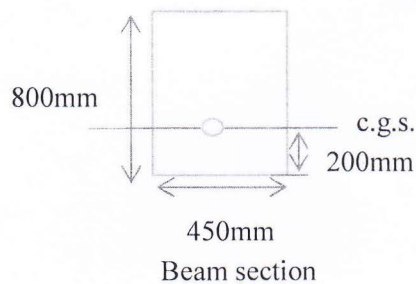


Fig: 1

2. A pretensioned concrete beam has a section of 300 mm by 500 mm (Fig. 2). It is eccentrically prestressed with 520 mm² of steel which is anchored to the bulkheads at a unit stress of 1200 MPa. The c.g.s. is 150 mm above the bottom fiber. Assuming $n= 6$,(a) using exact method compute the top and bottom stresses in the concrete immediately after transfer due to the prestress only and (b) using approximate method compute the top and bottom stresses (assume the reduced prestress to be 95% of the initial prestress). (15)

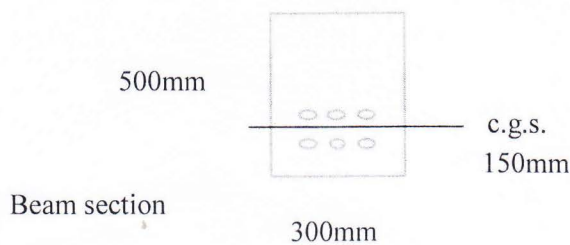


Fig: 2

3. (a) A post-tensioned concrete rectangular beam 400 mm by 400 mm has a simple span of 14 m and it is prestressed with 780 mm^2 steel (total), which is made up of 4 tendons. The tendons are tensioned one after another to the stress of 1200 MPa. If $E_{ci} = 33000 \text{ MPa}$ and $E_s = 200000 \text{ MPa}$, Compute the loss of prestress due to the elastic shortening of concrete in first tendon and the average prestress loss. (10)

(b) What are the sources of prestress loss? (5)

Required Formulae

- ❖ $f_c = -(F/A) \pm (Fey/I) \pm (My/I)$
- ❖ $f_c = -(F/A) \pm (M_{iy}/I)$
- ❖ $\Delta f_s = n [-(F/A) \pm (Fe^2/I) \pm (Me/I)]$
- ❖ $\Delta f_s = n f_c$

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Professional Practices and Communication
Time: 1 Hour

Course Code: CE 403
Full Marks: 20

Answer All Questions

1. Name three types of morality. Explain any one of them. 3
2. What is meant by whistle blowing? When it should be attempted? 3
3. According to IEEE code of ethics, describe at least 4 ethics of an engineer. 2
4. What are the impediments of responsibility? Explain any 2. 2
5. Read the following case and answer the question from ethical point of view. 5

John was named the department manager of a large new chemical processing unit to be designed and constructed. During the course of his work, John suggested to the project designer an alteration to the design that considerably improved safety. After John's suggestion has been successfully implemented, John was offered a very nice fishing trip to South America.
Should John accept the fishing trip? Explain your judgment.
6. What are the effective skills for better communication? Please explain some of it (at least 3). 3
7. Among five senses, which one is the strongest for communication? Why? 2

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Code: CE 421

Course Title: Structural Engineering VIII

Time: 60 Minutes

Full Marks: 3 x 20

ANSWER ALL QUESTIONS. *The figures are not drawn to scale.*

[1] Answer the followings

- a) Write a short note on single-degree-of-freedom-system (SDOFs)? What is damping and what's the effect of damping into a dynamical system show in a sketch? (8)
- b) Derive and solve the equation of motion of the SDOFs shown in Figure 1? Discuss about the different damping cases which case is realistic and why? (12)

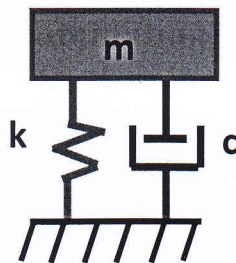


Figure 1

- [2] Determine the displacement and velocity equations of the dynamical system shown in Figure 2. Estimate displacement and velocity for time steps $t = 0, 0.11$. Consider $m = 5$ Kg, $k = 500$ N/m, $c = 0.66$ N-s/m, $\phi = 0$, $x(0) = 0$, $\dot{x}(0) = 0$. (20)

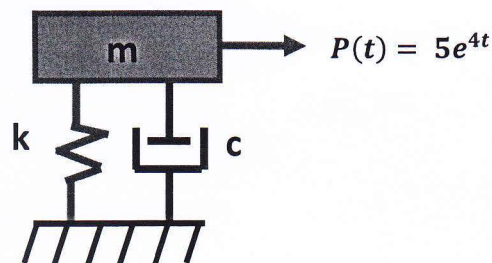


Figure 2

- [3] Why we use Newmark-Beta Method? Consider Problem 2 and determine the displacement and velocity by using Newmark-Beta Method ($\alpha = 0.5$, $\beta = 0.25$) and compare the results with Problem 2. (20)

University of Asia Pacific
Department of Civil Engineering
Mid Term Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Environmental Engineering VI (Environmental Management)
Time: 1 hour

Course Code: CE 437
Full Marks: 30

There are Three (3) questions. Answer all the questions.

1. (a) Define ecosystem resistance and resilient ecosystems. [2]
(b) With a neat diagram explain energy loss in biodegradation process. [2]
(c) How green house gases increase atmospheric temperature? What are the main causes of climate change? [2]
(d) With a neat diagram explain the complex pathways of diarrhoeal and other faecal-oral diseases. [2]
(e) Why wastewater from drainage system of slum areas in Bangladesh is severely polluted? [2]
2. (a) What are the advantages and disadvantages of cost-and-command approach for pollution management? [2]
(b) With an example show that, load based standards (when compared with concentration based standards) are often appropriate for pollution management in an industrial estate. [2]
(c) What is the main difference between active and passive user charges for pollution management? [2]
(d) What do you mean by administrative charges? [2]
(e) Why natural dilution is not an attractive option for water pollution management? [2]
3. (a) What are the positive aspects of urbanization? [2]
(b) What are the main factors that must be considered for developing an environmental sustainable city? You may consider the case study of urbanization state in Asia and Pacific. [4]
(c) How the revenue of a CETP process may be collected? Enlist the advantages of joint treatment of municipal and industrial waste. [4]

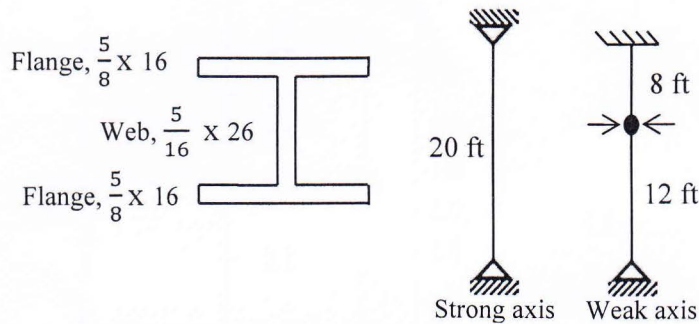
University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course Title: Structural Engineering VI (Design of Steel Structures)
 Time: 01 Hour

Course Code: CE 417
 Full Marks: 60

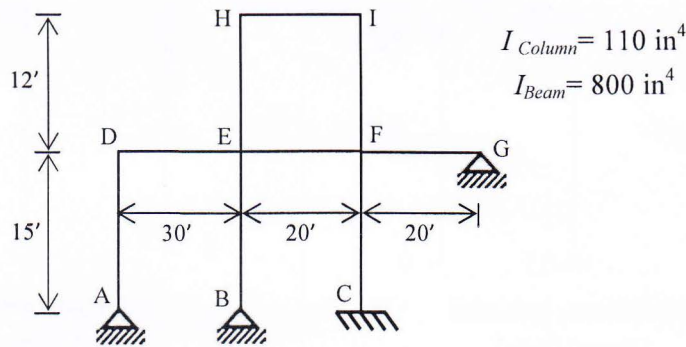
Answer all 03 (Three) questions
Assume reasonable value for missing data

1. (a) Using **AISC-ASD** method, determine the capacity of column having cross section (18) and support conditions shown in the following figure. Use A36 steel.



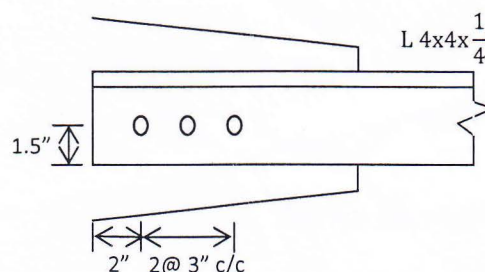
- (b) Write down the sources of residual stress. (02)

2. (a) (16)



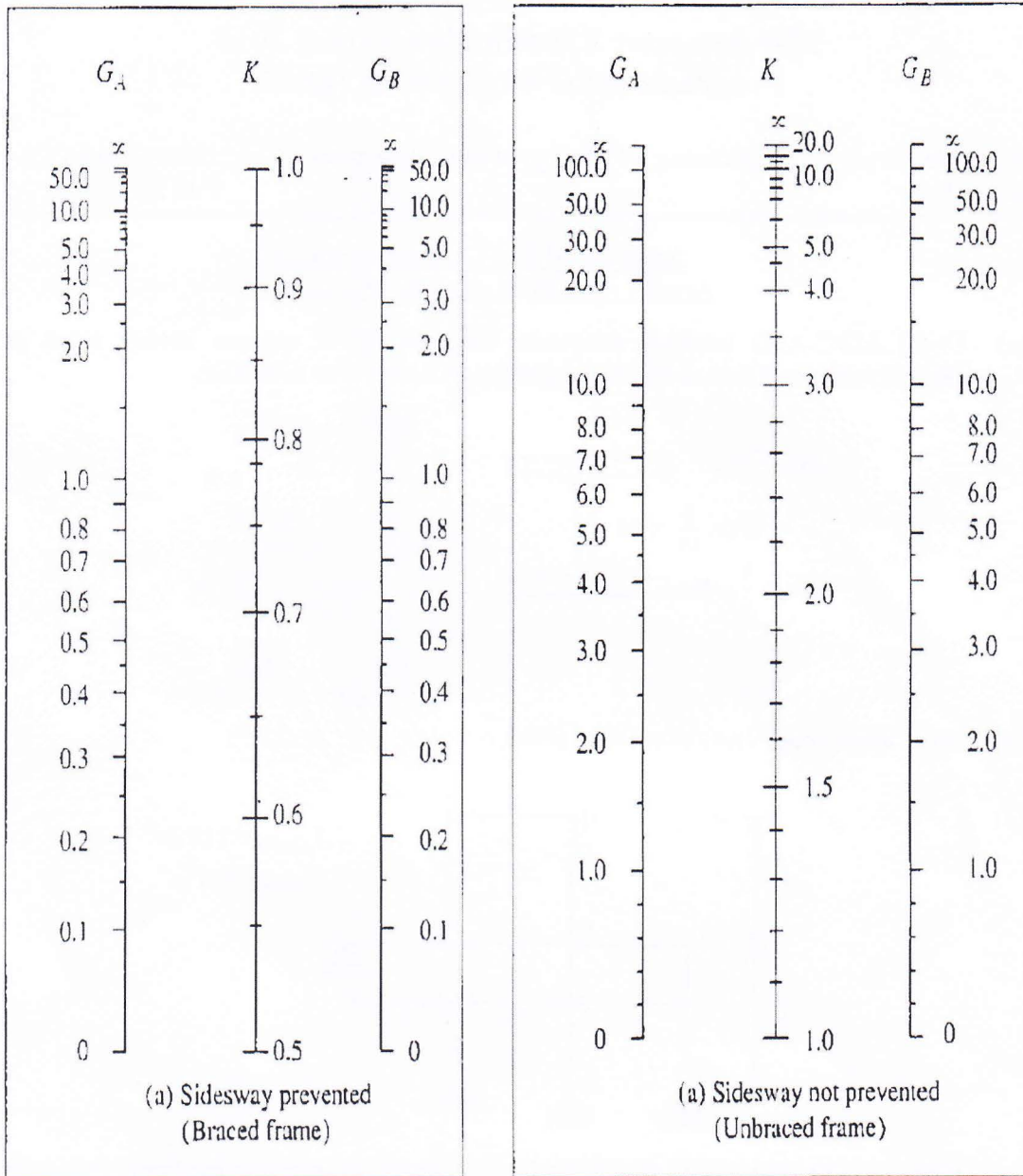
Calculate **effective length factor (k)** for all columns as shown in the figure (Use **table 01**)

- (b) Write advantages and disadvantages of steel structures over concrete structures. (04)
3. (a) Investigate the block shear failure mode on the angle section $L 4 \times 4 \times \frac{1}{4}$ attached with three- $\frac{7}{8}$ in diam. bolts to a $\frac{3}{8}$ in gusset plate as shown in the following figure. Use **AISC-LRFD** method and A36 steel. (17)



- (b) Define shear lag. (03)

Table 01



Critical Buckling Stress:

$$F_{cr} = [0.658 \frac{F_y}{F_e}] F_y$$

$$F_{cr} = [0.877 F_e]$$

$$F_e = \frac{\pi^2 E}{(\frac{KL}{r})^2}$$

Block shear capacity: Nominal strength

$$R_n = 0.6 F_y A_{gv} + U_{bs} F_u A_{nt}$$

$$R_n = 0.6 F_u A_{nv} + U_{bs} F_u A_{nt}$$

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2016
Program: B. Sc. Engineering (Civil)

Course Title: Environmental Engineering IV
Time- 1 hour

Course Code: CE 433
Full marks: 50

There are **THREE** questions. Question 1 is mandatory. In addition, answer any **ONE** between questions 2 and 3. (25*2 = 50)

1. (a) Define Environmental pollution. List the principal sources of the following pollutants : (2+4)
i) Oxygen Demanding wastes; ii) Nutrients; iii) Salts ; iv) Toxic metals
- (b) Show in a schematic, the zones of pollution and the change in aquatic ecology in a stream by wastewater disposal. (5)
- (c) Discuss the impacts of thermal stratification on the dissolved oxygen in a lake. (4)
- (d) 20 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 4.0 mg/L. If $k = 0.21 \text{ d}^{-1}$ at 20°C , estimate the ultimate strength of the sample. (10)
2. (a) Write short notes on i) Eutrophication ; ii) Thermal pollution (6)
- (b) Discuss how effluent flow can be reduced and upstream flow can be increased in order to control the water pollution. List the considerations to select particular control measures. (6)
- (c) Define critical DO. What is the significance of critical DO ? (3)
- (d) Consider a lake with $200 \times 10^6 \text{ m}^2$ of surface area for which the only source of phosphorus is the effluent from a wastewater treatment plant. The effluent flow rate is $0.45 \text{ m}^3/\text{s}$ and its phosphorus concentration is 10.0 mg/L ($= 10.0 \text{ g/m}^3$). The lake is also fed by a stream having $30 \text{ m}^3/\text{s}$ of flow with no phosphorus. If the phosphorus settling rate is estimated to be 10 m/year, (10)
 - (a) Estimate the average phosphorus concentration in the lake.
 - (b) What level of phosphorus removal at the treatment plant would be required to keep the average lake concentration below 0.010 mg/L ?
3. (a) What are the sources and sinks of DO in river to be considered for Streeter-Phelps DO model? Also mention the assumptions to be made for the model? (5)
- (b) Categorize biochemical oxygen demand and explain their difference with figure. Why is (6)

cBOD not equal to COD?

- (c) What are the adverse impacts of heavy metals? List the properties of "Persistent Organic Pollutants". (6)
- (d) Define "waste assimilation capacity" of streams. What are the various forces that help in this process? List the factors on which the self-purification of oxygen demanding wastes depend on. (2+3+3)

Given Formula:

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

$$P = \frac{S}{Q + v_s \cdot A}$$

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

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

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

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

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

University of Asia Pacific
Department of Civil Engineering
Midterm Examination Spring 2016
Program: B.Sc. Engineering (Civil)

Course code: CE 439

Course title: Environmental Engineering VII (Environmental Impact Assessment)

Time: 60 Minutes

Full marks: 20

Answer ALL questions

1. Define the following: (4)
 - Environmental Impact Assessment (EIA)
 - Screening
 - Initial Environmental Examination
 - Ecosystem

2. According to Article 7 of the Bangladesh Environmental Conservation Rules (1997), write the procedures to obtain environmental clearance certificate for a multi-storied apartment building? (3)

3. Explain different levels and forms of public involvement in an EIA process. (3)

4. Write the template of “Form 3 (application for environment clearance certificate)” included in Environmental Conservation Rules, 1997. (5)

5. Provide an indicative list of scoping activities in an EIA process. (5)

University of Asia Pacific
Department of Civil Engineering
Mid Semester Examination Spring 2016

Course No: CE 425
Course Title: Structural Engineering X
(Concrete Technology)

Time: 1 Hour
Full Marks: 60

There are two sets of questions. Answer all of them.

Set A

1. Describe the process of clinker production. (5)
2. How relative volume of cement ingredients changes with time? (3)
3. Write short notes on: (a) penetration resistance test (b) Carbonation depth measurement test. (2+2)
4. What are the effects of supplementary cementing materials on freshly mixed concrete? (5)
5. In what situation nondestructive tests should be conducted? What tools an engineer should carry in visual inspection of a structure? (3+1)

Set B

6. What do you mean by fresh concrete? What should be the criteria of fresh concrete? (1+4)
7. What do you mean workability? Why unworkable concrete is not generally considered for construction purpose? Write down four factors that affect the workability of fresh concrete? (1+2+2)
8. What is segregation? How can you avoid segregation? (1.5+2.5)
9. What is the slump test of concrete? Write down the name and sketch the various types of slump? (1+2+2)
10. What are the criteria of pumpable concrete? Explain briefly how the air entraining admixtures and water reducing admixtures influence on pumping concrete? (2+3)
11. What do you mean by ready mix concrete (RMC)? Write down six advantages of RMC? (1+3)
12. What is retempering of concrete? Will you agree on the retempering of concrete? Please justify your answer. (1+3)
13. What is the correlation among curing, time and strength? What are the favorable conditions for concrete curing? (1+2)
14. Write down the four hardened properties of concrete? What are the factors affecting the ultimate strength of concrete? (2+2)