Bangladesh Power Development Board (BPDB) – 2023

Post: Assistant Engineer (Civil)

Date: 24-02-2023; Friday; Time: 03:30 PM – 04:30 PM

Exam Taker: BUET

Time: 1 hour **Full Marks: 100**

Non-Technical Part– 40×1 = 40

1. Who is Chief Executive Officer (CEO) of Tesla Inc.? **Ans: Elon Musk.**
2. Which is not Space Agency? a) NASA b) SPACE c) ROSCOMOS d) JAXA. **Ans: SAPCE**
3. Who invented DC current? **Ans: Thomas Alva Edison**.
4. What was the magnitude of the earthquake in Turkey? **Ans: 7.8**
5. What is the capital of Ukrain? **Ans: Kyiv.**
6. What is the name of the currency of Sri Lanka? **Ans: Rupee.**
7. Where will the Summer Olympics 2024 be held? **Ans: France.**
8. Who is the president of China? **Ans: Xi Jinping.**
9. ChatGPT means – **Ans: a chatbot.**
10. GDP means – **Ans: Gross Domestic Products.**
11. Who is not a famous Artist? **a) Salauddin** b) Shahabuddin c) Joynul Abedin d) Kamrul Hasan.
12. Which is the largest District? a) Chittagong b) Sylhet c) Rangamati d) Dhaka. **Ans: Rangamati.**
13. The largest coalmine situated at – **Ans: Dinajpur.**
14. Who is the 1st Prime minister of Bangladesh? **Ans: Tajuddin Ahmed.**
15. How may sectors there were during liberation war? **Ans: 11.**
16. ECNEC is under – **Ans: Cabinet Ministry.**
17. Dahagram situated at – **Ans: Lalmonirhat.**
18. When did "Digital Security Act" passed? **Ans: 2018.**
19. The Smart Bangladesh means – **Ans: smart citizen, smart society, smart economy, and smart government.**
20. Padma Bridge connects – **Ans: Lauhojang, Zazira, Shibchar.**
21. BPDP is looking ____ some energetic engineers. **Ans: for.**
22. Children give promises to care ____ their parent's. **Ans: of.**
23. Correct spelling – **Ans: Extraterrestrial.**
24. 'To blow out some steam' phrase means – **Ans: to do something that helps one to get rid of strong feelings.**
25. In 'Omnipotent' word, omni means – **Ans: all.**
26. Opposite of stiff – **Ans: flexible.**
27. I dislike him because he is lazy, which clause is this? Ans:
28. The idea of a balanced diet is very difficult to ___ to anyone who knows nothing about food values. **Ans: put across.**
29. I would ___ left the job than the other. **Ans: rather.**
30. The clerks of office is out and ____ loafer. **Ans: out.**
31. সংবিধান শব্দের সন্ধি বিচ্ছেদ কোনটি? **উত্তরঃ সম্ + বিধান।**
32. যখন পড়বে না মোর "পায়ের চিহ্ন" - কোন কারকে কোন বিভক্তি? **উত্তরঃ করণকারকে ষষ্ঠী।**
33. মুখরা রমণী বশীকরণ কোন ধরনের রচনা? **উত্তরঃ অনূদিত নাটক।**
34. শুদ্ধ বানান কোনটি? **উত্তরঃ জিগীষা**
35. ব্রহ্মপুত্র শব্দের সঠিক যুক্তবর্ণ কোনটি? **উত্তরঃ হ্ম**

36. শশাঙ্ক এর সমার্থক শব্দ কোনটি? **উত্তরঃ চাঁদ।**

37. রক্তাক্ত প্রান্তর নাটকের পটভূমি কি ছিল? **উত্তরঃ পানিপথের ৩য় যুদ্ধ।**

38. রেস্তোরাঁ কোন ভাষার শব্দ? **উত্তরঃ ফরাসি।**

39. 'ভালো ছেলেরা শিক্ষকের আদেশ পালন করে" কোন ধরনের বাক্য? **উত্তরঃ সরল বাক্য।**

40. সমাস ভাষাকে - **উত্তরঃ সংক্ষেপ করে।**

Technical Part – 6×10 = 60

1. **(a)** Fill in the gaps with appropriate words.

i. Void ratio of soft clay is 1.5, porosity is _____.
ii. The angle of internal friction of a soil is 30°, coefficient of active earth pressure is _____.
iii. The N_c value for deep foundation is _____.
iv. The unconfined compressive strengths of soft clay in undisturbed sample and remoulded state are 50 kN/m^2 and 25 kN/m^2, sensitivity of the soft clay is _____.

(b) A dry sand was tested in direct shear apparatus under normal load of 36 kg, sample was failed under load of 58 lb. The sample size was 2 inch in height and 2 inch in width. Calculate the angle of internal friction of the sand.

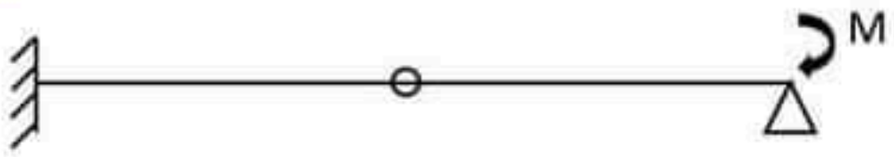
(c) A moist soil having volume of 0.2 ft^3 and weighs 25 lb. The oven dry weight is 20 lb. Calculate bulk unit weight, dry unit weight and water content of the soil.

2. Calculate the fineness modulus (FM), coefficient of uniformity (C_u) and percent of fine (silt and clay) of the sample.

Sieve size	#4	#8	#16	#30	#40	#50	#100	#200	Pan
% Retained	0	1	4	12	23	30	20	6	4

3. **(a)** The depth of equivalent constant stress of a singly reinforced rectangular beam, a = 3.5" and effective depth is 16.5". The ratio of depth of rectangular stress block, β_1 is assumed as 0.85. Comment whether the beam is tension-controlled or compression-controlled. The value of $\frac{c}{d_t}$ is 0.60 (compression zone) and 0.375 (tension zone).

(b) Draw the bending moment diagram of the beam having span of 2L. A concentric moment, M is applied at end point.



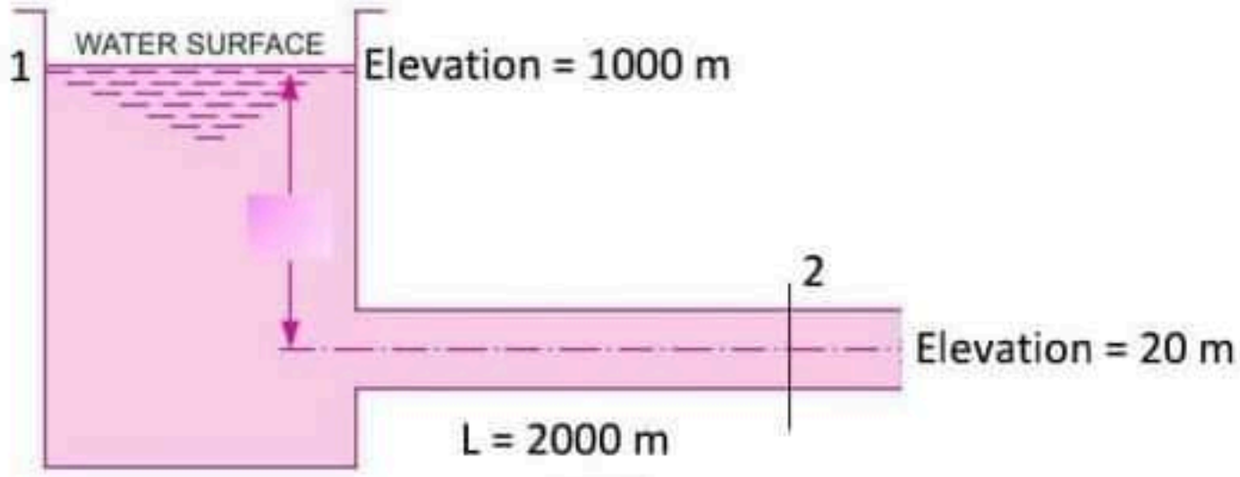
4. **(a)** The BOD_5 of a water sample is 125 mg/L in 20°C. The reaction rate constant at 20°C is 0.22 day^{-1}. Calculate the ultimate BOD.

(b) A horizontal flow grit chamber is used to pretreat wastewater with flow rate 26.5 ft^3/s. The chamber is 5.9 feet in deep and width is 15 times of length. What is the width of chamber if average approach velocity is 1.15 ft/s.

5. **(a)** A driver moving at a speed of 65 mph on 3% downgrade section of a highway sights an overturning truck 800 feet away on the highway and applied the brake. The coefficient of friction is 0.29, acceleration due to gravity is 32.2 ft/s^2. What would be the final distance between the two stopped vehicles?

(b) Calculation of ESAL.

6. **(a)** The water flows from a thermal power plant through a pipe having diameter of 20 cm. Flow velocity is 1.0 m/s and friction coefficient of the pipe is 0.015. Find the pressure at point 2.



(b) Water flows in a rectangular channel having a width of 3m, longitudinal slope is 0.001 and manning's coefficient is 0.20. If flow depth is 1m, calculate the flow rate if it is uniform flow.

POWER DEVELOPMENT BOARD

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01.Fill in the gap

i) Void ratio of soft clay is 1.5 and porosity is ?

Solution:

Porosity $\eta = e / (1+e)$

$=1.5/ (1+1.5)$

$=0.6$

ii) The angle of internal friction of soil is 30 degrees. What is the coefficient of active earth pressure?

Solution:

$$K_a = \frac{1-\sin\varphi}{1+\sin\varphi}$$

$$= \frac{1-\sin 30}{1+\sin 30}$$

$$= 0.33$$

iii) What is the value of Nc for deep foundation

Solution:

The factor N~ is a bearing capacity factor for deep circular foundations. According to Skempton (QQ} the value of N~ for a round deep foundation is 9.0.

iv) The unconfined compressive strength of soft clay in undisturbed sample and remolded state are 50 KN/m2 and 25 KN/m2 , sensitivity of the soil clay is?

Solution:

Given,

Qu (undisturbed) = 50 KN/m2

Qu (remolded) = 25 KN/m2

sensitivity of the soil clay = Qu (undisturbed)/ Qu (remolded)

$=50/25$

$=2$

02. The amount of BODs in a sewage found 125 mg/L at temperature 20°C. If k = 0.22/day, then determine the ultimate BOD.

Solution:

$$BOD_5 = BOD_u \left(1 - e^{-k\,t}\right)$$

$$BOD_u = \frac{BOD_5}{(1-e^{-k\,t})} = \frac{125}{(1-e^{-0.22\,x\,5})} = 190 \text{ mg/L}$$

Ans: 190 mg/L

03. A rectangular channel is 10 ft width and 3 ft depth. Determine the velocity & rate of flow if manning's coefficient is, n = 0.015 and bed slope of the channel is, S = 0.003.

Solution:

Area, $A = b\,h = 10 \text{ x } 3 = 30 \text{ ft}^2$

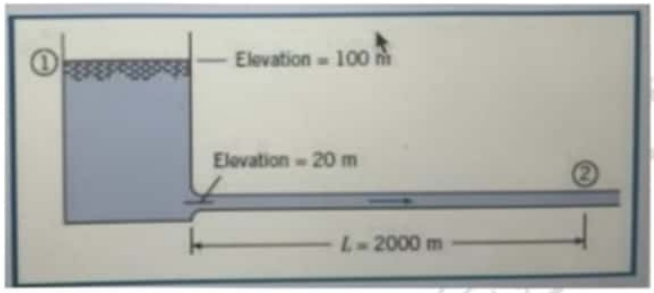
Wetted perimeter, $P = b + 2\,h = 10 + 2 \text{ x } 3 = 16 \text{ ft}$

Hydraulic radius, $R = A/P = 30/16 = 1.875 \text{ ft}$

Velocity, $V = \frac{1}{n} R^{2/3} S^{1/2} = \frac{1}{0.015} \text{ x}(1.875)^{2/3}(0.003)^{1/2} = 5.56 \text{ ft/s}$

Discharge, $Q = A\,V = 30 \text{ x } 5.56 = 16.68 \text{ ft}^3/\text{s}$

04. A horizontal pipe carries cooling water at 10 degree celsius for a thermal power plant from reservoir as shown in the figure below, where L is the length if pipe from the reservoir to the point of carrying. If the pipe diameter is 20cm, Flow velocity is 1.0 m/s and frictional coefficient is 0.015. Find the pressure at the pipe.



Solution:

Given that,

Length of Pipe = 2000m

Diameter of the pipe = 20cm

Elevation at point (1) = 100m

Elevation at point (2) = 20m

Based specific weight pressure inside tank P1 = $101.3 \text{ x } 10^3 \text{ N/m2}$

Now Head Loss $h_f = \frac{f\,x\left(\frac{L}{D}\right)x(V)^2}{2g}$

$= \frac{0.015\,x\left(\frac{2000}{0.20}\right)x(1)^2}{2\,x\,9.81}$

$= 7.64 \text{ m}$

$$= \frac{0.015 \times \left(\frac{1}{0.20}\right) \times (1)^2}{2 \times 9.81}$$

$= 7.64$ m

As per , Bernoulli Equations $Z_1+P_1/\gamma+\frac{V1^2}{2g} = Z_2+P_2/\gamma+\frac{V2^2}{2g} + h_f$

- ⇨ $80 + (101.3 \times 10^3)/(9.81 \times 1000) + 0 = 0 + P_2/(9.81 \times 1000) + \frac{1^2}{2 \times 9.81} + 7.64$ [Z1=100-20=80m]
- ⇨ $90.32 = P_2/9810 + 7.69$
- ⇨ $P2 = 9313.06$ N/m2
- ⇨ P2 = 9.31 KPa

Ans: 9.31 KPa

05. The depth of equivalent constant stress of singly reinforced rectangular Beam a = 3.5" and effective depth is 16.5". The ratio of rectangular stress block $\beta_1 = 0.85$. Comment whether the Beam is tensioned controlled or compression controlled.

Solution:

$a = 3.5$ in

$\beta_1 = 0.85$

$$c = \frac{a}{\beta_1} = \frac{3.5}{0.85} = 4.11 \text{ in}$$

$$\varepsilon_t = \frac{d-c}{c}(0.003) = \frac{15.5-4.11}{4.11}(0.003) = 0.0083 > 0.005$$

Therefore, it is a tension-controlled section Beam

06. In a natural state, a moist soil has a volume of 0.2 ft3 and weight 25 lb. The oven dry weight of soil is 20 lb. if the specific gravity is 2.75, calculate dry unit weight, bulk unit weight and water content.

Solution:

$$\text{Water content}, w = \frac{W_w}{W_s} = \frac{W - W_s}{W_s} = \frac{25-20}{20} = 0.25$$

Dry unit weight, $\gamma_d = \frac{W_s}{V} = \frac{20}{0.2} = 100 \text{ lb/ft}^3$

Bulk unit weight, $\gamma_d = \frac{W}{V} = \frac{25}{0.2} = 125 \text{ lb/ft}^3$

07. A sample of dry sand was tested in direct shear apparatus under a normal load of 36 kg. The sample failed under a shearing load of 58 lb. The sample size was 2" x 2". What is the angle of internal friction?

Solution:

For cohesionless soil, $c = 0$

Shear stress, $\tau = \frac{R}{A} = \frac{58}{2 \text{ x } 2} = 14.5 \text{ psi}$

Normal stress, $\sigma = \frac{N}{A} = \frac{36 \text{ x } 2.205}{2 \text{ x } 2} = 19.84 \text{ psi}$

Shear strength, $\tau = c + \sigma \tan \varphi$

$14.5 = 0 + 19.84 \tan \varphi$

$\varphi = tan^{-1}\left(\frac{14.5}{19.84}\right) = 36.16^0$

08. A driver travelling at 65 mi/h down grade 3% on a highway observes a Truck 800ft ahead of him that is completely blocking the road, and he applied break. Coefficient of friction is 0.29. What will be the final distance between two vehicles.

Solution:

$$S = 1.47\, V\, t + \frac{V^2}{30\left(\frac{a}{g} - G\right)}$$

⇨ S = 1.47x65x2.5+ [65^2 / 30 (0.29-.03)]

⇨ S = 780.54 ft

Final distance between two vehicles = 800-780.54 =19.46 ft

09. Find the fineness modulus from the following sieve.

Sieve Size	% Retained
#4	0
#8	1

09. Find the fineness modulus from the following sieve.

Sieve Size	% Retained
#4	0
#8	1
#16	4
#30	12
#40	23
#50	30
#100	20
#200	6
Pan	4
Total	500

Solution:

Sieve Size	% Retained	% Cumulative Retained
#4	0	0
#8	1	1
#16	4	5
#30	12	17
#40	23	40
#50	30	70
#100	20	90
#200	6	96
Pan	4	100
Total		

olved by:

াঃ তৌহিদুল ইসলাম

পজেলা সহকারী প্রকৌশলী

ানীয় সরকার প্রকৌশল অধিদপ্তর (এল.জি.ই.ডি)