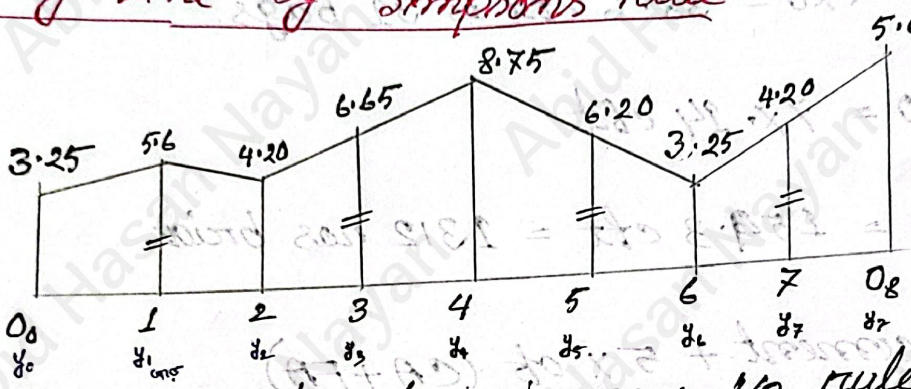
(Mx-01) ⇒ DSCC-2023 (Self) ⇐ (09.09.23)
Nom-25
Dep-45

Q-01 → The following perpendicular offsets were taken at a 10m intervals from a survey line to an irregular boundary line. Calculate the area enclosed between the survey line, the irregular boundary line by Simpson's rule.



Ans: Area calculation by simpsons 1/3 rule

$$A = \frac{D}{3}\left\{(y_0+y_8) + 4(y_1 \text{ (even)} + y_3 + y_5 + y_7) + 2(y_2 \text{ (odd)} + y_4 + y_6)\right\}$$

$$= \frac{10}{3}\left\{(3.25+5.65) + (4*22.65) + (2*16.2)\right\}$$

$$= \frac{10}{3} * 131.9 = 439.6767\ m^2$$

131.9

Theory:

- Trapezoidal Rule: $\int_a^b y\,dx = \frac{h}{2}\left\{(y_0+y_n) + 2(y_1+y_2\cdots+y_{n-1})\right\}$
- Simpsons 1/3 Rule: $\int_a^b y\,dx = \frac{h}{3}\left\{(y_0+y_n) + 2(y_2+y_4+\cdots) + 4(y_1+y_3+\cdots)\right\}$
- Simpsons 3/8 Rule: $\int_a^b y\,dx = \frac{3h}{8}\left\{(y_0+y_n) + 3(y_1+y_2+y_4+y_5+y_7+y_8+\cdots) + 2(y_3+y_6+y_9+\cdots)\right\}$

Here, $h = D$ = Intervals. Intervals যদি ভিন্ন ভিন্ন থাকে তাহলে আলাদা আলাদা boundary ধরে calculation করতে হবে

Q-02 → Calculate the critical depth and corresponding specific energy for a discharge of of 5.0 m^3/s. for a rectangular channel of $B = 2.0$ m. Define Froudes Number.

Ans: Given, $Q = 5.6\ m^3/s$, $B = 2m$

For, Rectangular channel $h_c = \left(\frac{\alpha Q^2}{gb^2}\right)^{1/3} = \left(\frac{1 * 5.6^2}{9.81 * 2^2}\right)^{1/3} = 0.93m$

Specific energy, $E = h_c + \frac{\alpha Q^2}{2gA^2} = 0.93 + \frac{1 * 5.6^2}{2 * 9.81 * (0.93 * 2)^2}$

$= 1.39$

#Froude Number:

The froude number is the ratio of inertia force and gravitational force. $\boxed{F_r = \frac{V}{\sqrt{gD}}}$ $g = 9.81\ ms^{-1}$ or, $32.17\ ft/s^2$

V = velocity, D = Hydraulic Depth

Q-03 → A simply Supported rectangular beam size $L = 6m$, and carrying a uniform load is = 34.34 kN including its own weight. if $b = 250$ mm, effective depth $d = 500$ mm, reinforcement 3-25 mm ϕ bar. Show whether it is safe at bond stress. (Given, $n = 10$, $f_c = 9.26$ MPa, $f_s = 140$ MPa)

Ans: Bond Stress, $\tau = \frac{T}{bd}$

$= \frac{0.00147 * 140}{0.25 * 0.5}$

$= 1.6464$ MPa

T = total tension force in reinforcement bar

T = Area of bar $* f_s$

Area of bar $= 3 * \frac{\pi}{4} * \left(\frac{25}{1000}\right)^2 = 1472.62\ mm^2$
$= 0.00147\ m^2$

f_s = Stress in reinforcement = $f_s = 140$ MPa

$b = 250\ mm = 0.25m$

$d = 500\ mm = 0.5\ m$

Now, Allowable bond Stress,

$\tau_b = \frac{0.87 * n * \sqrt{f_c}}{10}$

$= \frac{0.87 * 10 * \sqrt{9.26}}{10}$

$= 2.65$ MPa

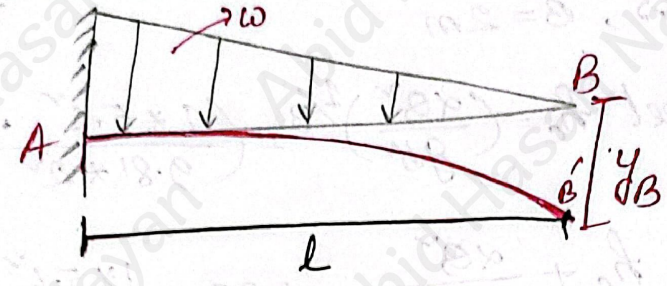
$n = 10$

$f_c = 9.26$ MPa

Here, $\tau_b > \tau$ So the beam is safe at bond Stress.

(Formula collected from Internet)

L-04 → A cantilever beam of length L carries a gradually varying load from zero at end and w per unit length at the fixed end. What should be the maximum deflection and where?



Double Intrigation method.

$$\left(y_B = -\frac{wL^4}{30EI}\right)$$

Negative sign shows the deflection is downward.

L-05 → A partially saturated soil V = 700 cc and weight W_s = 854 g, Dry weight W_d = 765 gm. Specific gravity of dry soil 2.67. Find void ratio, Porosity, water content & percent saturation.

$*9.81\ kN/m^3 = \frac{9810\ N}{10^6\ cc}$ | $1N = 0.102\ kg$

$= 9.81 * 10^{-3}\ N/cc$

$= 1.00 \times 10^{-3}\ kg/cc$

$= 1\ g/cc$

Ans: Given, V = 700 cc

W_s = 854 g

W_d = 765 g

G_s = 2.67

e = ?

n = ?

ω = ?

S = ?

$$\gamma_d = \frac{W_d}{V} = \frac{765}{700} = 1.09\ g/cc$$

$$\gamma_w = 9.81\ kN/m3 = 1\ g/cc$$

- $\gamma_d = \frac{G_s \gamma_w}{1+e}$

$\Rightarrow 1.09 = \frac{2.67 * 1}{1+e}$

$\therefore e = 1.45$

Red mark indicats Correction

- $n = \frac{e}{1+e} = \frac{1.45}{1+1.45} = 0.59$

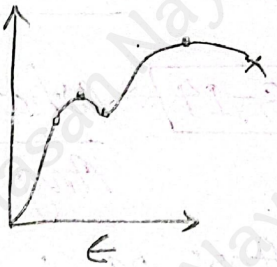
- $\omega = \frac{W_s - W_d}{W_d} = \frac{854-765}{765} = 0.116 * 100 = 11.6\ \%$

- $Se = \omega G_s \Rightarrow S = \frac{\omega G_s}{e} = \frac{0.116 * 2.67}{1.45} = 0.2136 * 100\ \%$

$= 21.36\%$

Q-06 → What are the sequences of stress-strain diagram for a mild steel under tensile test.

Ans: Proportionality limit > Elastic Limit > yield point > Ultimate point > Breaking point



Q-07 → Writedown the advantage of plantable Surveying.

Ans: ~ The observations and plotting are done simultaneously, Hence there is no risk of omitting necessary details.

~ The errors and mistakes in plotting can be checked by drawing check lines.

~ Irrigular objects can be plotted accurately as the lay of lands is in views.

Q-08 → What effects seen in bricks when excess of alumina presents in the clay for making bricks.

Ans: It may causes the brick to shrink, warp or crack on drying and burning as any other cementing materials.

Q-09 → Shape factor depends on only the,

Ans: The shap factor is used in plastic analyses to determine the collaps load of a structural member. It is a dimensionless quantity that depends only on the Shape of the cross section and not on the material properties.

Q-10 → The construction of temporary structure required to support an unsafe structure is called Shoring.

Q-11 → An under reinforced sections means — the tensile reinforcement is smaller than the combined compression capacity of the concrete and the compression steel.
(steel reaches yield before concrete)

Q-12 → Sewage isn't treated. when the (dilution factor) is: DF

- (Above 500) → (No treatment needed)
- (300 ~ 500) → (Plain sedimentation)
- (150 ~ 300) → (Sedimentation, screening, chemically precipitation is required)
- (less than 150) → (Complete treatment should given)

Q-13 → CPM (Critical Path Method) - ① Critical activity ② Total float ③ এর মান 'Zero'

Q-14 → What is the ratio of Maximum shear stress and Avg shear stress for a rectangular beam.

Ans: Maximum Shear Stress in a rectangular beam is 1.5 times the avg. shear stress. (1.5:1)

Q-15 → Unconfined compressive strength (q_u) for: (Very Soft)

Soil Properti.	q_u (kg/cm²)	Soil	q_u (kg/cm²)
Very soft clay	<0.25	Stiff	1-2
Soft	0.25-0.50	Very Stiff	2-4
Firm	0.5-1	Hard	>4

Q-16 → Causes of depression & Undulation of Runway pavement?

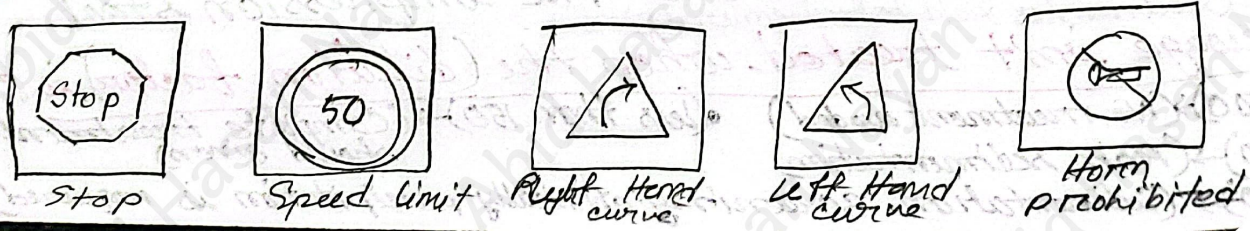
Ans: ① Improper compaction of Sub-Grade, ② Impact of heavy wheel loads ③ Punching effect

Q-17 → Elements of channel section: A channel section refers to a structural shap used in structure Construction & Engineering. Often used in design of beams, columns, and othere structural members. Main elements

① Flanges ② Web ③ Depth ④ Width ⑤ Flange thickness ⑥ Web thickness ⑦ Fillet radius ⑧ centroid ⑨ Sectional properties (Moment of inertia, I, Section modules, S) ⑩ Materials.

Q-18 → In a Slab, Reinforcement is (1~6)% according to BNBC of gross sectional area. (0.15%-0.18%) (IS standard)

Q-19 → Five mandatory traffic Sign:



Q-20 → Difference between Prime coat, Tack coat, Seal coat.

#Prime Coat: Prime coat is a application of low viscocity bitumen over a granular base or base course to preparing it for laying an asphalt mixture.

⇨ Purpose: The purpose of the prime coat is to coat and bond loose materials on the surface of base course to harden or toughen.

(1) The base surface to provide a work platform for construction equipment. To plug capillary void in the base course surface prevent migration of moisture.

(2) Prime coat also serves the purpose to blocking capillary action in base course, so that water may not arise upto asphalt layers.

(3) Prime coat apply before the 24 hrs than the base course surface behave like asphalt base course.

Tack Coat: Layer between asphalt base course or wearing course is called Tack coat.

⇨ Purpose: It behave like bonding coat between W.M.M (wet mix macadam) or Asphalt layer.

(2) To form bond between asphalt base course and asphat wearing course

(3) If tack coat is not applied, asphat base course will tends to slip under trafffic load, and pavement will fail due to slipping. Tack coat is also known as (Bitumen Bond)

#Seal Coat: It is placed top of the pavement.

⇨ Purpose: (i) Seal coat increase the libe span of pavement

(ii) To provide friction to the behicles which is moving on Road.

(3) To providing waterproofing layers after applying the seal coat water isn't penetrate in the other layers. It behave like impermeable layers.

Q-21 → For a Road width = 7m, Design velocity = 80 km/hr, Radius of curvature = 400 m what will be super elevation. (all friction coefficient is negligible)

Ans: Super elevation, $e = \frac{BV^2}{gR}$

$= \frac{7 * (22.22)^2}{9.81 * 400}$

→ Full Super elevation $e = 0.88$

$B = 7m$

$V = 80 km/hr = 22.22 ms^{-1}$

$R = 400 m$

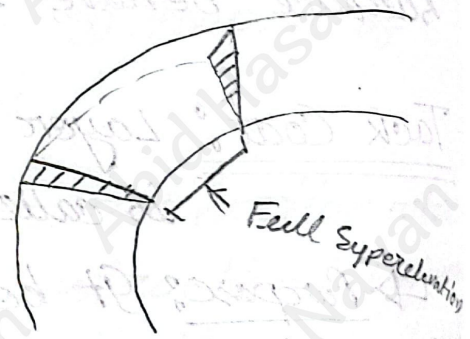
$g = 9.81 ms^{-2}$

* Rate of Superelevation, $e + f = \frac{V^2}{gR}$ | $f = 0$

$\Rightarrow e = \frac{22.22^2}{9.81 * 400}$

$\Rightarrow e = 0.1262 = 12.62\%$

*Full Superelevation: The point in a curve when the entire segment of roadway is subject to super elevation, usually at the curve's apex.



If friction is Negligible then Super elevation will balance 75% velocity
Formula: e= {(0.75v)^2 ÷127R}