GATE AGRICULTURAL ENGINEERING 2021 MEMORY BASED PAPER

1. Rectangular polygon having 10 equal sides. Find out the interior angle between two adjacent sides of polygon in degree is-

(A) 296

(B) 196

(C) 144

(D) 324

Answer-**(C) 144**

2- There are seven cars; P, Q, R, S, T, U and V. The cars have been parked in a row. Choose in correct options while satisfying the below conditions.

(a) The car U & T are parked next to each other.

(b) The car V & S are parked next to each other.

(c) The car P & Q are not parked next to each other.

(d) The car Q & S are parked next to each other.

(e) The car T is parked to the left of the car Q.

(f) The car R is parked to the immediate right of car V.

Find out the most incorrect statements while satisfying the given constrains

(A) The 2 cars have been parked between Q and V

(B) The car V is the only car which is parked in between R and S.

(C) The car P is parked at one of the extreme end.

(D) The car Q and R are not parked next to each other.

Answer- **(A) The 2 cars have been parked between Q and V**

3- The people _____ were at demonstration were from all sections of society.

(A) whose

(B) which

(C) who

(D) whom

Answer- **(C) who**

4- Oasis is to sand as island is to _____.

Find out the most logical anology from the given options in below-

(A) Mountain

(B) Water

(C) Land

(D) Stone

Answer- (B) Water

5- The Students who have passed the examination successfully, cannot sit in the examination again. The students, who have failed the examination in their first attempt, will have to compulsory sit in the examination in the next year. The students always passed the examination in the second attempt. Find out the number of students who appeared in the examination for the first time in year 2 and year 3 respectively.

Year	Year 1	Year 2	Year 3
Pass	50	60	50
Fail	10	5	3

(a) 55 and 52
(b) 60 and 52
(c) 55 and 48
(d) 57 and 51
Answer- **(c) 55 and 48**

6- Find out the number from the given options, which is exactly divisible by $(11^{13} + 1)$?
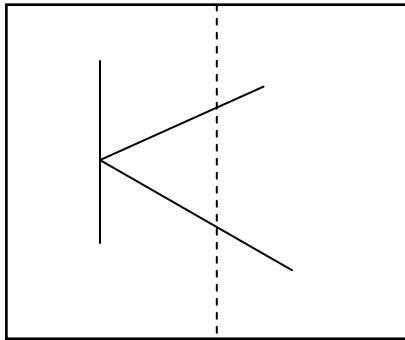
(a) $11^{39} - 1$
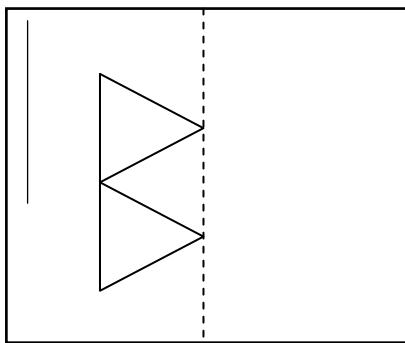
(b) $11^{52} - 1$

(c) $11^{26} + 1$

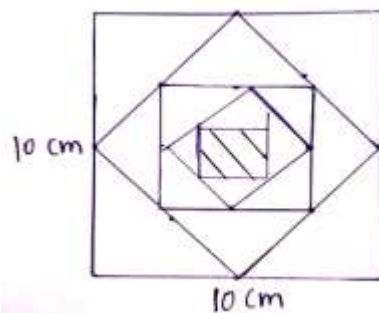(d) $11^{39} + 1$

Answer- **(b) 11^{52} - 1**

7- Find out the pattern when the below given figure is folded about the given dotted line.

Answer-

8- In the figure which is given below a square is constructed by joining the mid points of the just next bigger square find out the area (in cm^2) of smallest square which has been shed it-

(a) **3.125**

(b) 6.25

(c) 12.50

(d) 1.5625

Answer- (a) 3.125

9- The X is a continuous random variable, having range between [0,100]. The probability density function, $f(x) = 0.01$. Find out the mean of X is _____.

(a) 50

(b) 2

(c) 55

(d) 125

Answer- **(a) 50**

10- **A matrix 'A' is represented by** $A = \begin{bmatrix} 4 & 1 \\ 3 & 6 \end{bmatrix}$. **Find out the sum of eigen values of given matrix.**

Answer- 10

11- **A matrix 'A' is represented by** $A = \begin{bmatrix} 7 & 1 & 1 & 2 \\ 2 & 3 & 1 & 4 \\ 1 & 1 & 6 & 5 \\ 5 & 4 & 1 & 2 \end{bmatrix}$.

Find out the trace of the matrix-
(a) 18
(b) 16
(c) 14
(d) 20
Answer- **(a) 18**

12- **Find out the value of Limit-**

$$\lim_{n \to \infty} \left(\frac{1}{x^2} + \frac{2}{x^2} + \frac{3}{x^2} + \cdots \text{...... ... ...} + \frac{x-1}{x^2} + \frac{1}{x} \right)$$

(a) 0
(b) $\frac{1}{2}$
(c) $1/\sqrt{2}$
(d) 1

Answer- **(b)** $\frac{1}{2}$

13- P (A) = 0.35, P (B) = 0.25, Find out the value of P (A / A U B), if the-

$\qquad$ P (A U B) = P (A) + P (B)

Answer – 0.583 [.580 - .585]

14- The vector V is given by-

$$\vec{V} = V_1\hat{\imath} + v_2\hat{\jmath} + v_3\hat{k}$$

Find out the curl of vector V-

(a) $\hat{\imath}\left[\dfrac{\partial V_3}{\partial y} - \dfrac{\partial V_2}{\partial z}\right] - \hat{\jmath}\left[\dfrac{\partial V_3}{\partial x} - \dfrac{\partial V_1}{\partial z}\right] + \hat{k}\left[\dfrac{\partial V_2}{\partial x} - \dfrac{\partial V_1}{\partial y}\right]$

(b) $\hat{\imath}\left[\dfrac{\partial V_1}{\partial y} - \dfrac{\partial V_3}{\partial z}\right] - \hat{\jmath}\left[\dfrac{\partial V_3}{\partial x} - \dfrac{\partial V_1}{\partial z}\right] + \hat{k}\left[\dfrac{\partial V_2}{\partial x} - \dfrac{\partial V_1}{\partial y}\right]$

(c) $\hat{\imath}\left[\dfrac{\partial V_3}{\partial y} - \dfrac{\partial V_2}{\partial z}\right] - \hat{\jmath}\left[\dfrac{\partial V_2}{\partial x} - \dfrac{\partial V_3}{\partial z}\right] + \hat{k}\left[\dfrac{\partial V_2}{\partial x} - \dfrac{\partial V_1}{\partial y}\right]$

(d) $\hat{\imath}\left[\dfrac{\partial V_3}{\partial y} - \dfrac{\partial V_2}{\partial z}\right] - \hat{\jmath}\left[\dfrac{\partial V_3}{\partial x} - \dfrac{\partial V_1}{\partial z}\right] + \hat{k}\left[\dfrac{\partial V_3}{\partial x} - \dfrac{\partial V_2}{\partial y}\right]$

Answer- **(a)** $\hat{\imath}\left[\dfrac{\partial V_3}{\partial y} - \dfrac{\partial V_2}{\partial z}\right] - \hat{\jmath}\left[\dfrac{\partial V_3}{\partial x} - \dfrac{\partial V_1}{\partial z}\right] + \hat{k}\left[\dfrac{\partial V_2}{\partial x} - \dfrac{\partial V_1}{\partial y}\right]$

15-   y" + y'+ 0.25 y = 0

Answer- (3 - 2x) e$^{-0.5x}$

16- $\dfrac{1}{r^n}\ \dfrac{\partial}{r^r}\left[\dfrac{\partial^m \partial T}{\partial r}\right] + \cdots.$ **Value of n for sphere-**

(i) n = 1

(ii) n = 2

(iii) n = 3

(iv) n = 4

Answer- (ii) n = 2

17- The unaffected wind velocity flowing in a windmill is 15 km/hr. The windmill attacked the rotor such that the down steam velocity is reduced to 1/3rd of unaffected wind velocity. Find out the maximum thrust force (in N) on the rotor if the diameter of the rotor is 2 m and the density of air is 1.2 kg/m^3.

Answer- 116.31 [116-117]

18- Find out the discharge (m^3/sec) of most economical trapezoidal section. The depth and the manning coefficient of the above section is 0.4 m and .01 respectively. Assume the side slope as 1 : 1 and bed slope is 1/2500.

Answer- 0.2 [0.19 – 0.21]

19- A bench terrace is constructed at 10% slope in Himalayan region. The vertical interval is found to be 2.5 m. Find out the width (m) and area lost (in percent), if the better slope is 100%.

(a) Width = 22.5 m and area lost is 10.44 percent

(b) Width = 22.5 m and area lost is 15.44 percent

(c) Width = 18.5 m and area lost is 10.44 percent

(d) Width = 16.5 m and area lost is 10.44 percent

Answer- **(a) Width = 22.5 m and area lost is 10.44 percent**

20- **A wet grinding ball mill of 200 cm diameter is loaded with steel balls each having a diameter of 20 cm. Find out the change in the operating speed (in rpm) of wet grinding ball mill, if the diameter of each ball if reduced to 10 cm from 20 cm.**

Answer- Doubt

Answer may be 0.84 rpm if the reducing factor from critical to operating is not considered.

Answer may be 0.546 rpm if the reducing factor (0.65) from critical to operating is considered.

Hint-

Type of mill	Reducing factor (percent)	Reducing factor (fraction)
Wet grinding	65%	.65
Solid ball mill	80%	0.80

21- The two observation wells penetrated into a confined aquifer and located 1.4 km apart in the direction of flow. The head difference between two walls 4 m. If the coefficient of the permeability of the aquifer is 3.5 m/day and porosity is 40%. The time (in days) of travel of an inert tracer from one well to another well is-

Answer- 56000 [56000 – 56000]

22- The coefficient of variation of emitter discharge is 0.07. The minimum, average and maximum operating discharge are 45 l/h, 50 l/h and 60 l/h. Find out the overall efficiency of the system, if the application efficiency and number of emitters are 90% and 1 respectively.

Answer-   0.7379 [0.73 - 0.75]

23- The stichometric air-fuel ratio is 14.4 and the equivalence ratio is 0.91. Find out the actual air-fuel ratio.

Answer- 15.824 [15 – 16]

24-The total rainfall of 90 mm results in a maximum retention (or filtration) of 136 mm. The analysis of the volume of the runoff is done by SCS-CN method. The initial abstraction is 0.25 multiple of maximum retention. Find out the percentage change in the volume of the runoff, if the maximum retention is decreased to 64 mm.

Answer- 142.98 [142.5 – 143.5]

25- Thousand kg of potato are dried from 14 to 93% Solids. Considering 7% peeling loss, find out the product yield.

Answer- 14 [14 – 14]

26- The water is coming to the field at a rate of 80 liter/second. The water continues to flows for 10 hrs. Due to the upcoming water, the moisture content is increased to 32% from 20%. The depth of the root zone and a density of soil is 50 cm and 1.5 gm/cm^3. Find out the application efficiency (in percent) if the area of the field is 2 ha.

Answer- 62.5% [62.4 – 62.6]

27- The 38 gram of the seed is transferred to the field in one revolution of the fluted doller. The seed rate and row to row spacing has been observed as 200 kg/hectare and 40 cm respectively. Find out the ratio of speed of ground wheel to roller, if the diameter of the ground wheel is 600 mm.

(a) 2.52 : 1

(b) 3.52 : 1

(c) 9.52 : 1

(d) 1.36 : 1

Answer- **(a) 2.52 : 1**

28- The water content and the specific gravity of a soil is 20% and 2.7 respectively. The wet bulk density is 1.8 gm/cm^3. Find out the dry density (gm/cm^3) and the porosity.

(a) 1.5 and .42

(b) 1.5 and .52

(c) 2.5 and .42

(d) 2.5 and .52

Answer- **(a) 1.5 and .42**

29-The height of the shelterbelt is 16m. The minimum and the actual wind velocity at 15 m height from the ground surface is 9.6 m/s and the 16 m/s. The angle of deviation of prevailing wind direction from the perpendicular to the shelter belt is 20^0. Find out the area of the protection (in ha) if the length of the wind break is 200 m.

Answer- 2.87 [2.8 - 3]

30- A spur gear is transmitting a 1 kW power at 600 rpm. The pressure angle of involute profile is 20^0. Find out the total transmitting force (in N) on the contacting gear tooth (in normal direction) if the pitched circle radius is 10 cm.

Answer- 169.35 [169.2 – 169.4]

31- The power required to crush particle from 4.75 mm to .5 mm is 7.2 kW. Find out the work index if the feed is entering at a rate of 2 tonne/hr.

Answer- 11.91 [11.85 – 11.95]

32- The Muskingum equation of flood routing satisfy which equation of the force balance-

(a) Equation of force balance

(b) Equation of continuity

(c) Equation of continuity and momentum

(d) Equation of energy

Answer- **(b) Equation of continuity**

33- The drawdown in a confined aquifer at a distance of 0.3 and 0.9 m from the centre of the well has been found to be 1.17 and 0.8 m respectively. The discharge rate of the aquifer is 1500 ltr/s. with a thickness of 20 m. Find out the drawdown at well in m. Diameter of well is 30 cm

Answer- 1.403 [doubt in data]

34- Find out the cleaning efficiency of an air screen cleaner

(i) The impurities present in the feed were 8.5%.

(ii) The impurities present in the clean grain are 1.2%.

(iii) The outflow of the blower contains 0.2% clean sit.

(iv) The overflow of first screen contains 1% clean sit.

(v) The underflow contains 1.1% clean sit.

Answer- 86.778 [doubt in data)

35- The albado stem has a diameter and the height of 6 and 50 mm respectively. The ultimate tensile strength is 1500 N/mm^2 and the bending stress is 350 N/mm^2. Find out the maximum horizontal force (in N) on albedo stem-

(a) 148.44 N

(b) 88 N

(c) 37 N

(d) 83 N

Answer- A but [doubt in data]

①

Sum of interior angles $= 180(n-2)$

$$= 180(10-2) = 1440$$

Interior angle $= \dfrac{1440}{10} = 144.$

②

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P

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P X

Q S V R

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P

P Q

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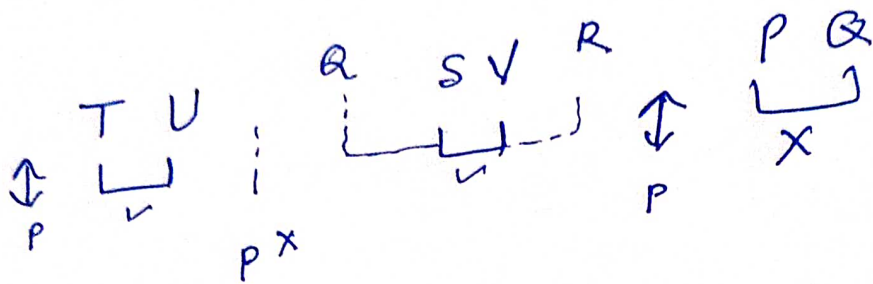
③   the people   [who] ⟶ subject ___

④ oasis ⟶ [sond / रेत] [surrounded by sound]

Island ⟶ surrounded by water.

(5)

	Pass	fail
year 1	50	10
year 2	60	5
year 3	50	3

60 ⟍ 10

50 + 5 = 55 ✓

45 + 3 = 48 ✓

(6)

$$\frac{x^n - a^n}{x + a}$$

$$11^{52} - 1 = \quad \mathrel{\raise{0.3ex}{\not}}{\mathrel{13}} \left(11^{13} \right)^4 - (1)^4$$

$$\frac{\overset{x_2}{\left(11^{13} \right)^4} - (1)^4}{11^{13} + 1} \longrightarrow \quad \text{con vedit} \\ \text{di visible}$$

①

folding
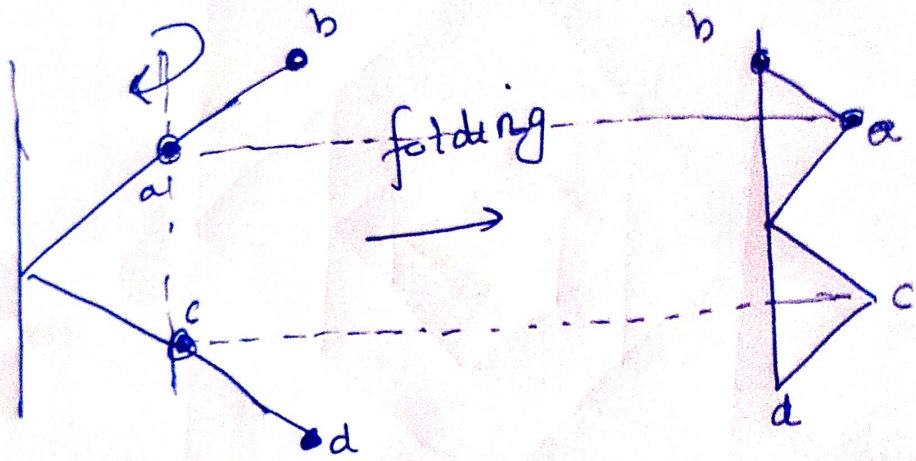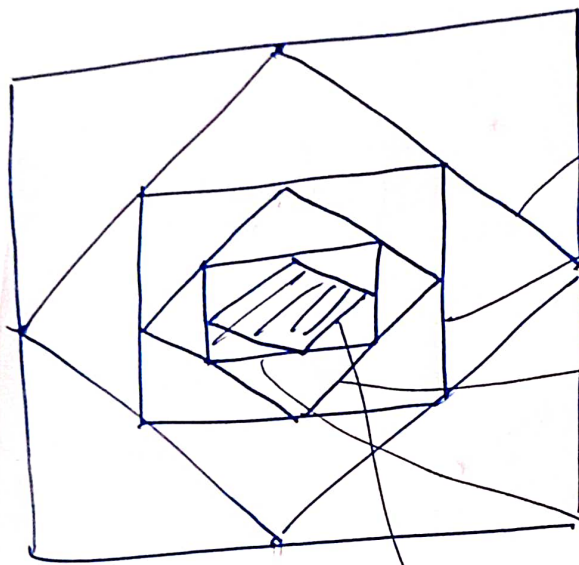
$$\frac{100}{2} = 50 \ m^2$$

$$\frac{50}{2} = 25 \ m^2$$

$$\frac{25}{2} = 12.5 \ m^2$$

$$\frac{12.5}{2} = 6.25 \ m^2$$

$$\frac{6.25}{2} = 3.125 \ m^2$$

⑧

9) $E(x) = \int x \cdot f(x) = \int_{0}^{100} x \, (0.01)$

$= \dfrac{1}{2} \left[x^2 \right]_{0}^{100} \times 0.01$

$= \dfrac{0.01}{2} \times 100 \times 200 = 50$

Queshon → $A = \begin{bmatrix} 4 & 1 \\ 3 & 6 \end{bmatrix}$

find out the sum of eigen Volues

Answer = 10

②

$$A = \begin{bmatrix} 7 & - & - & - \\ - & 3 & - & - \\ - & - & 6 & - & - \\ - & - & 2 & - & - \end{bmatrix}$$

find out trace of matrix

Answer $= 18$

$$\lim_{x\to\infty} \frac{1}{x^2} + \frac{2}{x^2} + \frac{3}{x^2} + \text{---} \frac{x-1}{x^2} + \frac{1}{x}$$

Answer $= \dfrac{1}{2}$

Solution $\displaystyle\lim_{x\to\infty} \frac{1}{x^2}\left[1 + \text{---} + (x-1)\right] + \frac{1}{x}$

$\displaystyle\lim_{x\to\infty} \frac{1}{x^2} \cdot \frac{(x-1)x}{2} + \frac{1}{x}$

$\displaystyle\lim_{x\to\infty} \frac{1}{2}\left[\frac{x-1}{x}\right] + \frac{1}{x} = \lim_{x\to\infty} \frac{1}{2}\left[1 - \frac{1}{x}\right] + \frac{1}{x}$

$= \dfrac{1}{2}$

④ $P(A) = 0.35$

$P(B) = 0.25$

Answer $= 0.583$

$P(A \cup B) = P(A) + P(B)$

when $P\left(A / A \cup B\right) = \dfrac{P\left[A \cap (A \cup B)\right]}{P(A \cup B)}$

$= \dfrac{P(A)}{P(A \cup B)} = \dfrac{0.35}{0.60} = 0.583$

(5)

Vector v is geven by

$$\vec{v} = v_1 \hat{i} + v_2 \hat{j} + v_3 \hat{k}$$

find out curl $\vec{v}$

Answer $= \hat{i} \left[\dfrac{\partial v_3}{\partial y} - \dfrac{\partial v_2}{\partial z} \right] \oplus \hat{j} \left[\dfrac{\partial v_3^3}{\partial x}_{4x} - \dfrac{\partial v_1}{\partial z} \right]_z$

$$+ \hat{k} \left[\dfrac{\partial v_2^2}{\partial x} - \dfrac{\partial v_1}{\partial y} \right]$$

Solohon $= \begin{vmatrix} \hat{i} & \hat{j} & \hat{k} \\ \dfrac{\partial}{\partial x} & \dfrac{\partial}{\partial y} & \dfrac{\partial}{\partial z} \\ v_1 & v_2 & v_3 \end{vmatrix}$

$\dfrac{\partial}{\partial a}$

(6) $y'' + y' + 0.25 y = 0$

$y(0) = -3$

$y'(0) = ?$ $= 3.5$.

$\lambda^2 + \lambda + 0.25 = 0$

$\lambda^2 + \lambda + \frac{1}{4} = 0$

$4\lambda^2 + 4\lambda + 1 = 0$

$$(2\lambda + 1)^2 = 0$$

$$\lambda = -1/2$$

$y = (c_1 + c_2 x) e^{-0.5 x}$

$y(0) = 3$

$c_1 = 3$

Answer $= \boxed{(3 - 2x) e^{-0.5 x}}$?
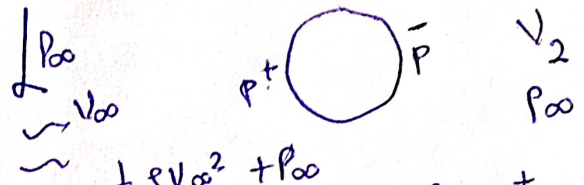
①

$V_\infty = 15 \ km^3/hr = 4.166 \ m/sec$

$D = 4$

$\rho_a = 1.2$

$F_{thrust} = \frac{1}{2} \rho_a A \left(V_\infty^2 - V_2^2 \right)$

$= \frac{1}{2} \times 1.2 \times \frac{\pi}{4} \times 4^2 \left[4.166^2 - \left(\frac{4.166}{3} \right)^2 \right]$

$= 116.31 \quad N$

$\boxed{C_{P_{max}} = \frac{16}{27}} \quad V_2 = \frac{V_\infty}{3}$

$(For \ (1))$

T_{max}

$(Maximum \ Torque)$

$P_{max} = C_{P_{max}} \times \frac{1}{2} \rho A V_\infty^3$

$T . \pi \cancel{D} \overset{rps}{N} = \frac{16}{27} \times \frac{1}{\cancel{2}} \times \rho \frac{\pi}{4} D^2 V_\infty^3$

$\boxed{T = \frac{2}{27} \frac{\rho_a D V_\infty^3}{N}}$

$\downarrow$ rps

Max
Torque
$(For \ (1))$

$\downarrow P_\infty$
$\rightsquigarrow V_\infty$
$p^+ \bigcirc \bar{p} \quad V_2 \quad P_\infty$

$\frac{1}{2} \rho V_\infty^2 + P_\infty \quad = \frac{1}{2} \rho V^2 + p^+$

$(For \ (1))$

$\frac{1}{2} \rho V_2^2 + P_\infty = \frac{1}{2} \rho V^2 + \bar{p}$

maximum

Thrust $\quad F = (p^+ - \bar{p}) A$

$= \frac{1}{2} \rho (V_\infty^2 - V_2^2) A$

$F = \frac{1}{2} \rho A \left(V_\infty^2 - V_2^2 \right)$

$F = \frac{1}{2} \rho A \left[V_\infty^2 - \frac{V_\infty^2}{9} \right]$

$F = \frac{1}{2} \rho \frac{\pi}{4} D^2 \times \frac{8}{9} V_\infty^2$

$\boxed{F_{max \atop thrust} = \frac{\pi \rho D^2 V_\infty^2}{9}}$

☆ $\dfrac{1}{r^{\#}} \dfrac{\partial}{\partial r}\left[\dfrac{\partial^{m} \partial T}{\partial r}\right]$

Value of n for sphere

(i) $n = 1$

(ii) $n = 2$ ✓

(iii) $n = 3$

(iv) $n = 4$

$\left[\dfrac{1}{r^2}\dfrac{\partial}{\partial r}\left(r^2\dfrac{\partial T}{\partial R}\right) + \dfrac{1}{r^2 \sin^2\theta}\left(\dfrac{\partial^2 T}{\partial \phi^2}\right) + \dfrac{1}{r^2 \sin\theta}\dfrac{\partial\left(\sin\theta\,\partial T\right)}{\partial\theta\,\partial\theta}\right.$

$+ \dfrac{g^{\circ}}{\alpha\,\mathcal{S}\,C_p} = \dfrac{\partial T}{\partial \#}\dfrac{1}{\alpha}$

✗ most economical section.

⑨

$d = 0.4$

$n = 0.01$

side slope = 1: 1 ,

find out Q

slope = 1/2500

Soluhon

$\tan \theta = \dfrac{1}{1}$, $\theta = 45°$

$b = 2d \tan\left(\theta/2\right)$

$\boxed{b = 0.8284 d}$

$b = 0.824 d \times 0.4 = 0.33136$

$A = bd + zd^2$

$= 0.2922$

$V = \dfrac{1}{0.01}\left(\dfrac{0.4}{2}\right)^{2/3} \sqrt{\dfrac{1}{2500}}$

$V = 0.683$

$Q = 0.2925 \times 0.683 = 0.20 \ m^3/sa$

⑯

$S = 10\% \times I = 2.5$

Batter slope $= 100\%$

find out Area lost and width.

$$D = \frac{S \, w}{100 - SS_{or}}$$

$$2.5 = \frac{10 \times w}{90}$$

$$w = 22.5 \, m.$$

$$AL = \frac{S + 200}{\dfrac{200}{S} + \dfrac{S}{100}} = \frac{10 + 200}{\dfrac{200}{10} + \dfrac{10}{100}}$$

$$= 10.44 \%.$$

✱ ⑪ $D = 200$ cm

    I^{st} Ball dia $= 20$ cm

    IInd Ball dia $= 10$ cm

find out the change in speed for wet grinding (in rpm)

mill.

$$N = \frac{1}{2\pi}\sqrt{\frac{g}{(R-r)}}$$

$$R = \frac{200 \text{ cm}}{2} = 100 \text{ cm} = 1 m$$

$$r_1 = \frac{20}{2} = 10 \text{ cm} = 0.1$$

$$r_2 = \frac{10}{2} = 5 \text{ cm} = 0.05 \text{ cm}$$

$$N_1 = \frac{1}{2\pi}\sqrt{\frac{9.8}{1-0.1}} = 0.525 \qquad = 31.5 \text{ rpm}$$

$$N_2 = \frac{1}{2\pi}\sqrt{\frac{9.8}{1-0.05}} = 0.511 \qquad = 30.66$$

change in critical speed = 0.84 rpm

change in operating speed = $0.84 \times$ factor

$\qquad\qquad\qquad\qquad\qquad = 0.546$ rpm $\Big\}$

$$\begin{array}{c|c} \dfrac{\text{factor}}{} & \\ \text{wet grinding} & 65\% \ (0.65) \\ \text{solid} & 80\% \ (0.80) \end{array}$$

(12)

Aquifer

1.4 km apart

4m Hydraulic head

3.5 m/day

porosity is 40%.

$$V_a = \frac{ki}{n} = \frac{3.5 \times 4}{0.4 \times 1400} = 0.025$$

$$t = \frac{1.4 \times 10^3}{0.025} = 56000 \text{ days}$$

(13)

$N_e = 1$

$C_v = 0.07$

$E_a = 0.9 = 90\%$.

$Q_{1min} = 45$

$Q_{vrag} = 50$

$Q_{max} = 60$

$$EU = \sqrt{\left[1 - \frac{1.027\ C_v}{N_e^{0.5}}\right]} \frac{Q_{min}}{Q_{avg}}$$

$$= \sqrt{\left[1 - 1.127 \times 0.07\right]} \frac{45}{50}$$

$$EU = \left[1 - \frac{1.27\ C_v}{N_e^{0.5}}\right] \frac{Q_{min}}{Q_{avg}}$$

$$= \left[1 - \frac{1.27 \times 0.07}{(1)^{0.5}}\right] \frac{45}{50}$$

$$= 0.81999$$

$$n_o = EU \times n_a \qquad 73.79\%$$

$$= 0.8199 \times 0.9 = \boxed{0.6539}$$

(14)

stichometric air fuel ratio , $\cancel{14.3}$ $\cancel{14.3}$ = 14.4

equivalence ratio = $\cancel{0.92}$ 0.91

$$\frac{fuel\ air}{equi\ values\ (ratio)}\ \phi = \frac{(A/F)_{stiochmatoric} = 14.}{(A/F)_{Actual}}$$ Gate.

air fuel equi force ratio $(\lambda) = \dfrac{(A/F)\ actual}{(A/F)\ shiomehu\ ratio}$

$\underline{15.97}$ $(A/F)_{Actual} = \dfrac{\cancel{14 \cdot 373} = \cancel{15.97}}{0.92}$

$= \dfrac{14 \cdot 4}{0.91} = 15.824$

(75)

$P = 90 \, mm$

$I_a = 0.25 \, S$

$S_1 = 136$

find out change in Runoff.

$S_2 = 64$

$$Q = \frac{(P - I_a)^2}{P - I_a + S}$$

$$Q_1 = \frac{[P - 0.25 \, S]^2}{P + 0.75 \, S}$$

$$= \frac{[90 - 0.25 \times 136]^2}{90 + 0.75 \times 136}$$

$$= 16.333.$$

$$Q_2 = \frac{[90 - 0.25 \times 64]^2}{[P + 0.75 \times 64]}$$

$$= 39.68$$

change in Runoff $= 23.35 \, mm$

$$\% = \left[\frac{Q_2 - Q_1}{Q_1}\right] \times 100$$

$$= 142.98 \%$$

$F = 1000$

loss 7 %. $= 70$

$F = 930$

$F x_F = P x_P$

$930 \times 14 = P \times 93$

$P = 140$

product yied $= \dfrac{P}{F} \times 100$

$= \dfrac{140}{1000} \times 100$

$= 14 \%$

1)

$w_d = 80$ lit/sec $t = 10$ hours

$m_{ci} = 20 \%.$

$m_{final} = 32 \%.$

$A = \dfrac{1.25}{2}$ ha

$d_w = \left(\dfrac{32-20}{100}\right) \times 1.5 \times 50$

$= 9$ cm $= 0.09$ m

$d_{aiR} = \dfrac{80 \times 10^{-3} \times 10 \times 3600}{\dfrac{1.25 \times 10^4}{2}}$

$= 0.144 = 0.144$ m

$n_a = \dfrac{0.09}{0.144} = 62.5 \%.$

(18)

rows to row spacing = 40 cm

~~52~~ 38 gm is transferred

$$\frac{Ng}{Np}$$

$D = 600\ mm.$

seed rate = 200 kg/ha.

seed rate =

2·52 : 1

$$\frac{n \times n_{up}}{\pi\, Dg \left(\dfrac{Ng}{Np}\right) \times w}$$

$$\frac{200}{10^4} = \frac{38 \times 10^{-3} \times \cancel{10^4}}{\pi \times 0.6 \times \dfrac{Ng}{Np} \times (2 \times 0.4)}$$

$$\boxed{\frac{Ng}{Np} = 2.5199}$$

$$\frac{Ng}{Np} = \frac{38 \times 10^{-3} \times 10^4}{200 \times \cancel{2} \times 0.4 \times \pi}$$

$$\boxed{\frac{Ng}{Np} = 2.5199}$$

water content = 20 %

wet density = 1.8

& G = 2.7

$\gamma_w = 1$

$$\gamma d = \frac{G \gamma_w}{1+e} = \frac{\gamma}{1+w}$$

$$\gamma d = \frac{1.8}{(1+0.2)} = 1.5$$

$$\gamma d = \frac{G \gamma_w}{1+e}$$

$$1.5 = \frac{2.6}{1+e}$$

$$e = 0.733$$

$$e = \frac{n}{1-n}$$

$$e - n \times e = n$$

$$n = \frac{e}{1+e} = \frac{0.733}{1.733} = 0.4238$$

(26)

$H = 15$ ✓

$V_{min} = 9.6$ ✓

$V_{max} = \cancel{8} \; 16$ ✓

$\theta = 20°$ ✓

$L = 200$ ✓

$d = 17 \; H \; \dfrac{V_m \; \cos\theta}{V}$

$= 17 \times 15 \times \dfrac{9.6}{16} \cos 20°$

$= 1\cancel{36.37} \quad 143.77$

$\overset{143.77}{}$

$A = 200 \times \cancel{136.31} = \cancel{27263.36} \quad 28754$

$A = \cancel{2.72} \; ha$

$2.87 \; ha$

Power = 1 kw, radius = 10 cm, N = 600
involute profile Angle = $20°$, find ~~normal~~ force
out total force

$P = 1$ kw

$T = F_t \times r$

$P = \dfrac{2\pi T N}{60}$

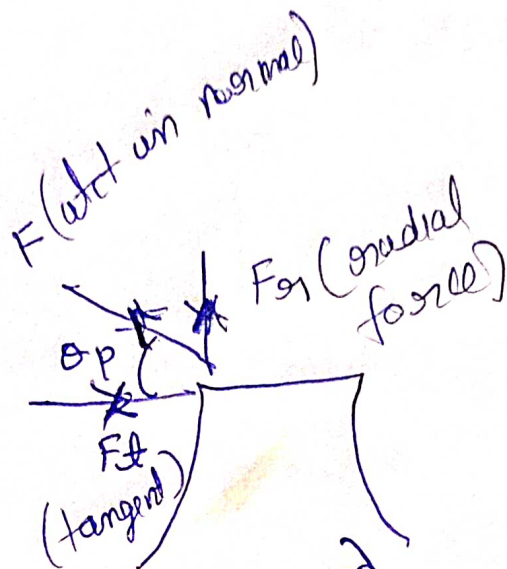$10^3 = \dfrac{2\pi \times T \times 600}{60}$

$T = 15.9154$

$T = F_t \times 0.10$

$F_t = 159.14$

$F_\phi = F \cos \theta_p$

$159.14 = F \cos 20°$

$F = 169.35$

F (act in normal)

F_R (radial force)

θ_p

F_t (tangent)

(torque)

$F =$ total force.

$\theta =$ Pressure Angle

$F_t =$ tangential force

$F_R =$ Radial force

$T = F_t \times r$

$r =$ Pict angle
radius

Work index

$D_F = 4.75 \text{mm}$

$D_p = 0.5 \text{mm}$

$P = 7.2 \text{ kw}$

$f = 2 \text{ tonnes}/hr$

$$\frac{P}{f} = 0.3162 \; w_i \left[\frac{1}{\sqrt{D_p}} - \frac{1}{\sqrt{D_F}} \right]$$

$$\frac{7.2}{2} = 0.3162 \; w_i \left[\frac{1}{\sqrt{0.5}} - \frac{1}{\sqrt{9.75}} \right]$$

$$\underline{w_i = 11.9169}$$

※ the muskinghum equation of flood routing

satisfy whech equation

① equation of force balance

② equation of continuity ✓

③ equation of continuity and momentum

④ equation of energy

$r_1 = 0.30$ $\qquad$ $S_1 = 1.17$

$r_2 = 0.90$ $\qquad$ $S_2 = 0.80$

$d_w = 30 \text{ cm}.$ $\qquad$ $Q = \underline{1500 \text{ lit/sec}}$

$S_w = ?$

$$\dfrac{2\pi\, k\, b\,(S_1 - S_2)}{\ln\left(r_2/r_1\right)} = \dfrac{2\pi\, k\, b\left(S_w - S_1\right)}{\ln\left(r_1/r_w\right)}$$

$$\dfrac{1.17 - 0.80}{\ln\left(0.9/0.3\right)} = \dfrac{S_w - 1.17}{\ln\left[0.30/0.15\right]}$$

$$\boxed{S_w = 1.403\, m}$$

clean (main outlet)

feed F

clean seed

$Q = 100 - 8.5 = 91.5 = 0.915$

$E = 100 - 1.2 = 98.8 = 0.988$

$\left(\begin{array}{c} \text{clean} \\ \text{grain} \end{array} \right)$ $G = 0.023 =$

$$= \frac{E(E-F)(F-G)(1-G)}{F(1-F)(E-G)^2}$$

$$= \frac{0.988(0.988 - 0.915)(0.915 - 0.023)(1 - 0.023)}{0.915(1 - 0.915)(0.988 - 0.023)^2}$$

$\dfrac{100 - x}{100} = 0.2$

$$\frac{0.06285}{0.0724} = 86.778\%$$

$D = 6\,mm$ 　　　　　$L = 50\,mm.$

uthmate tensihe strength $= 1500\,N/mm^2$

bending stress $= 350\,N/mm^2$

$D = 6\,mm.$ 　　　　$C = 3\,mm = \dfrac{D}{2}$

$I = \dfrac{\pi}{64}\,d^4 = 63.6176\,mm^4$

(solid/curalan

$I = \dfrac{\pi}{64}\,d^4$

$I = \dfrac{3\pi d^3 t}{32}$

$F = \dfrac{I \; S_4}{C \times L}$

$= \dfrac{63.6176 \times \overset{350}{1500}}{3 \times \overset{50}{50}} = 6380.196\,N$

$148.44\,N$

(
Holloar
and
thin
yelmds

$\dfrac{M}{I} = \dfrac{\sigma}{y}$

$\dfrac{F \times L}{I} = \dfrac{\sigma_b}{D/2}$

$F = \dfrac{I \cdot \sigma_b}{L \times \dfrac{D}{2}} \longrightarrow C$

stem
neight