Numerical Answers to Exam Question

Academic Year : *2023-24* **Semester :** *1* **Course Code :** *CV1011*

Course Title : *Mechanics of Materials*

Tabulated By : *Liu Yu and Ivan Au*

Question No	Answer
1	(a) $M_A = T(-0.0728i+0.233j)$, (b) $T = 1.07\ kN$, (c) $A_{min} = 55.4mm^2$
2	(a) $\Sigma F = 12kN \downarrow$, $x = 5.5m$, (b) $Ax = 0$, $Ay = 5.4\ kN \uparrow$, $Ey = 6.6\ kN \uparrow$
3	a) 0.629 MPa; b) 4.92 MPa
4	a) {10, 0}, 5 MPa; b) 0.375, 0; c) 0.5

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV1012

Course Title : Fluid Mechanics

Tabulated By : LSY

Question No	Answer
1a	P(air) = 21346.6 Pa, P(gauge reading) = 60586.6 Pa
1b	Fh = 117.72 kN, Fv1 (rect) = 78.48 kN, Fv2(quadrant) = 61.638 kN, F = 140.12 kN
1c	h =1.39m, BM = 1.85m, BG < 1.85 to be stable
2a	P1 - P2 = 6180.3 Pa, Q = 0.028 m3/s
2b	V2 = 12. 08 m/s, V3 = 12 m/s, F = 722.4 N
3a	refer to notes
3b	Lp = 4.49m, Fp = 1762.8 N
3c	Q = 0.2 m3/s
4a	hp = 13.17 m, Power P = 1014.3W
4b	SCC: H = 10 + 774.63 Q2, Q = 0.11 m3/s, new PCC: H = 80-70 Q2, Q = 0.288 m3/s

Numerical Answers to Exam Question

Academic Year : 2023-2024 **Semester :** 1 **Course Code :** CV 2011

Course Title : Structural Analysis I

Tabulated By : Li Bing & Fu Y G

Question No	Answer
Q1	a= $0.0\ kN$; b = 12.5 kN FD= $-0.745P$; AE = -0.47P
Q2	Support forces (45 KN ;67.5 KN;57.6 KN/115 KNm) M(0;45;0;67.5;0;115) KNm
Q3	M_A=67.5kN·m; v_c=-1485/4EI; θ_c=-90/EI;
Q4	Δ_E=1.638 mm; θ_B=0.00291 rad ; Δ_B=21mm

Numerical Answers to Exam Question

Academic Year : 2023-2024 **Semester :** 1 **Course Code :** CV2013

Course Title : Engineering Geology and Soil Mechanics

Tabulated By : Wu Wei

Question No	Answer
2(a)(i)	141/27NE or 321/27NE
2(a)(ii)	24-25°
2(a)(iii)	150 m
3(a)(ii)	1.87 g/cm3
3(b)(i)	0.1 m
3(b)(ii)	2 ×10-6 and 2x10-8 m/s
3(b)(iii)	4.85 kPa
4(a)(i)	3.99 × 10-2 cm/s
4(a)(ii)	11 kPa
4(b)(i)	134 kPa, 12 kPa
4(b)(ii)	96 kPa
4(b)(iii)	0.688 m
4(b)(iv)	28.40%

Numerical Answers to Exam Question

Academic Year : 2023-2024 **Semester :** 1 **Course Code :** CV 3011

Course Title : Reinforced Concrete Design

Tabulated By : Li Bing & Qian SZ

Question No	Answer
Q1	M=238.5 KNm deesign is adequated.
Q2	Asc=3959 mm2 Ast=5888 mm2 Asw/s=1.29
Q3	(a) As,ms=243 mm2, As, sup=318 mm2 (b) deflection control is ok
Q4	(a) M=310 kNm (b) 8 H32 bars

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV3013

Course Title : Foundation Engineering

Tabulated By : EC Leong

Question No	Answer
1	(c) Relative density = 49.3%, (d) Relative density = 53.2%
2	(b)(i) Design resistance = 92.9 kN, Design load = 155 kN; (b)(ii) Settlement = 5 mm
3	(a) Length of pile = 11 m.
4	(b) ODF = 1.78; (c) ODF = 1.29; (d) ODF = 3.16

CV3014 – TRANSPORTATION ENGINEERING

Numerical answers:

1, (a) 0.83 (b) 250, 92, 40, 3680 (c) 162+70
2, (a) 47/11, 32/11, 86/11, 118/11, (b) 27/11, 2/11, 26/11, 138/11 (c) 32/11, 37/11, 86/11, 78/11 (d) 5.875, 0.125, 1.25, 4.5, 5.75
3, (a) NA (b) 6, 5.25
4, (a) 120, 130, 150, 400 (b) NA (c) NA.
5, NA.

Numerical Answers to Exam Question

Academic Year : 2022-23 **Semester :** 1 **Course Code :** CV3017

Course Title : Urban Water Circularity

Tabulated By : Zhou Yan

Question No	Answer
1 (a)	1728m2, L=50m, W=8.64m, H=3.125m
1(b)	>, >, <
1(c)	0.72m
2(d)	1880m3
2(e)	23.5mg/L.min, 75mg/L.min
3(a)	0.212m
3(c)	80.7m3
4(b)	47.66mg/L, 61.82mg/L, 20.5mg/L
4(c)	74.20%

Numerical Answers to Exam Question

Academic Year : 2022-23 **Semester :** 1 **Course Code :** CV4011

Course Title : Project Planning and Management

Tabulated By : Teoh Bak Koon

Question No	Answer
Q1	Not Applicable
Q2(a)	112 days
Q2(b)i	119 days
Q2(b)ii	113 days
Q3(a)	22 months
Q3(b)i	BCWP = SGD 405.5k
Q3(b)ii	SGD 634k, SGD 629k
Q4	Not Applicable

Numerical Answers to Exam Question

Academic Year : 2022-23 **Semester :** 1 **Course Code :** CV4012

Course Title : Project Planning and Management

Tabulated By : Teoh Bak Koon

Question No	Answer
Q1	Not Applicable
Q2(a)	112 days
Q2(b)i	119 days
Q2(b)ii	113 days
Q3	Not Applicable
Q4(a)	22 months
Q4(b)i	BCWP = SGD 405.5k
Q4(b)ii	SGD 634k, SGD 629k

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV4101

Course Title : CV4101 Structural Analysis III

Tabulated By : Fu Yuguang, Yang Yaowen

Question No	Answer
1	(a) a1=22.5 mm; M1_p'=68kN·m; (b) a2=8 mm; M2_p'=75.5kN·m; (c) N=1120kN; M_p=62.4kN·m
2	(a) n_ph=4; (b) G= k(6M_1+6M_2); λ_A=(4M_1)/27; λ_B=(M_1+M_2)/9; λ_C=(4M_1+2M_2)/45; λ_D=(2M_1+2M_2)/27; λ_E=(2M_1)/9; λ_F=(2M_1+4M_2)/45; M_1=M_2=7.5; G=90k;
3	(a) P_cr = 1.43 (π^2 EI)/L^2; (b) P_cr = 0.544 (π^2 EI)/L^2
4	(a) translational spring stiffness = 12EI/L^3; 0.25 (π^2 EI)/L^2 < P_cr < 2.05 (π^2 EI)/L^2 (b) P_cr = 1.14 (π^2 EI)/L^2

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV4102

Course Title : Advanced Steel Design

Tabulated By : Lie Seng Tjhen and Zhao Ou

Question No	Answer
1	(a) β=0.8, γ=8, N1,Rd = 1579.75 kN, N2,Rd = 1579.75 kN; (b) N1,Rd = 1342.79 kN, N2,Rd = 1342.79 kN; (c) g = 60 mm
2	(a) 233.7; (b) 234
3	(a) 3180
4	(a) 45, 16.67, 25.83

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV4107

Course Title : Engineering Economics and Finance

Tabulated By : rtiong and Kim jinwoo

Question No	Answer
2	(a) x=3.68%; (b) ROR for B=7.6%
3	NPVs for (b) $86773.6
4	(a) NPV: A=$1518; B=$2682; C=$-610
	b. option I: $348; II: $500

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** CV4110

Course Title : Excavation and Retaining Walls

Tabulated By : Yi Yaolin

Question No	Answer
1c	1.45, 1.68
2a	4.03
2c	1.04
Q3(b)	1.377
Q3(c)	0.985
Q4(a)	350.2, 510, 459, 25.5
Q4(b)	15.2 mm

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :**

Course Title : Traffic Engineering

Tabulated By : Lum Kit Meng

Question No	Answer
1	$\chi^2_{observed} = 0.726$; H_o not rejected; fits a negative exponential distributi
2	C_{m1} = 618 veh/h; C_{m9} = not control by stop sign; C_{m7} = shared lane capa
3	Cycle time = 170 s; Green times are respectively 38 s, 49 s, 28 s and 39
4	4(a) V = 5284 veh/h; 4(b) V= 6920 veh/h
5b(ii)	q = kv = 2245 veh/h
6(c)	x1=x2=1.2, x3=3.6, Tr=33.6 (before adding a link). After adding a link B taking BC is higher than taking BD. Paradox not observed.

CV4112

ion

acity = 137 veh/h

l s

C, the route cost of

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :**

Course Title : Inland and Coastal Flood Management

Tabulated By : Qin Xiaosheng

Question No	Answer
1a	[18.2 79.2 25.4 15.2 11.6 10.0 9.0 8.2]
1b	(ii) 4900 m3/s; (iii) 0.0042
2a	0.47, 0.87, 0.39; 0.48; 1.73 m3/s
2b	(i) 197.2 m2/day; 0.266; (ii) 1.52 m; (iii) 0.544 m
3a	(ii) 2.26m
3c	(i) 89.4m (ii) -10.7m
4c	52.5 kPa, 13.3 kPa
4d	2.36 m

CV4121

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EM5103

Course Title : Water Resources Management

Tabulated By : LSY

Question No	Answer
1	see notes
2	see notes
3	3a: see notes, 3b: reservoir capacity = 5810x10^3 m^3, 3c: UH = Runoff/6.22
4a	2 hr UH Table: Time(hr):UH = 0:0; 1:1.5; 2:8; 3:18.5; 4:21; 5:12.5; 6:4.5, 7:1;
4b	W = 1.9; C1 =-0.053; C2 = 0.579; C3 = 0.474.peak = 52.26 m^3/s

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN1001

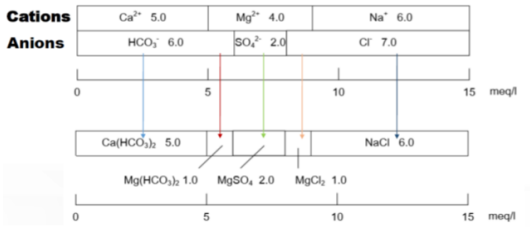
Course Title : Environmental Chemistry

Tabulated By : Grzegorz Lisak

Question No	Answer
3 (a) (b) (c) (d)	

parameter	Concentration, mg/L	Eq.wt	meq/L
CO_2	13.2	22	0.6
Ca^{2+}	100	20	5
Mg^{2+}	48	12	4
Na^{+}	138	23	6
Fe^{3+}	0.8	18.6	0.04
			Sum cations =15.04
$SO_4^{=}$	96	48	2
?	?	?	?
HCO_3^{-}	366	61	6
			Sum anions = 8

According to law of Electroneutrality, the sum of meq/l of cations equals the sum of anions. In this case, the total anions is (15-8 =) 7 meq/l less than total cations.
The calculation indicates the equivalent Cation-Anion in MacRitchie Reservoir water, is not balanced.



According to bar diagram, the hypothetical combinations of compounds are Ca(HCO3)2 5 meq/L, Mg(HCO3)2 1 meq/L, MgSO4 2 meq/L,MgCl2 1 meq/L and NaCl 6 meq/L.

According to bar diagram, the missing 7 meq/L must be Cl.

Cl^- = 15 - 8 = 7 meq/l

$$\text{Milliequivalent per litre (meq/L)} = \frac{\text{mg/L}}{\text{Equivalent Weight (EW)}}$$

EW of Cl^- = 35.5/1 = 35.5

Concentration of Cl^- = 7 meq/l x 35.5 = 248.5 mg/l

Total Hardness = Σ (Ca^{2+}) + (Mg^{2+}) + (Fe^{3+})
= 5 + 4 + 0.04 = 8.04 meq/L =402 mg/L as $CaCO_3$

Alkalinity = $[HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+]$
At pH = 7.2 $\Rightarrow [CO_3^{2-}] \approx 0$, $[H^+] \approx 0$, $[OH^-] \approx 0$
Alkalinity $\approx [HCO_3^-] + 2[CO_3^{2-}] + [OH^-] - [H^+] \approx$ 6 x 50 = 300 mg /L as $CaCO_3$

TH > TA at pH 7.2
NCH = 402 – 300 = 102 mg/L as CaCO3

4 (c) (d) (e)	K = [NH3] [H+]/[NH4+] [NH3] = K[NH4+]/[H+] At pH = 7, [H+] = 10-7 and [NH4+] = 0.008M NH4+ +2 O2(g) = NO3- + 2H+ +H2O ΔG°f = -79.37 0 111.34 0 -237.18 KJ/mol ΔG°reaction = -111.34+ (-237.18) - (79.37) - 2(0) = -269.15 KJ/mol (<0, -ve) Because ΔG°reaction < 0. Yes, the reaction will be thermodynamically favorable. Toxic NH4+ will be convert into NO3- forming eutrophication problem in treated wastewater. [NH3] = 5.74x10-10 (7x10-3)/10-7 = 4.018x10-5 M at 25°C Toxic to fish if [NH3] > 0.53x10-3/17 = 2.94x10-5M Since [NH3] > 2.94x10-5M, So water is toxic to fish at 25°C C = C0 e-kt t0.5 = 0.693/k = 20 days k = 0.03465 day-1 At 100 days C100 days = C0 e-(0.03465)(100) =3.13x10-2 C0 Fraction remains = 3.13%

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN2004

Course Title : GEO-ENVIRONMENT AND SOIL MECHANICS

Tabulated By : Xunchang Fei

Question No	Answer
1	N.A.
2	b: O2 = 6340 g; CO2 = 6642 g. c: assume new concentration, X = 22.5 mg/L; sparged = 1123.5 g; remained = 876.5 g; removal = 56%.
3	a: t = 5787 d. b: t = 46 d. c: t = 46 + 694 = 740 d.
4	a: 1.87 g/cm3. b: dh = 0.1 m; k1 = 2e-6 m/s; k2 = 8e-6 m/s; σ' = 4.85 kPa.
5	a: Tv = 4e-2 cm/s; u = 11 kPa. b: u = 134 kPa; σ' = 12 kPa; σ' = 96 kPa; sc = 0.688 m; wc = 28.

EN3001 - Solid and Hazardous Waste Management

Numerical answers:

Q2(b); 54.57 x 10^6 GJ

Q2(c); 26.26 x 10^6 GJ (incineration) and 8.93 x 10^6 GJ (anaerobic digestion)

Q3(a); 5290 m^3

Q3(b); 70.8%

Q4(d); 0.095%

Q5(a); 0.12 kg/day (Toluene), 0.0862 kg/day (Benzene) and 0.048 kg/day (Dichloroethane)

Q5(bii); 13 hr

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN3002

Course Title : Wastewater Engineering

Tabulated By : CTH

Question No	Answer
1a(i)	66.6 kg/d
2a(i)	33.3%
2a(ii)	100%
2b	0.0323 m, 0.136 m
3b	200 mL/g
3c	5731 m^3/d
3d(i)	9.2 m
3d(ii)	1440 m^3/d
3d(iii)	202 mg/L
4(b)	7.76 m, 12.68 m

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN3004

Course Title : Air Pollution Control Engineering

Tabulated By : Wang Rong

Question No	Answer
1	(b) 2.14 W m^{-2} 66.4%
2	(a) $7.6x10^{-10}$ ppm (b) C_{max} = $9.77x10^{-7}$ ng m^{-3}; C_{ground}=1.96x10-10 ng m^{-3}
3	(d) η(gravity settler)=43.6% η(cyclone)=98.1%
4	(c) Coal amount = 6×10^{5} kg/hr O_2 added = 8977.45 kg/hr

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN3006

Course Title : Energy Resources Engineering

Tabulated By : Tuti Lim

Question No	Answer
1	(a)(i) 1.51% ; (ii) Oil: 43.1 years & NG: 40.3 years
2	(a) BTU/US$: 1,541 (A); 6,834 (B) and 5,929 ©
3	(a)(i) 84,826 kg (b)(i) 43200 GJ; 21.85 m
4	(a) 492 --> 500 turbines

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** EN4001

Course Title : Environmental Impact Assessment & Monitoring

Tabulated By : CTH

Question No	Answer
3a	0.958, 0.958
3b	3613 kg/h, 16875 kg/h

Numerical Answers to Exam Question

Academic Year : 2022-23 **Semester :** 1 **Course Code :** CV4116

Course Title : Coastal Engineering

Tabulated By : Prof Adrian Law and A/P Edmond Lo

Question No	Answer
Q1	(a) (i) 80 ug/L ; (ii) 29 ug/L
Q2	(a) 497 m2/s ; (b)152.3km, 172.8 km ; (c) 1.06 x 10^-6 (1/s)
Q3	(b) (i) Lm = 0.445m; jet-like x = 0.25m, plume-like x = 2.75, 3.0, 3.25 and 3.5, transition for other x
Q4	-

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** MT1001

Course Title : Mathematics I for Maritime Studies

Tabulated By : Yan Ran

Question No	Answer
1(a)(i)	0≤x≤10,000
1(a)(ii)	decrease
1(a)(iii)	price = 6
1(b)(i)	both markets MC=4
1(b)(ii)	total profit=33.3
1(b)(iii)	total profit = 19.03
1(c)	$\frac{24x^5(x^3-7)^3-6x^2(x^3-7)^4}{4x^6}$
2(a)	The last blank: 11596.93
2(b)	≈22,527.19
3(a)	$\frac{2}{3}(1+\ln x)^{\frac{3}{2}}-2(1+\ln x)^{\frac{1}{2}}+C$
3(b)	$\frac{1-\ln^2}{2}$
3(c)	3.163
4(a)	$e^u v^2/y^2 + 2ve^u/y$
4(b)	y*=20000
4(c)	1/48

Numerical Answers to Exam Question

Academic Year : 2023-24 **Semester :** 1 **Course Code :** MT4001

Course Title : SHIPPING LOGISTICS

Tabulated By : DR KELVIN PANG

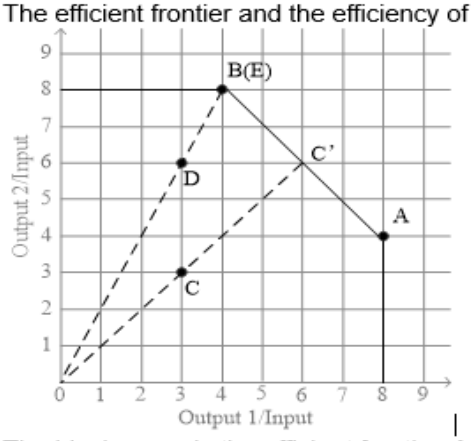
Question No	Answer
1a(i)	Demand D= 450 kg per week = (52 x 450) kg per year Fixed ordering cost S = $600 per order Unit cost C = $6 Percentage holding cost per year h = 0.20 EOQ = √[(2 x 52 x 450 x 600)/(0.20 x 6)] = 4,837.36 kg At Q = EOQ, annual total cost = (EOQ/2)hc + (D/EOQ)S = [(4,837.36/2) x 0.2 x 6] + [((52 x 450)/4,837.36) x 600] = $5,804.83
1a(ii)	Since the product's shelf-life is 8 weeks, the distributor can only store 8 weeks of demand, i.e., 8 x 450 = 3,600 kg. With considerations to the limited storage space and minimum order quantity, the new optimal order quantity is 3,600 kg (shelf-life constraint). Total cost = $1,530.82 + $1,435.07 = $2,965.89 In this case, we equate the total costs associated with ordering at the EOQ and the breakpoint levels for the retailer in determining the discount level.
1(b)	S* = fixed transportation cost + product-specific order costs = $2,000 + 3($1,200) = $5,600 Optimal order interval for joint ordering n* = = √[(8,000x0.20x600 + 15,000x0.20x600 + 12,000x0.20x600)/(2x5600)] = 19.36 times per year Optimal lot size for each model: QA = 8,000/19.36 = 413 (rounded off to nearest integer) QB = 15,000/19.36 = 775 (rounded off to nearest integer) QC = 12,000/19.36 = 620 (rounded off to nearest integer)

5(c)

The outputs per unit of input

Terminal	Output 1/Input	Output 2/Input
A	8	4
B	4	8
C	3	3
D	3	6
E	4	8

The efficient frontier and the efficiency of the companies can be shown as follows:



The black curve is the efficient frontier. Any point on the efficient frontier represents a terminal that is efficient (has relative efficiency 1). Hence, the relative efficiency values of terminals A, B, and E are 1, 1, and 1. Points C and D are strictly inside the feasible region (and thus with relative efficiency < 1).

The relative efficiency of terminal D is $\frac{3}{4} = \frac{6}{8} = 0.75$.

The coordinates of point C' are: (6, 6).

So, the relative efficiency of terminal C is $\frac{3}{6} = \frac{3}{6} = 0.5$.

To conclude, the relative efficiency of terminals A, B, C, D, and E is 1, 1, 0.5, 0.75, and 1.

5(d)

EDD:

sequence	finish time	Due date	tardiness	Tardiness cost
J1	15	25	0	0
J4	33	26	7	14
J3	59	45	14	21
J2	91	50	41	123
J5	118	60	58	145

Total tardiness cost = USD303.

The makespan is 118 days.

SPT:

sequence	finish time	Due date	tardiness	Tardiness cost
J1	15	25	0	
J4	33	26	7	14
J3	59	45	14	21
J5	86	60	26	65
J2	118	50	68	204

Total tardiness cost = USD304.

The makespan is 118 days.

Numerical Answers to Exam Question

Academic Year : 2023-2024 **Semester :** 1 **Course Code :** MT4101

Course Title : Intermodal Transpirtation

Tabulated By : TEO CHEE CHONG

Question No	Answer
2(a)	24.55 knots
2(b)	3,500 TEUS and 2,450 TEUs
2(c)(i)	667 TEUs
3(c)(ii)	42 hours and 8 hours