Answers to the Exam's Questions for AY1920 Semester 1

Code	Course Title	Question	Answer
CV1011	Mechanics of Materials	Q1a	x = 8.92m, y = 7.54m
		Q1b	CE = 10.1 kN (T) ,
		Q1b	EF = 2.53 kN (C),
		Q1b	HF = 16.80 kN (C),
		Q1b	CF = 2.78 kN (T)
		Q2a	x-axis = 56.1 mm, y-axis = 18.4 mm
		Q3a	340.5kN, 20.1 mm
		Q3b	830.33 Nm/m
		Q4a	$\sigma_x = 83.46MPa.$ $\theta = 30.48^o$ $\sigma_{y'} = 18.46MPa$ $\sigma_1 = \sigma_{ave} + R = 88.00MPa$ $\sigma_2 = \sigma_{ave} - R = -4.55MPa$
		Q4b	σ = 90.7 *MPa,*
			τ = *79.6 MPa,*
			τ_{max} = 91.6 Mpa,
			σ_1 = -46.2 Mpa

CV2011	Structural Analysis I	Q1b	$R_{Ay} = \frac{5}{3}P \quad R_{By} = \frac{P}{3}$
		Q1c	
		Q2b	$H_E = 38.6\ kN \quad V_E = 47.04\ kN$ $H_G = -71.6\ kN \quad V_G = 72.96\ kN$
		Q3a	$\frac{1}{4}\frac{M_o a^2}{EI}\ (\uparrow)$
		Q3b	$\frac{7}{12}\frac{M_o a}{EI}$
		Q4a	$\Delta_D = \frac{109\ kN \cdot m^3}{EI} \downarrow$
		Q4b	$\theta_B = \frac{140\ kN \cdot m^2}{EI}$

Answers to the Exam's Questions for AY1920 Semester 1

CV2013	**Ground Engineering**	**Q2d**	21^o
		Q2e	150m
		Q3a(ii)	$q_{in} = q_{out} \rightarrow v_A = v_B$
		Q3a(iii)	$h_M = 2$ m 9.8 kPa
		Q3a(iv)	$4x10^{-5}$ m^3/s, 2x10-5 m/s
		Q3b(i)	$8x10^{-6}$ m^3/s / m run of dam
		Q3b(ii)	39.24 kPa
		Q3b(iii)	Pore Water Pressure= 36.62 kPa
			Effective stress at Point P = 52.543
		Q3b(iv)	$2.0x10^{-6}$ m/s
		Q4b(i)	Total vertical stress: 130.0 kPa
			Pore water pressure: 58.86 kPa
			Effective vertical stress: 71.14 kPa
			Preconsolidation pressure: 85.37 kPa
		Q4b(ii)	Total vertical stress: 190 kPa
			Total pore water pressure: 118.86 kPa
			Effective vertical stress: 71.14 kPa
		Q4b(iii)	0.277 m
		Q4b(iv)	229 days
		Q4b(v)	6.98 m

CV2015	**Hydraulics**	**Q1a**	V = 1.52 m/s
		Q1b	0.354 y
		Q2b(ii)	2.25 m
		Q2c(i)	0.742 m
		Q3b(i)	$3.308x10^{-3}$
		Q3b(ii)	2.411 m
		Q3b(iii)	1.906 m
		Q4b(i)	yc = 2.168 m
			Reach 1: $y_{n1} \rightarrow \infty$
			Reach 2: y_{n2} = 1.9 m
			Reach 3: y_{n3} = 6.706 m
			Reach 4: y_{n4} = 2.904 m
		Q4b(iv)	-480.5 m

CV3011	**Reinforced Concrete Design**	**Q1**	90.75 kN/m
		Q4b	Column AB:
			$K_{AB} : K_{AF}$ = 0.1333 : 0.25
			M_{AB} = 33.4 kNm
			$M_{AB,min}$ = 1.9 kNm
			Column LM:
			$K_{LM} : K_{LF} : K_{LR}$ = 0.1333 : 0.1667 : 0.25
			M_{LM} = 45.6 kNm
			$M_{LM, MIN}$ = 3.8 kNm

Answers to the Exam's Questions for AY1920 Semester 1

CV3013	**Foundation Engineering**	**Q1c(i)**	u_0 = 49 kPa
			σ_{v0} = 175 kPa
			σ'_{v0} = 126 kPa
			Q_1 = 8.13
			B_q = 0.40
		Q1c(ii)	34.7^o
		Q1c(iii)	73.2 kPa
		Q1c(iv)	0.81
		Q2c	immediately after construction = 10.3mm
			30 years after construction = 15.4mm
		Q3b	1191.9 kN
		Q3d	728.3 kN
		Q4a(ii)	2.40 m
		Q4b(ii)	Pa = 270.43, Mo = 1388.29
			ODF = 1.261
			anchor force = 86.88 kN

CV3014	**Transportation Engineering**	**Q1a**	152+60
		Q1b	229.06 m
		Q2a	0.82
		Q2b	jam density = 200veh/km
			k = 73.6veh/km
			v = 40 km/h
			q = 2944 veh/hour
		Q2c	77.5km/hr
		Q3a	t = 15.74
			TT = 62960
		Q3b	$\frac{1}{1+\exp(0.002N_{car}-5.8)}$
		Q4a	A to C = 6, B to C = 1
		Q4b	$D_{AC} = 15.38$ $x_2 = 3.845$ $x_3 = 9.69$ $x_1 = 1.845$
		5a	Stn 101+60: Cut area = 3.30m^2, Fill area = 3.50m^2
			Stn 101+75: Fill area = 11.50m^2
			Stn 101+92: Cut area = 1.5m^2, Fill area = 5.25m^2
			Stn 102+10: Cutl area = 12.75m^2
		5b	Borrow = 145.385 m^3
		6a(i)	210mm

CV3015	**Environmental Engineering**	**Q1a**	T_B = 31.25 L/min
		Q1b(i)	100%
		Q1b(iii)	Nil
		Q2c(ii)	1.2 mg/L
		Q3b	V = 2690 L/d, Storage capacity = 80.7 m^3
		Q3c	0.26 gVSS/g
		Q3d	167 mL/g
		Q4a(i)	10 d
		Q4a(ii)	2870 kg/d
		Q4c(i)	V_L = 235 m^3
		Q4c(ii)	5.64h

Answers to the Exam's Questions for AY1920 Semester 1

CV4011	**Project Planning & Management**	**Q2a(ii)**	298 days
		Q2b(ii)	day 116
		Q3b(i)	Cost Variance: A = -15,797,
			Cost Variance: B = -42,979,
			Cost Variance: C = -3,310,
			Cost Variance: D = 12,000
		Q3b(ii)	$40,688
		Q4c	180,000
		Q4d	236,000
		Q4e	SGD 207,200

CV4101	**Structural Anaylsis III**	**Q1a**	DOF = 2, U_3^1 and V_3^1
		Q1b	U_3^1 $4.286.10^{-4}$ m V_3^1 $7.143.10^{-4}$ m
		Q1c	U_3^1 $7.143.10^{-4}$ m V_3^1 $1.571.10^{-3}$ m
		Q2a	DOF = 2, θ_2^1 and V_3^1
		Q2b	θ_2^1 $-1.375.10^{-2}$ rad V_3^1 $-2.250.10^{-2}$ m
		Q2c	$3.125.10^{-3}$ m
		Q3a	9
		Q3b(ii)	$P_{cr} = 0.8151 \frac{\pi^2 EI}{L^2}$
		Q4a(i)	$P_{cr} = 0.8824 \frac{\pi^2 EI}{L^2}$
		Q4b(ii)	$(2\varphi^2 + 14)cos2\varphi + 13\varphi sin2\varphi - 14 = 0$

CV4102	**Advanced Steel Design**	**Q1a**	γ = 10.955 β = 0.58
		Q1b	$N_{1,RD}$ = 899.572 kN $N_{2,RD}$ = 1256.390 kN
		Q1c	Brace 1, $A_1 f_{y1} = 2640.0 \times 355 = 937.2$ kN Brace 2 = $A_2 f_{y2} = 1720.0 \times 355 = 610.6$ kN
		Q2a	$F_{t,Ed}$ = 193.642 kN $F_{c,Ed}$ = 423.642 kN
		Q2c	Shear capacity = 135.552 kN Total bearing resistance = 798.768 kN
		Q4a	250 kNm

CV4107	**Engineering Economics and Finance**	**Q2a**	x% = 5.597%
		Q4b	3 years

Answers to the Exam's Questions for AY1920 Semester 1

CV4110	**Excavation and Retaining Walls**	**Q1a(i)**	97.6^{o}
		Q1a(ii)	0.442
		Q2a(i)	24.71 kN/m^2
		Q2a(ii)	$\gamma_{eL}' = 7.24$ kN/m^3 and $\gamma_{eR}' = 10.76$ kN/m^3
		Q2a(iii)	$\phi\delta' = 30.7^{o}$, $K_a = 0.331$ and $K_p = 3.02$
		Q2c	T = 138.28, Tie rod force = 207.4
		Q3a	Top strut = 3.76 m
			2nd to 4th struts = 5.64 m
			Max wall bending mmt = 212.8 kNm/m
		Q3b	0.100 m
		Q4b	1.061
		Q4c	5.371 m

CV4112	**Traffic Engineering**	**Q3a**	175 veh/h
		Q3b	d = LOS F
		Q4b	4968 veh/h
		Q5a(iii)	2101 veh/h
		Q5b(ii)	k1 = 20.36 veh/km, μ1 = 51.57 km/h
			max queue length = 96.7 m

CV4116	**Coastal Engineering**	**Q1a(i)**	300
		Q1a(ii)	H_{rms} = 0.435 m,
			H_{33} = 0.572 m
			H_{10} = 0.78 m
		Q1b	6 hr, T = 2.8 sec
		Q1c	A = 0.00942
		Q2a	Transitional water depth: 2.45 m to 156 m
			Range of wave group velocity = 4.9 to 7.8 m/s
		Q2b(ii)	5.6 m
		Q3a(ii)	2.70 m
		Q3a(iii)	81.60%
		Q3b	2.81 kN
		Q4a	Hs = 0.68 m, L = 36.6 m

CV4120	**Advanced Reinforced Concrete Design**	**Q1a**	80 kNm
		Q1b(ii)	$F_1 = 0.358H$, $F_2 = 0.275H$, $F_3 = 0.267H$
		Q2a	60.1 kNm
		Q2c	$w_k = 0.14$ mm, $w_{k,lim} = 0.11$ mm
		Q3a(ii)	$w_u = \frac{24(m_u' + m_u)}{l^2}$

Answers to the Exam's Questions for AY1920 Semester 1

Code	Course Title	Question	Answer
EM9104	**Air Quality Management**	**Q4c(i)**	9.93
		Q4c(ii)	83%
		Q5a	106.44 $\mu g/m^3$
		Q5b(i)	0.5 ach
		Q5b(ii)	$C_i = 2.5\ pC_i / L$

EM9105	**Energy Resources Management**	**Q2a(i)**	14,142 Million MT
		Q2a(ii)	7.20%
		Q4a(i)	SO_2: 1411 MT/y NO_2: 1208 MT/y
		Q4a(ii)	Annual SO_2 emission: 201.62 MT/y
			Annual SO_2 treatment cost: \$5.327 Million
		Q4b(i)	89.4 m
		Q4b(ii)	52%

Answers to the Exam's Questions for AY1920 Semester 1

Code	Course Title	Question	Answer
EN2002	Environmental Biology & Microbiology	Q2a(i)	0.60 day^{-1}, 1.2 days
		Q2a(ii)	$1.26*10^{-11}$ mol of P
		Q2b	Catabolism: 3.72 moles
			Anabolism: 2.095 (or 2.10) moles
		Q4a	$6*10^{5}$ CFU / ml

EN3001	Solid & Hazardous Waste Management	Q3a	0.351 m^3/kg
		Q3b	Orignal vol = 4.55 m^3
			Residue vol = 0.40 m^3
		Q3c(i)	11148 KJ/kg
		Q3c(ii)	10539.07 KJ/kg
		Q4a	$C_6H_{12}O$ = 0.31 mg/L, C_6H_6 = 0.62 mg/L
		Q4b	$C_6H_{12}O$ LC50 = 100 mg/L, C_6H_6 LC50 = 5 mg/L
		Q4c	$(TLV\text{-}TWA)_{mix}$ = 1.246

EN3002	Wastewater Engineering	Q1b(i)	3.5 mg/L
		Q1c(i)	31.5 kg/L lime
		Q1c(ii)	117.2 kg/day
		Q2b(ii)	0.24 mg/L
		Q2c	1.5 m^2
		Q2d	$3.25x10^{-4}$ mg/L
		Q2e	Method 1: Removal efficiency = $\frac{C_{in}-C_{eff}}{C_{in}}$ Method 2: Flow-weighted removal efficiency = $\frac{Q_{in}C_{in}-Q_{eff}C_{eff}}{Q_{in}C_{in}} = \frac{C_{in}-(Q_{eff}/Q_{in})C_{eff}}{C_{in}}$
		Q3a(i)	0.56 mg/L COD
		Q3a(ii)	0.197 d
		Q3a(iii)	82.1 kgVSS / d
		Q3a(iv)	117 kg/d
		Q3b(i)	2.0 d
		Q3b(ii)	240 g/d
		Q3b(iii)	359 mg/L
		Q3b(iv)	0.363 gVSS/g COD removed
		Q4b	A = 409.7 m^2, HRT = 7.13 m^3/m^2.d
		Q4c	790 m^3

Answers to the Exam's Questions for AY1920 Semester 1

EN3003	**Environmental Transport Processes**	**Q1a**	3.125×10^{10} s
		Qb(i)	797.9 mg/m^3
		Qb(ii)	0.007979 kg/s
		Qb(iii)	7.2 m/h
		Qb(iv)	10166.4 m
		Q2a(i)	82.8 µg/L
		Q2a(ii)	72.5%
		Q2a(iii)	Fraction of P (in summer): 86.4%
			Fraction of P (in winter): 81.2%
		Q2a(iv)	$C_{106}H_{263}O_{110}N_{16}P + 138O_2$
		Q2b(i)	BOD = 350 mg/L, non-biodegradable COD = 150 mg/L
		Q2b(ii)	278.8 mg/L
		Q2b(iii)	301.4 mg/L
		Q3a	Avg k = 0.20 min^{-1}
		Q3b	3
		Q4b	F_W = 0.277
			F_{S1} = 0.693
			F_{SS} = 0.028
			F_{GAS} = 0.001
		Q4c	C_w = 139 mg/L
			C_{gas} = 6.95 mg/L
		Q5b(ii)	Re = 11.45, Sc = 1092 and Sh = 84.3

EN4105	**Integrated Environmental Management**	**Q4a(i)**	I = 0.205 mg/kg-d
			Carcinogenic Risk = 6.2×10^{-4}
		Q4b(i)	350 m^3, 572 ton
		Q4b(ii)	$122,860
		Q6a	Ni = 0.069%
			Pb = 0.164%
			Cu = 0.126%

Answers to the Exam's Questions for AY1920 Semester 1

Code	Course Title	Question	Answer
MT1001	Mathematics I for MS	Q1a(i)	(4, 350.67)
		Q1a(ii)	64
		Q1b(i)	q = 7, p = 10/e
		Qb(ii)	$\frac{7}{q}$
		Q1c(i)	$132.50
		Q1c(ii)	$64,516
		Q2a	R' = $3,362.39
		Q3a	$\ln\frac{x}{(\sqrt{x}+1)^2}+C$
		Q3b(i)	1/12
		Q3b(ii)	- 1/144
		Q3c(i)	$\int_0^1 2\left[x-x^2e^{x(x-1)}\right]dx$
		Q3c(ii)	0.4241
		Q4a	$\left(2u-\sqrt{v}\right)\left(4x-\frac{x}{y^2\sqrt{v}}\right)$
		Q4b	24,622.87 dollars
		Q4c	V = 1.0258
MT2003	Maritime Technology	Q4c	33%
		Q4d	21%
MT4001	Shipping Logistics	Q6a(i)	$3,113.53
		Q6a(ii)	$0.06506
MT4101	Intermodal Transportation	Q3b(i)	22.43 TEUs/hour
		Q3b(ii)	700 TEUs
		Q3b(iii)	69 trucks