Bangladesh Army University of Science and Technology

Department of Civil Engineering

Final (Online Live) Examination, Summer 2020 **Level-I Term-I**
Course Code: CE 1103 **Course Title: Surveying**
Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) Explain the following terms: 10
   i. Surveying
   ii. Field book

   b) An old map was plotted to a scale of 50 m to 1 cm. Over the years, this map has been shrinking, and a line originally 20 cm long is only 19.20 cm long at present. Again the 20 m chain was 5 cm too long. If the true area of the map measured by planimeter is 125.50 cm^2, find the true area of the land surveyed. 25

2. a) With neat sketches, explain the following terms: 10
   i. Whole circle bearing
   ii. Reduced bearing

   b) The following forward and backward bearings were observed in a close traverse ABCDEA. 25

Line	Length (ft)	Forward Bearing	Backward Bearing
AB	100	$60^0\ 30'$	$240^0\ 55'$
BC	142	$120^0\ 25'$	$300^0\ 50'$
CD	112	$204^0\ 45'$	$25^0\ 10'$
DA	115	$299^0\ 50'$	$120^0\ 15'$

   Calculate the interior angles ($\angle A$, $\angle B$, $\angle C$, $\angle D$)

3. a) Explain the term 'levelling'. Mention the types of levelling operations. 10

   b) The following consecutive readings were taken with a dumpy level along a chain line at a common interval of 20m. The first reading was at a chainage of 65m where the RL is 100.500m. The instrument was shifted after fourth reading: 25

   3.150, 2.245, 1.125, 0.860, 3.125, 2.760 m

   Find the RLs of all the points by either of the following two methods:

   a. Line of Collimation Method
      or,
   b. Rise-and-Fall Method

4. a) The magnetic bearing of a line AB was N28°30'E in the year 1910. The declination at the time in the place was 7°15' East. Find the true bearing for this line. 10

   In the year 2010 the declination at the place was 3°30' East. Determine the magnetic bearing in 2010.

   b) Explain the term 'contouring'. State the characteristics of contour lines with neat sketches. 25

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PART B

5. a) Explain degree of curvature with neat sketch. 05

b) Based on the following information, calculate necessary data for setting out the transition and circular curve in the field. Deflection angle,Δ= 45°, Design speed, V = 70 km/h, Maximum rate of super-elevation, e_{max} = 0.12, Max. rate of change of radial acceleration = 0.2 m/sec3, chainage of PI = 720 m 30

Tabulate the data for one transition curve using deflection angle method. Use maximum peg interval = 20m.

6. a) Explain the function of parabolic arc in vertical curve. 05

b) A parabolic vertical curve is to be set out connecting two uniform grades of +3.0% and -4.5%. Chainage and reduced level of the point of vertical curve (PVC) are 1250 meters and 32.5 meters respectively. The rate of vertical curvature (k) is 20. Calculate the chainage and reduced levels of peg station no. 6, PVI, PVT and midpoint of the curve. Assume peg station at 5m interval. 30

7 a) Mention the basic assumptions in computing the volume using cross-sections. 20

b) A road embankment is proposed for construction in an area. The following information are obtained from preliminary survey: 15

G.L. (w.r.to some known datum) of centerline of cross section at chainage 0, 100, 200, 300 ft is 18, 13, 12, 13 ft respectively. F.L. (w.r.to some known datum) of road top is 15 ft.

If proposed width of the road top is 30 ft and Side Slope=2H:1V, determine volume of earthwork for road embankment. Assume ground is level across embankment width and consider "level section" for cross sectional area calculation.

8. a) Explain the following terms of Astronomical Surveying (i) Celestial Sphere, (ii) Latitude, (iii) Longitude (iv) Azimuth and (v) Altitude 15

b) A & B are two points on earth surface at different locations. Determine the shortest distance between A (Φ=140°E, θ=20.5°S) and B (Φ=70°E, θ=20.5°S). 20

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Final (Online Live) Examination, Summer 2020 **Level-I Term-I**
Course Code: PHY 1109 **Course Title: Physics I**
Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) What are the characteristics of simple harmonic motion? Show that for a particle executing simple harmonic motion, its maximum velocity is ωA. 17

   b) Calculate the average kinetic energy for a particle executing simple harmonic motion. 18

2. a) Write short notes on: i) damped vibration, ii) forced vibration, iii) resonance. 18

   b) Two simple harmonic motions acting simultaneously on a particle are given by the equations: 17

   $$y_1 = 2\sin(\omega t + {}^{\pi}/_{6})$$

   $$y_2 = 3\sin(\omega t + {}^{\pi}/_{3}).$$

   Find the equation of the resultant vibration.

3. a) Define wave motion. What are mechanical wave and electromagnetic wave? Write down the characteristics of wave motion. 20

   b) The equation of a plane progressive wave is given by $y = 0.1\,sin\,2\pi\,(340t - 0.15x)$. Calculate: i) amplitude, ii) wave velocity, iii) wavelength, iv) frequency and v) time period. 15

4. a) What are critical constants of a gas? 07

   b) Calculate the critical constants of a gas in terms of the constants of the Van der Waal's equation. 28

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Final (Online Live) Examination, Summer 2020 **Level-I Term-I**
Course Code: PHY 1109 **Course Title: Physics I**
Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART B

5. a) What is efficiency of an engine? Derive an expression for the efficiency of a Carnot engine in terms of the temperatures of the source and the sink. 20

   b) Find the efficiency of a Carnot engine working between the steam point and the ice point. 15

6. a) Write short notes on: i) moment of inertia, ii) Hooke's law. 12

   b) Calculate the maximum possible value of Poisson's ratio. 23

7. a) Define steam line motion and turbulent motion. 10

   b) State and prove Bernoulli's theorem. 25

8. a) Find out a relationship between surface tension and surface energy. 20

   b) Calculate the amount of energy needed to break a drop of water of diameter 2×10^{-3} m into 10^9 droplets of equal size. Surface tension of water, 72×10^{-3}N/m. 15

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Final (Online Live) Examination, Summer 2020 **Level-1 Term-I**

Course Code: MATH 1109 **Course Title: Math I (Differential Calculus, Integral Calculus and Coordinate Geometry)**

Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) Find the domain and range of the function $f(x) = (x + 1)/(x - 1)$. 15

b) Show that thefollowing function 20

$$f(x) = \begin{cases} 1 & when\ x < 0 \\ 1 + \sin x & when\ 0 \le x < \frac{\pi}{2} \\ 2 + (x - \frac{\pi}{2})^2 & when\ x \ge \frac{\pi}{2} \end{cases}$$

is differentiable at $x = \frac{\pi}{2}$.

2. a) Differentiate the function $f(x) = x^n$ by method of first principle. 20

b) State L'Hospital's rule. Show by L'Hospital's rule that $\lim_{x\to 0} \frac{1-\cos x}{x^2} = \frac{1}{2}$. 15

3. a) If $z = \ln\left(\frac{x^3+y^3}{x^2+y^2}\right)$, then show by Euler's Theorem that $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y} = 1$. 35

4. a) Verify Mean-Value Theorem for the function $f(x) = x^3 - x^2 + x$ on the interval $[1,2]$. 15

b) Find equation of tangent and normal to the Folium of Descartes $x^3 + y^3 = 3xy$ at $\left(\frac{3}{2}, \frac{3}{2}\right)$. 20

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Final (Online Live) Examination, Summer 2020 **Level-1** **Term-I**

Course Code: MATH 1109 **Course Title: Math I (Differential Calculus, Integral Calculus and Coordinate Geometry)**

Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART B

5. a) Derive the reduction formula for $\int \sin^n x\, dx$. 35

6. a) Prove that $B(m,n) = \frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. 35

7. a) Find area of the region that is bounded by the curves $y = 4x - 2x^2$ and $y = x^2 - 2x$. 20

   b) Derive the formula for the volume of a sphere of radius r. 15

8. a) Determine which conics is represented by the following general equation of second degree 35

$$x^2 + 4xy + y^2 + 2x + 4y + 2 = 0$$

and by transformation of coordinates convert this equation into standard form of the conics.

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Final (Online Live) Examination, Summer 2020 **Level-1 Term-I**
Course Code: CHEM 1109 **Course Title: Chemistry**
Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART A

1. a) Describe Rutherford atom model with its limitations. 15

   b) He^+ contains only one electron and is therefore a hydrogen like ion, calculate the wavelength in increasing order of the first two transition in Balmer series of He^+ ion. Compare these wavelengths with the same transitions in H atom. Comments on the differences. (The Rydberg constant for He^+ is 8.72×10^{-18} J and that for H is 2.18×10^{-18} J) 20

2. a) Define periodic table? Find out the position of the following elements in the periodic table using electronic configuration- (i) Potasium (ii) Chromium (iii) Chlorine 20

   b) Explain surface pretreatment briefly. 15

3. a) Write down the reactions with chemical equations involved in the manufacture of cement. 20

   b) Explain briefly the stages of setting of cement. 15

4. a) What is thermoplastic and thermosetting plastic? Write down their advantages and disadvantages. 20

   b) Write down the characteristics of a good paint. 15

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Final (Online Live) Examination, Summer 2020 **Level-1** **Term-I**
Course Code: CHEM 1109 **Course Title: Chemistry**
Time: 01 (One) hour **Full Marks: 105**

N.B. (i) Answer any three questions from this PART (ii) Marks allotted are indicated in the margin
(iii) Symbols and abbreviations bear their standard meaning

PART B

5. a) Explain Chemical equilibrium graphically. 15

   b) Using the equation of Kp prove that, amount of product increase with increasing the pressure for the following reversible reaction: 20

$$N_2(g) + H_2(g) \rightleftharpoons NH_3(g)$$

6. a) Deduce the integrated rate equation of a second order reaction. 18

   b) Using the rate equation of first order reaction, prove that half-life of a first order reaction does not depend on the initial concentration of reactant. 17

7. a) What do you mean by vapour pressure and enthalpy of vaporization. 15

   b) Explain the term degradation of polymer. Describe three processes of degradation of polymers. 20

8. a) Describe Clausius-Clapeyron equation. 17

   b) Write short notes on- (i) Capillary action (ii) Viscosity (iii) Surface tension 18

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Final (Online Live) Examination, Summer 2020 **Level-I Term-I**
Course No: HUM 1109 **Course Title: Professional English**
Time: 01 (One) hour **Full Marks: 70**

N.B. (i) Answer all the questions from each PART (ii) Marks allotted are indicated in the margin

PART A

1. Read the text and fill in the gaps with the correct form of verbs as per subject and context. 10

   Today, we (a) —— (be) a free nation. We (b) —— (have) to take great pains to achieve freedom. Our war of liberation (c) —— (take) place in 1971. People of all walks of life (d) —— (come) forward and got (e) —— (involve) in the war directly or indirectly.

2. Write appropriate 'Wh' questions for the following answers (any five): 15

   a) He is senior to me by two years.
   b) I come from Rajshahi.
   c) He read the book three times.
   d) He is my son.
   e) The cow lives on grass.
   f) They got married confidentially.
   g) Muslims pray five times a day.

3. Transform the following sentences (any five): 15

   a) I am sure of his passing the exam. (into complex)
   b) Who will take the class? (into passive)
   c) I have known him since he was a child. (into compound)
   d) Where he goes is known to me. (into active)
   e) Since it's raining, we should not go out. (into compound)
   f) There is no mother but loves her children. (into simple)
   g) We should work hard for being successful in life (into complex).

4. Change the following words as directed and make sentences with the changed forms (any five): 15

   a) beauty (into verb), b) successful (into adverb), c) poor (into noun),
   d) tolerate (into adjective) e) high (into noun), f) light (into adverb),
   g) terror (into adjective).

5. Write a paragraph (anyone): 15

   a) English for professional purposes
   b) Hostel life and home life

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Final (Online Live) Examination, Summer 2020 **Level-1 Term-I**
Course No: HUM 1109 **Course Title: Professional English**
Time: 01 (One) hour **Full Marks: 70**

N.B. (i) Answer all the questions from each PART (ii) Marks allotted are indicated in the margin

PART B

6. Summarize the following text in your own words. 15

Dhaka's infrastructure doesn't match the scale of its population. Just 7 percent of the city is covered by roads, compared with around 25 percent of Paris and Vienna. Dhaka also suffers from the absence of a planned road network. There are 650 major intersections, but only 60 traffic lights, many of which don't work. That means the police force isn't enforcing driving or parking rules; they're in the intersections, directing traffic. The cost of Dhaka's traffic congestion is estimated at $3.8 billion a year, and that's just the delays and air pollution, not the less-tangible losses in quality of life. Paradoxically, the poor infrastructure is one of the reasons why the city is growing so fast. Without roads or trains to whisk them to the suburbs, Dhaka residents have no choice but to crowd into the middle, set up slums between high-rises, and walk to work.

Then there are the users of the roads. Besides pedestrians, the narrow lanes are shared by bicycles, rickshaws, scooters, motorcycles, CNGs, buses, and cars. All these modes take up a different amount of space and have different top speeds. Most people you talk to in Bangladesh blame the traffic jams on the rickshaws. There are too many of them, they say, and they drive so slowly that they trap the cars, buses, and CNGs behind them. The government is under pressure to designate some lanes as car-only, to build wider roads and overpasses, to take the slow traffic out from in front of the fast.

7. Write 10-12 sentences on the importance of learning English in studying engineering. 20

8. Write an essay on "The causes of road accidents in Bangladesh". (100-150 Words) 35