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University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2018
Program: B.Sc in Civil Engineering
1st Year 2nd Semester

Course Title: English Language II
Time: 3.00 Hours

Course Code: HSS 103

Credit: 3.00
Full Marks: 50

Instructions:

- *Marks are indicated in the right margin.
- *Answer all the questions

Read the following passage and answer questions 1 & 2.

The Dragon Boat Festival commemorates the death over 2,000 years ago of a Chinese hero, Chow Yen. Chow Yen jumped into a river and drowned himself in protest against a corrupt government. The people saw the incident and they felt very sorry for him. They collected a fleet of boats and beat drums, making a lot of noise. They also raced the boats in the river trying to scare away the fish which were trying to eat Chow Yen's body. Other people made dumplings of rice, meat, beans, and they threw these dumplings into the river to feed the fish and other creatures in the river.

Nowadays people still make dumplings, but they do not throw the dumplings into the river any more. They eat the dumplings, which are very delicious. Dragon Boat Races are still held in China, in Hong Kong and many parts of the world where there is a sizeable Chinese community. The dragon boats are quite narrow and long. They have the head of a dragon in the front and the tail of a dragon at the back. There are about 22 people on each boat. There is a big drum in every boat. While the people are racing, one person will beat the drum and the people will row together to the rhythm of the drum.

1. Write whether the following sentences are true or false. 0.25 × 4 = 1

- a. The Chinese government during the time of Chow Yen was corrupt.
- b. People continue to throw dumplings into the river nowadays.
- c. The boats used for the Dragon Boat Festival are very tall and wide.
- d. During the Dragon Boat Festival, a group of people beat the drum and another group row together to the rhythm of the drum.

2. Answer the following questions in your own words. 4 × 1 = 4

- a. Why did Chow Yen drown himself?
- b. Why did people make a lot of noise?
- c. Why did they throw dumplings into the river?
- d. How many people can ride on a dragon boat?

3. Choose the correct modal from the box to complete each sentence.

1×6=6

must	ought to	might	need to	can	shouldn't
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- a. It's very cold today. Do you think it _____ snow later?
- b. You _____ leave your door unlocked when you go out.
- c. They _____ have filled the car with petrol before they set off.
- d. Mum says we _____ watch TV after we've finished our homework.
- e. This is impossible, it _____ be a mistake!
- f. Entrance to the museum was free. We didn't _____ pay to get in.

4. Join each pair of the following sentences.

1×6=6

- a. Who is that boy? He is playing in the field.
- b. The passenger alighted from the train. He called a taxi.
- c. He did not win. He worked hard.
- d. I dislike him. He is very insincere.
- e. The manager appointed Nahid. He will do the accounts.
- f. Nayla collects old stamps. It is her hobby.

5. Write a report on "Civil Fest" held at UAP Plaza on 22 January, 2019. (120-150 words) 7

6. Write a review of a movie that you have watched/enjoyed recently. (180 -200words) 7

7. Complete the following story adding a suitable title. (150-200 words) 7

It was almost 10.30 in the morning and I was still sleeping. I did not have any intention to go to the university as the previous night we had returned from our departmental picnic quite late. Suddenly I got a call from my best friend that our advisor wanted to meet me urgently.....

8. Write an essay on any one of the following topics (word limit 200-250)

12

- a. Natural Disasters: Causes and Effects
- b. City Life and Village Life

University of Asia Pacific
Department of Civil Engineering
Final Examination, Fall 2018
Program: B.Sc. Engineering (Civil)

Course Title: Chemistry

Course Code: CHEM 111

Time: 3 Hours

Full Marks: 150

Write your answers neatly and cleanly. Good Luck!

Section: A

There are **FOUR** questions in this section. Answer any **THREE**.

1. (a) What is meant by the term enthalpy? Why is enthalpy considered as a state function? [10]
(b) State and explain the Hess's Law of constant heat summation. [10]
(c) How much heat is evolved when 9.07×10^5 g of ammonia is produced according to the following equation? (Assume that the reaction occurs at constant pressure) [5]
$$\text{N}_2 + 3\text{H}_2 \rightleftharpoons 2\text{NH}_3; \Delta H = -91.8 \text{ kJ}$$
2. (a) How is a true solution differed from a colloidal solution? [5]
(b) Describe the molecular view of solution processes. [15]
(c) Glucose, $\text{C}_6\text{H}_{12}\text{O}_6$, is a sugar that occurs in fruits. It is also known as "blood sugar" because it is found in blood and is the body's main source of energy. What is the molality of a solution containing 5.67 g of glucose dissolved in 25.2 g of water? [5]
3. (a) What are the colligative properties? Why are they so called? [10]
(b) How is diffusion process differed from osmosis? State the law of osmotic pressure. [10]
(c) Arginine vasopressin is a pituitary hormone. It helps to regulate the amount of water in the blood by reducing the flow of urine from the kidneys. An aqueous solution containing 21.6 mg of vasopressin in 100.0 mL of solution has an osmotic pressure at 25°C of 3.70 mmHg. What is the molecular mass of the hormone? [5]
4. (a) How does the Pauli Exclusion Principle limit the possible electron configurations of an atom? [5]
(b) Describe the Stern-Gerlach experiment to explain the spin properties of electrons. [15]
(c) The ions Na^+ and Mg^{2+} occur in chemical compounds, but the ions Na^{2+} and Mg^{3+} do not. Explain. [5]

Section: B

There are **FOUR** questions in this section. Answer any **THREE**.

5. (a) A chemical equilibrium is dynamic in nature not static. Explain. [10]
(b) Illustrate the Law of Mass Action from kinetic considerations and apply it to the equilibrium, $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$ [10]
(c) How is the above equilibrium affected by temperature and pressure changes? [5]
6. (a) Dilithium, Li_2 , is considered as the lightest stable neutral homonuclear diatomic molecule after H_2 . [5+5+5=15]
(i) Describe the molecular orbital structure of this molecule. Give the molecular orbital diagram and electron configuration of Li_2 .
(ii) What is the bond order for Li_2 ?
(ii) Is the Li_2 a diamagnetic or paramagnetic substance?
(b) Define the term bond energy. What is the relationship between bond order and bond energy? [10]
7. (a) Name the properties of water that allow it to creep up or flow in tubes. Explain each of those properties. [12]
(b) Describe the bonding in H_2O according to the valence bond theory. Assume that the molecular geometry is the same as given by the VSEPR model. [8]
(c) Calculate the concentration of hydronium ion at 25°C in 0.010 M Ca(OH)_2 solution. ($K_w = 1.0 \times 10^{-14}$) [5]
8. (a) What is environmental degradation? How is the discharge of untreated waste water from different industries around Dhaka city contributing to the heavy and toxic metals pollution in nearby water body, soil, and plants? [15]
(b) How is ozone layer depletion occurred? What are the impacts of ozone layer depletion on global environment? [10]

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Fall-2018
Program: B. Sc. in Civil Engineering

Course Title: Mathematics-II
Time: 3.00 hour

Course Code: MTH 103
Full Marks: 150

There are **Eight** questions. Answer any **Six**. All questions are of equal value. Figures in the right margin indicate marks.

1. (a) Find the co-ordinate of the point and the ratio in which the yz - plane divides the line joining points $A(-2, 4, 7)$ and $B(3, -5, 8)$. Also find direction cosines of OA, OB and AB, where O is the point $(4, -3, 1)$. 15
- (b) Find the two tangent planes to the sphere $x^2 + y^2 + z^2 - 4x + 2y - 6z + 5 = 0$ which are parallel to the plane $2x + 2y = z$. 10
2. (a) Find the equation of the plane through the points $(2, 1, -3)$, $(3, -1, 4)$, $(7, 5, 6)$ and also find the perpendicular distance from the point $(4, 2, -3)$ to this plane. 13
- (b) Find the equation of a plane which passes through the intersection of $7x - 4y + 7z + 16 = 0$ and $4x + 3y - 2z + 3 = 0$ and is parallel to $3x - 7y + 9z + 5 = 0$. 12
3. (a) Show that the equation $3x^2 + y^2 + 2z^2 + 3x + 3y - 4z = 0$ represents ellipsoid and also find the centre and length of the semi axes. 13
- (b) Find the distance of the point $(-1, -5, -10)$ from the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ and the plane $x - y + z = 5$. 12
4. (a) A particle moves along a curve whose parametric equations are $x = e^{-5t}$, $y = 5\cos 6t$, $z = 3\sin 4t$, where t is the time. 10
 - (i) Determine its velocity and acceleration at any time.
 - (ii) Find the magnitudes of the velocity and acceleration at $t = 0$.
- (b) Find the area of the triangle whose vertices are $A(3, -1, 3)$, $B(1, -1, -3)$, $C(4, -3, 1)$ 8
- (c) Find the unit vector perpendicular to each of the vectors $\vec{A} = 4\hat{i} - \hat{j} + 3\hat{k}$ and $\vec{B} = -2\hat{i} + \hat{j} - 2\hat{k}$ and also find the projection of \vec{A} on another vector \vec{B} . 7

5. (a) Find $\vec{\nabla}\varphi$ if 10
- (i) $\varphi = \ln |\vec{r}|$
- (ii) $\varphi = \frac{1}{|\vec{r}|}$
- (b) Show that $\vec{r} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$ is irrotational and not solenoidal. 8
- (c) The acceleration of a particle at any time $t \geq 0$ is given by 7
 $\vec{a} = 12\cos(2t)\hat{i} - 8\sin(2t)\hat{j} + 16t\hat{k}$. If the velocity is zero at $t = 0$ then find \vec{v} at $t = 0.5$.
6. (a) If $\vec{A} = (3x^2 + 6y)\hat{i} - 14yz\hat{j} + 20xz^2\hat{k}$, evaluate $\int_C \vec{A} \cdot d\vec{r}$ from $(0, 0, 0)$ to $(1, 1, 1)$ along the following path C : 18
- (i) $x = t, y = t^2, z = t^3$
- (ii) The straight lines from $(0, 0, 0)$ to $(1, 0, 0)$, then to $(1, 1, 0)$ and then to $(1, 1, 1)$
- (iii) The straight line joining $(0, 0, 0)$ and $(1, 1, 1)$
- (b) Find the directional derivative of $\varphi(x, y, z) = 4xy - 3x^2z^2$ at $(2, -1, 2)$ in the direction $2\hat{i} - 3\hat{j} + 6\hat{k}$. 7
7. (a) Let $\vec{F}(x, y) = 2xy^3\hat{i} + (1 + 3x^2y^2)\hat{j}$ 15
- (i) Show that \vec{F} is a conservative vector field on the entire xy -plane.
- (ii) Find φ by first integrating $\frac{\partial\varphi}{\partial x}$.
- (iii) Find φ by first integrating $\frac{\partial\varphi}{\partial y}$.
- (b) If $\vec{A} = 3xy\hat{i} - y^2\hat{j}$, evaluate $\int_C \vec{A} \cdot d\vec{r}$, where C is the curve in the xy -plane, $y = 2x^2$, from $(-1, 3)$ to $(2, 2)$. 10
8. (a) State Green's theorem. By using Green's theorem evaluate the line integral 15
 $\int_C (xy + y^2)dx + x^2dy$ along the closed path C bounded by the curves $y = x$ and $y = x^2$ oriented in counter-clockwise direction.
- (b) State Divergence theorem. Use the Divergence theorem to find the outward flux of the vector field $\vec{F}(x, y, z) = 2x\hat{i} + 3y\hat{j} + z^2\hat{k}$ across the unit cube. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Mechanics II
 Time: 3.0 hours

Course Code: CE 103
 Full Marks:100 (10×10)

SECTION A

1. Answer any two questions:

(2*10)

a) The stone blocks A and B, shown in Figure 1 weighs 150 lb and 500 lb respectively. Determine the smallest P that must be applied to block B in order to move it. The coefficient of static friction between the blocks is 0.3, between all the blocks and surfaces is 0.5.

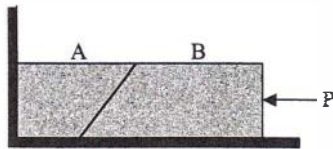


Figure 1

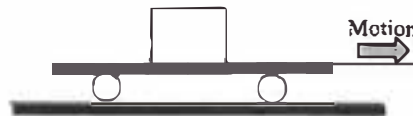


Figure 2

b) A block weighing 50 N is resting on a cart as shown in Figure 2. If the cart speeds up to 10m/s in a constant acceleration from rest within 3 seconds, determine whether the block will slide or not. [Given: Coefficient of static and kinetic friction between the block and cart is 0.35 and 0.30 respectively.]

c) If coefficient of static friction between a heavy chain and inclined surface as shown in Figure 3 is 0.35, calculate the length x of the chain so that the chain is on the verge of slipping up the plain. Given: Unit weight of chain is 2.5 lb/ft and total length of the chain is 15 ft.

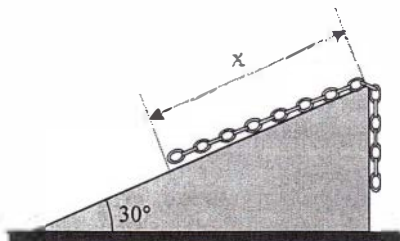


Figure 3

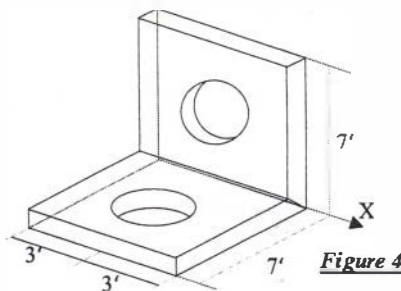


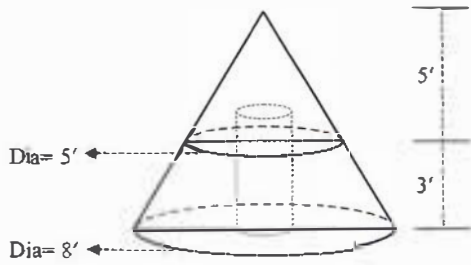
Figure 4

2. Answer any one question:

(10)

a) Calculate mass moment of inertia of the homogenous composite body shown in Figure 4 with respect to the X axis. Unit weight = 50 lb/ft³, uniform thickness of rectangular plates = 0.25 ft, diameter of circular holes = 2 ft, centroids of circle coincide with rectangle.

b) Calculate mass moment of inertia of the heterogeneous composite body shown in **Figure 5** with respect to its geometric axis.



Unit weight of cone=	100 pcf
Unit weight of frustum=	150 pcf
Height of cylinder=	5 ft
Diameter of cylinder=	2 ft

Figure 5

3. The system shown in **Figure 6** is used to support the flowerpot (weighing 75 lb) at A. Calculate tension in the wires AC and AD. (10)

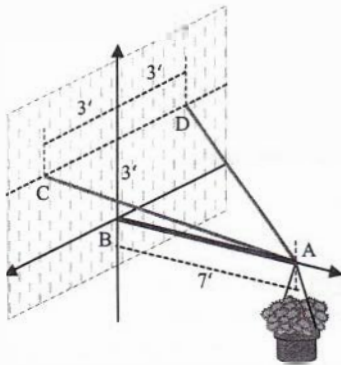


Figure 6

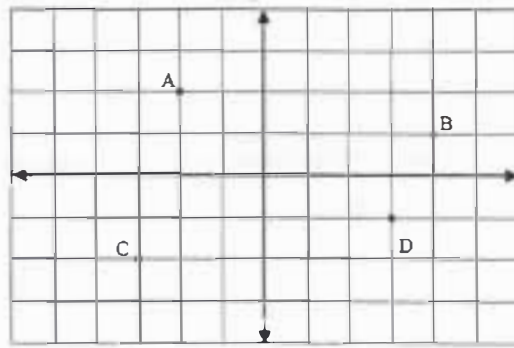


Figure 7

4. Calculate the magnitude and location of the resultant of the noncoplanar parallel force system shown in **Figure 7**. If forces at A, B, C and D are 100 kip, -350 kip, -200 kip and 500kip respectively. (10)
Given: 1 small square on grid = 10 ft x 10 ft.

SECTION B

There are SEVEN Questions in this section. Answer any FIVE Questions

5. In a steel chute shown in **Figure 8**, packages are expected to slide from a height of 10 ft with an initial velocity of 3 fps. It is expected that they will come to rest after moving 4 ft horizontally. Determine the constant slope of the incline (α). Consider weight of each package is 10 lb. (10)

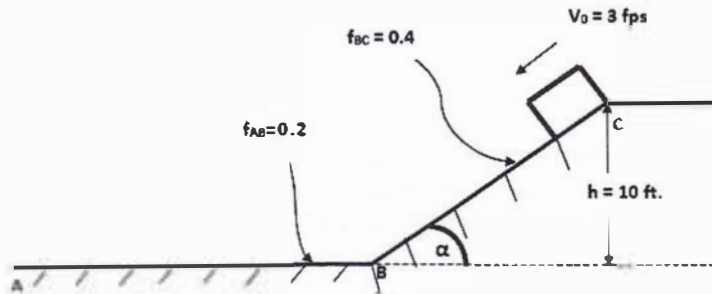


Figure 8

6. A solid cylinder of 15" diameter rolls down a 60° inclined plane without slipping. The initial velocity of the center of gravity of the cylinder is 10 fps. Determine the time it will take before reaching a speed of 60 fps. Also, determine the force of friction between surface and cylinder. Given: Weight of cylinder=1000 lb. (5+5)

7. A kid is jumping on a spring mattress as shown in the *Figure 9*. At an instance of jumping, one spring of the mattress gets compressed by 9 inch. If the kid weighs 40 lb. and spring constant is 48 lb per inch. Determine the following: (6+4)
- The speed of the kid at the instant the spring reaches its free length.
 - How far up the kid would go?

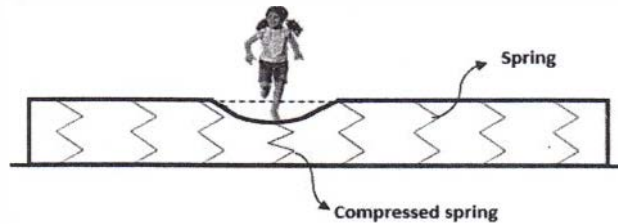


Figure 9

8. A firefighter decides to throw water jet to extinguish the fire caught at a height of 30' of a building (*Figure 10*). The velocity of water jet from the nozzle is 60 fps. If he decides to throw water at an angle of 45° , calculate the distance from the building that the firefighter needs to stand to throw water? Also, determine the time that will pass before water jet reaches the fire location? (6+4)

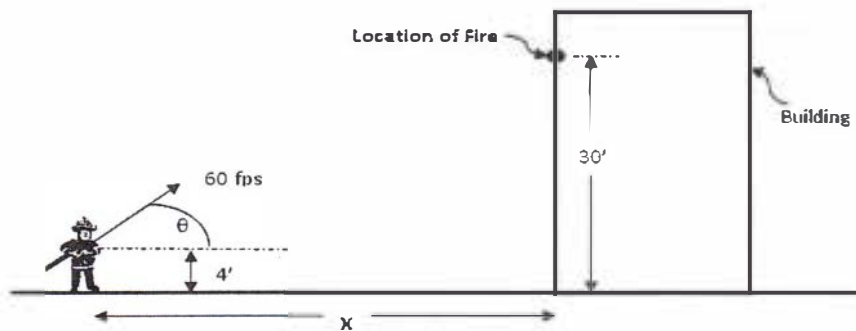


Figure 10

9. A 400 lb body moves with rectilinear motion on a horizontal plane as shown in *Figure 11*. It is driven by an inclined force F . The magnitude of F varies with time as shown in the graph. If the body is at rest initially, calculate the speed after 4 seconds using principles of impulse-momentum. [Given, $f = 0.3$] (10)

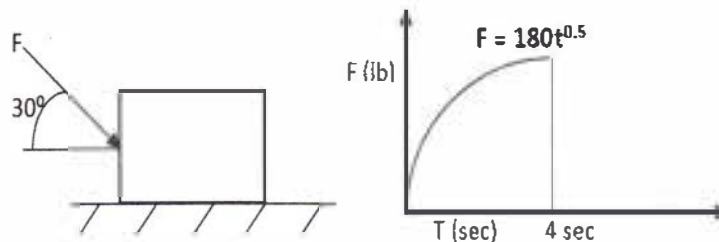


Figure 11

10. Two *smooth* spheres A and B with velocities $v_{A1} = 9$ fps and $v_{B1} = 12$ fps, collide with each other as shown in **Figure 12**. The spheres are of equal size but A weighs 5 lb and B weighs 2 lb. The coefficient of restitution is $e = 0.85$. (5+4+1)

Determine the following:

- Absolute velocities of these spheres after impact.
- Impulse during restitution period.
- Loss of kinetic energy during impact.

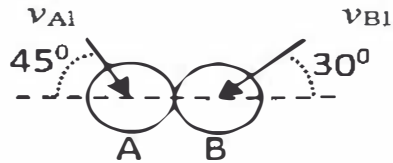


Figure 12

11. A water filled bucket is being pulled out from the well as shown in **Figure 13**. A constant torque M is applied at the shaft that rotates the flywheel and thus wraps up the rope. The bucket is initially at rest. It is found that the bucket reaches the top of well from water surface due to two full revolutions of the wheel. Also, the speed of the rotating part changes from 0 to 2 rads^{-1} . (2+2+6)

Given:

- Weight of water filled Bucket: 3 lb;
- Moment of Inertia of rotating parts: 200 slug-ft^2 ;
- Wheel diameter: 2.4 ft; Shaft diameter: 0.5 ft.
- Friction Force: 1 lb

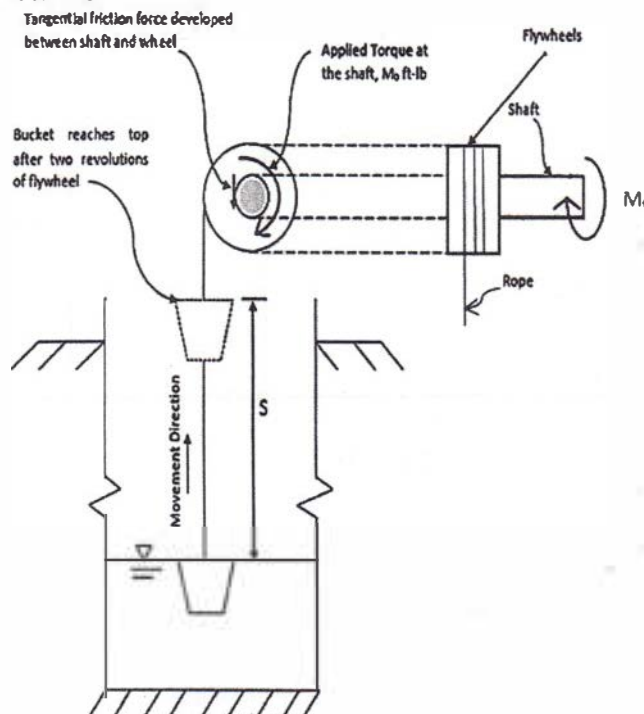


Figure 13

Determine the following:

- Depth of the well.
- Tension in the cable.
- The torque applied at the shaft using Work-Energy principle.

University of Asia Pacific
Department of Civil Engineering
Final Examination Fall 2018
Program: B.Sc. Engineering (Civil)

Course Title: Surveying
 Time: 3 Hours

Course Code: CE 105
 Full Marks: 100

Answer any FIVE questions
(Please assume reasonable values for any missing data)

1.
 - a) What is "Tacheometry"? What are the different types of telescopes used in tacheometric surveying? (2)
 - b) Two distances of 35 m and 145 m were accurately measured out and the intercepts on the staff between the outer stadia webs were 0.347 m at the former distance and 1.447 m at the later. Calculate the tacheometric constants. (5)
 - c) A 20 m chain was found to be 43 cm too long after chaining a distance of 1375 m. It was found to be 54 cm too long at the end of day's work after chaining a total distance of 2765 m. Find the true distance if the chain was correct before the starting of the work. (5)
 - d) A tacheometer was set up at station A. The staff was held vertically at point B and the instrument is fitted within an analectic lens. The staff readings at point B were 2.255, 2.605 and 2.955, the line of sight being at an inclination of $+8^{\circ}24'$. Another observation on the vertically held staff at B.M. gave the readings 1.640, 1.920 and 2.200, the inclination of the line of sight being $+1^{\circ}6'$. Calculate the horizontal distance between A and B, and the elevation of B if the R.L. of B.M. is 420 m. The constants of the instruments was 100. (8)

2.
 - a) The following staff readings were observed successively with level, the instrument having been moved forward after the second, fourth and eighth readings. The readings (in meters) are:
 0.875, 1.235, 2.310, 1.385, 2.930, 3.125, 4.125, 0.120, 1.875, 2.030, 3.765.
 The first reading was taken with the staff held upon a benchmark of elevation 132.135 m. Enter the readings in level book-form and determine the reduce levels (by rise and fall method). Apply the usual checks. (7)
 - b) What is "Plane Table Surveying"? Write down the advantages and disadvantages of plane table surveying. (6)
 - c) Define GIS and Remote Sensing. What are the components of GIS? What are the stages of an idealized remote sensing system? (7)

3.
 - a) The following table gives the values of the offsets in feet taken from a chain line to an irregular boundary: (10)

Distance	0	50	100	150	200	250	300	350	400
Offset	10.6	15.4	20.2	18.7	16.4	20.8	22.4	19.3	17.6

Calculate the area in square feet included between the chain line, the irregular boundary and the first and the last offset by - i) Simpson's Rule and ii) Trapezoidal Rule.

 - b) An excavation is to be made for a reservoir 25 m long and 15 m wide at the bottom, having the side of the excavation slope at 2 horizontal to 1 vertical. Calculate the volume of excavation if the depth is 5 meters. The ground surface is level before excavation. (5)

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Course Title: Surveying
 Time: 3 Hours

Course Code: CE 105
 Full Marks: 100

- c) The areas within the contour line at the site of reservoir and the face of the proposed dam are as follows: (5)

Contour (m)	Areas (m ²)	Contour (m)	Areas (m ²)
101	1,000	111	1 350,000
103	12,800	113	1 985,000
105	95,200	115	2 286,000
107	147,600	117	2 512,000
109	872,500		

Taking 101 as the bottom level of the reservoir and 117 as the top level, calculate the capacity of the reservoir.

4. a) What is "Surveying"? Explain the principles of surveying. (5)
 b) Differentiate between plain and geodetic surveying? What are the equipment needed for conducting a chain survey? (5)
 c) Find the magnetic declination at a place if the magnetic bearing of the sun at noon is i) 185° and ii) $355^{\circ} 25'$. (5)
 d) To continue a survey line AB past an obstacle, a line BC 227 m long was set out perpendicular to AB, and from C, angles BCD and BCE were set out at 60° and 45° respectively. Determine the lengths which must be chained off along CD and CE in order that ED may be in AB produced. Also determine the obstructed length BE. (5)
5. a) What is "Contouring"? Write down the characteristics of contour lines. (3)
 b) Draw a diagram showing all the parts of a simple circular curve. (5)
 c) What is a "Transition Curve"? Describe the necessity of transition curves. Describe equilibrium cant and cant deficiency. (6)
 d) Determine the offsets (by radial offset and approximate method) to be set out at 5-chain interval along the tangents to locate a 20-chain curve, the length of each chain being 20 m. (6)
6. a) The table below gives the lengths and bearings of the lines of a traverse ABCDE, the length and bearing of EA having been omitted. Calculate the length and bearing of the line EA. (10)

Line	Length (m)	Bearing
AB	204	$87^{\circ} 30'$
BC	226	$20^{\circ} 20'$
CD	187	$280^{\circ} 0'$
DE	192	$210^{\circ} 3'$
EA	--	--

- b) Draw contour lines for 96 m and 97 m in the following grid. Please attach the page with your answer script. (10)

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(This page should be attached with the answer script)

97.30	96.40	97.50	98.40
97.60	98.70	100.80	98.00
95.70	99.50	100.20	96.80
98.30	98.40	97.50	95.40