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University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2023
Program: B.Sc. in Civil Engineering

Course Title: English Composition and Communication

Course Code: HSS 103

Time: 3:00 Hours

Credit: 3.00

Full Marks: 50

1. Choose the correct option to fill in the blanks in the following sentences. 10x.5 = 5

- a. Everyone is coming to the meeting, _____ (accept/except) for Tom.
- b. The Sahara is a vast _____ (desert/dessert) with little vegetation.
- c. The _____ (principal/principle) reason for this decision is financial.
- d. I'd rather have tea _____ (than/then) coffee for breakfast.
- e. His clothes are always so _____ (lose/loose); they need to fit properly.
- f. She had to _____ (break/brake) suddenly to avoid a collision.
- g. The kids are excited because _____ (there/their/they're) getting a new puppy.
- h. She said _____ (its/it's) her favorite movie.
- i. The new tax law will _____ (affect/effect) many households.
- j. Be sure to _____ (cite/site/sight) your sources in your research paper.

2. The following is a paragraph containing 20 grammatical errors (8 capitalization-related errors, 12 punctuation-related errors). Rewrite the text correctly and underline your changes. 20x.25 = 5

a Lion lay asleep in the forest a timid little Mouse came upon him unexpectedly and ran across the lions nose roused from his nap the lion laid his huge paw angrily on the tiny creature to kill her Spare me begged the poor mouse please let me go and some day i will surely repay you

3. Fill in the blanks using the correct form of the words in brackets. 5x1 = 5

"You have nothing to (a) _____ (apology) for," Sarina said (b) _____ (cold). The way she (c) _____ (emphasis) on the word 'nothing' was troublesome, it was not (d) _____ (help) for my case at all. I tried to be as (e) _____ (nature) as possible while I tried to drum up my reply.

4. Transform the sentences as instructed. 10x1 = 10

- a. If we don't exit now, we will get trapped in the snowfall. (*Transform into a simple sentence*)
- b. Though we were not certain if we could complete it, we agreed to assist them. (*Transform into a compound sentence*)
- c. Not only did Lily work on her assessment but she also assisted me complete mine. (*Transform into a compound sentence*)

- d. As a result of our hard work and commitment, we were able to design a workable system for the maternity ward. *(Transform into a complex sentence)*
- e. Melanie was a health professional, and so her task was to take care of sick people. *(Change into a simple sentence)*
- f. I looked around for Donna but couldn't find her. *(Transform into a complex sentence)*
- g. My relatives and I went to the cinema last night as we were bored. *(Transform into a compound sentence)*
- h. Tina wanted to spend time with her friends, so she completed all her schoolwork promptly. *(Transform into a simple sentence)*
- i. As Bonnie arrived at her office, she realized she had forgotten her folders. *(Transform into a simple sentence)*
- j. Bidding farewell, Max shook Richard's hand for one last time. *(Transform into a compound sentence)*

5. Translate the following text into English. Pay special attention to the theme of the text rather than the words. **5x1 = 5**

বিবিসির খবরে বলা হয়েছে, আমেরিকার মোট জনসংখ্যার মাত্র ১ শতাংশ ভারতীয় হলেও সিলিকন ভ্যালিতে এই হার ৬ শতাংশ। এই ৬ শতাংশের মধ্য থেকেই আবার বড় বড় প্রযুক্তি জায়ান্টের শীর্ষ পদে ভারতীয়দের আধিপত্য। কিন্তু এখন প্রশ্ন হচ্ছে, কীভাবে বিশ্বের শীর্ষ মার্কিন প্রযুক্তি প্রতিষ্ঠানগুলোতে ভারতীয়রা অবস্থান করে নিচ্ছেন? তারা ব্যক্তিগত জীবনের তুলনায় পেশাদার জীবনকে অগ্রাধিকার দেন, আর আমেরিকান অফিসে অতিরিক্ত কাজের সংস্কৃতিতেও তাঁরা অভিযোজিত হয়ে যান। এসব বৈশিষ্ট্য বিশ্বনেতাদের কাতারে ভারতীয়দের জায়গা করে দেয়।

6. Write an event report on the 'Annual Civil Engineering Student Conference' held on 25 September, 2023. Share your perspective as a 1st year civil engineering student. Describe the objectives, key activities, and notable speakers of the event. Highlight how this experience relates to your studies and future career as well. **10x1 = 10**

7. Write an essay within 350-500 words **10x1 = 10**

The Role of Civil Engineers in Sustainable Development

Or,

Green Heaven or Concrete Jungle: Why We Should Implement Urban Parks in City Planning

GOOD LUCK!

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, spring-2023
Program: B. Sc. in CE (1st year/2nd semester)

Course Code: CHEM 111

Course Title: Chemistry

Credit: 3.0

Time: 3.00 Hours

Full Marks: 150

Instructions:

1. There are Six (6) Questions. Answer all of them. All questions are of equal value. Part marks are shown in the margins.

1. a. Discuss the effect of temperature and pressure on the solubility of gas in liquid. 10
 b. Hydrogen peroxide is a powerful oxidizing agent used in concentrated solution in rocket fuel and dilute solution in hair bleach. An aqueous solution of H₂O₂ is 30.0% by mass and has a density of 1.11 g/mL. Calculate the (a) molality, (b) mole fraction of H₂O₂, and (c) molarity. 15

OR

- a. Define sol, gel, emulsion, and micelle with examples. 10
 b. Discuss the origin of charge formation in colloids by peptization. Explain with suitable examples. 15
2. a. For the following first order reaction, derive the integrated rate expression. Show the mathematical expression of half-life. 10

$$2\text{N}_2\text{O}_5(\text{g}) \rightarrow 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$$

 b. Differentiate between order and molecularity. 7
 c. The conversion of cyclopropane to propene in the gas phase is a first-order reaction with a rate constant of $6.73 \times 10^{-4} \text{ s}^{-1}$ at 500°C. If the initial concentration of cyclopropane was 0.25 M, what is the concentration after 8.8 minutes? 8

OR

- a. State the quantitative relation between temperature and reaction rate. Show the relation graphically. 10
 b. Identify are the main points of collision theory. 7
 c. For a reaction, the energy of activation is zero. What is the value of the rate constant at 300 K if $k = 1.6 \times 10^6 \text{ s}^{-1}$ at 280 K. 8

3. a. Define reaction quotient. Explain that with the help of the reaction quotient, the direction of a reversible reaction can be predicted. 10
- b. Show the expression of equilibrium constants in terms of concentration and pressure. 5+10=15
Hydrogen (g) and iodine (g) react to form hydrogen iodide (g). Suppose you have 1 mol of hydrogen and 2 mol of I₂ placed in a vessel having a volume of 1 L. How many moles of substances are the gaseous mixture when at equilibrium? The equilibrium constant value is 49.7.
4. a. Identify the different methods for the prevention of corrosion in metal structure. 10
- b. From your concept of redox reaction, explain the mechanism of rust formation in iron. 15
5. a. Write down the name of gases that are involved in the formation of acid rain. Explain the mechanism of acid rain formation. Discuss the main harmful effects of acid rain. 10
- b. Define Sewage. Identify the harmful effects and treatment process of Sewage. 15
- 6 a. Show the hybridized structure of ethyne with an explanation. 10
- b Draw the geometry of the followings: 15
H₃O⁺, SO₄²⁻, SF₄, I₃⁻ and SO₂.

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination, Spring 2023
Program: B.Sc. in Civil Engineering

Course Title: Mathematics II
Time: 3 hours

Credit Hour: 3.00

Course Code: MTH 103
Full Marks: 150

There are **eight** questions. Answer **six including Q-1, Q-2, Q-3 and Q-4**. All questions are of equal value. Figures in the right margin indicate marks.

1. a) Define the followings: 15
Vector, Sense, Position vector, Unit vector, Null vector, Parallel vector, Equal vector, Opposite vector, Co-planer vector, Like vector.
- b) Find the volume of the parallelepiped whose edges are given by $\vec{A} = 2\hat{i} - 3\hat{j}$, 10
 $\vec{B} = \hat{i} + \hat{j} - \hat{k}$ and $\vec{C} = 3\hat{i} - \hat{k}$.
2. a) Define reciprocal set of vectors. Find a set of reciprocal vectors \vec{a}' , \vec{b}' and \vec{c}' to the 15
set $\vec{a} = 2\hat{i} + 3\hat{j} - \hat{k}$, $\vec{b} = \hat{i} - \hat{j} - 2\hat{k}$ and $\vec{c} = -\hat{i} + 2\hat{j} + 2\hat{k}$.
- b) Define box product. Prove that box product represents the volume of a parallelepiped. 10
3. a) Define gradient. Find the directional derivative of $\phi = 4e^{2x-y+z}$ at (1, 1, -1) in the 10
direction $-4\hat{i} + 4\hat{j} + 7\hat{k}$.
- b) Define divergence and curl. 15
Show that $\vec{A} = (6xy + z^3)\hat{i} + (3x^2 - z)\hat{j} + (3xz^2 - y)\hat{k}$ is irrotational. Find ϕ such that $\vec{A} = \nabla\phi$.
4. a) If the velocity and displacement of a moving particle are zero at $t = 0$, find velocity 10
and displacement. The acceleration of the particle at any time $t \geq 0$ is given by
 $\vec{a} = 12\cos 2t \hat{i} - 8\sin 2t \hat{j} + 16t\hat{k}$.
- b) If $\vec{A} = (3x^2 + 6y)\hat{i} - 14yz\hat{j} + 20xz^2\hat{k}$, evaluate $\oint_C \vec{A} \cdot d\vec{r}$ from (0, 0, 0) to (2, 2, 2) 15
along the following paths C:
 - i. $x = t$, $y = t^2$, $z = t^3$.
 - ii. the straight lines from (0, 0, 0) to (2, 0, 0) then to (2, 2, 0) then to (2, 2, 2).

5. Define line, surface and volume integral. Evaluate $\iint \vec{A} \cdot \hat{n} ds$, where $\vec{A} = 18z\hat{i} - 12\hat{j} + 3y\hat{k}$ and S is that part of the plane $2x + 3y + 6z = 12$ which is located in the first octant. 25

OR

6. State Green's theorem. Verify Green's theorem in the plane for $\oint (xy + y^2)dx + x^2dy$ where C is the closed curve of the region bounded by $y = x$ and $y = x^2$. 25

7. a) 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 $2x + y = 0$. 10

- b) Find the centre and radius of the sphere 05

$$3x^2 + 3y^2 + 3z^2 - 8x + 12y - 10z + 10 = 0.$$

- c) Show that the plane $x + 2y + 2z + 1 = 0$ cuts the sphere 10

$$7x^2 + 7y^2 + 7z^2 - 14x + 21y + 7z + 6 = 0.$$

OR

8. a) Write the condition of parallel and perpendicularity of two planes. Find the equation of plane which is parallel to the plane $4x - 4y + 2z - 3 = 0$ and a distance 4 unit from the point $(4, 1, -2)$. 15

- b) Find the equation of plane which is passing through $(1, 1, 2)$ and perpendicular to two planes $2x - 2y - 4z - 6 = 0, 3x + y + 6z - 4 = 0$. 10

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2023
Program: B. Sc. Engineering (Civil)

Course Title: Engineering Mechanics II
 Time: 3 hours

Credit Hours: 3.0

Course Code: CE 103
 Full Marks: 100

ANSWER ALL THE QUESTIONS
[Assume any reasonable value if needed]

1. Calculate required force Q in **Fig. 1** to move block A leftward by moving the wedge downward, if A weighs 100 kN. Neglect weight of the wedge.
 Coefficient of static friction: for both sides of wedge = 0.25; between block and horizontal surface = 0.45

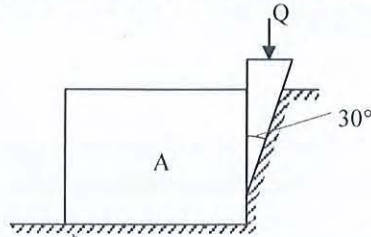


Fig.1

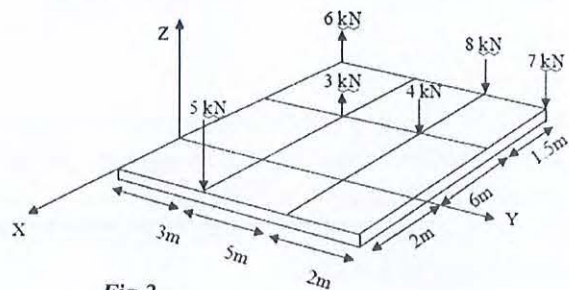


Fig.2

2. Six parallel forces act on a concrete slab as shown in the **Fig. 2**. Determine the resultant of the forces and locate the intersection of the line of the resultant with the XY-plane.
3. Calculate the magnitude of the resultant, its point of action and direction cosines for the following system of non-coplanar forces:
 L (300 lb, 4, -2, 7, 1, 2, 3);
 M (400 lb, -1, 6, -2, 1, 2, 3);
 N (200 lb, -3, 7, 0, 1, 2, 3).

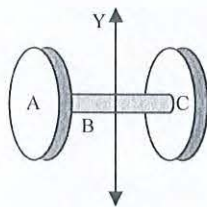


Fig.3

Given,	A	B	C
Diameter:	4'	2'	4'
Length:	2'	6'	2'
Unit weight (lb/ft ³):	900	490	900

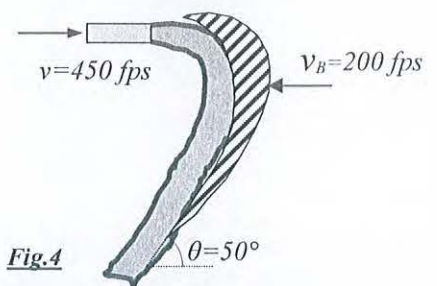


Fig.4

4. Calculate the mass moment of inertia of the composite body with respect to Y axis as shown in **Fig. 3**.
5. A jet of steam issued from a nozzle with a velocity of 450 fps and the absolute rate of 1.5 lb per sec. It enters a moving blade with a velocity of $v_B = 200$ fps. The blade is shaped as shown in **Fig. 4** and has a negligible frictional loss. Calculate resultant force exerted on the blade.

6. In **Fig.6**, the bodies A and B weigh $W_A = 50$ lb, $W_B = 20$ lb, with pulley diameters $d_A = 1$ ft and $d_B = 2$ ft. Rotating part C weighs 75 lb and has a radius of gyration 1.25 ft with respect to its axis. Coefficient of kinetic friction for A and B is 0.25 and 0.30 respectively. If B moves 4 ft from rest, calculate velocity of A and B using work energy principle

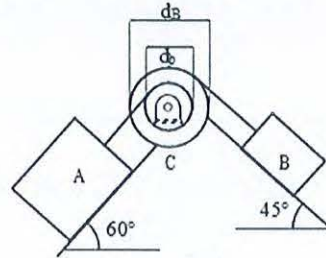


Fig.6

7. A system weighing 6 lb is spinning counterclockwise with respect to point C shown in **Fig.7**. Here, $AC = BC = DC = 3$ ft. When force E is applied, the system accelerates. Angular velocity after the force is removed is 1.3 times of initial angular velocity. a) How much work is done by $E = 10$ lb through a rotation of 55° ? The effects of friction are negligible. b) What is the final angular velocity if radius of gyration of the spinning part is 2.5 ft?

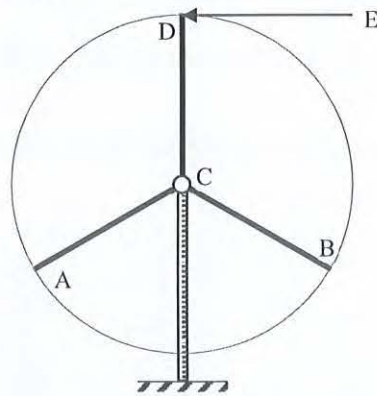


Fig. 7

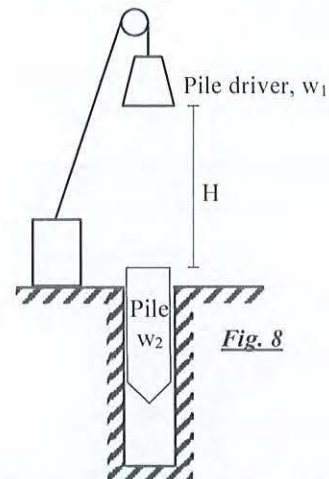


Fig. 8

8. A pile-driver of weight, $w_1 = 35.5$ kip drives a pile of weight, $w_2 = 7$ kip vertically into the ground. The driver falls freely a vertical distance of $H = 7$ ft before hitting the pile and there is no rebound. Calculate the velocity of driver and pile after impact.
9. For the same system in **Ques 9** if $w_2 = 6$ kip and $H = 5.5$ ft, combined velocity of driver and pile is calculated 16 fps. Calculate acceleration of pile after impact. When will the pile stop into the ground? Given that ground resistance is 250 kip.
10. A cricket ball is thrown in such a manner that it hits the pitch at point D, shown in **Fig.10**, and bounces towards the stump and passes it 3 in above stump height. Coefficient of restitution is 0.45 between pitch and ball. Assuming that the path of ball is linear and pitch surface smooth, calculate the velocity of the ball just before and after impact.

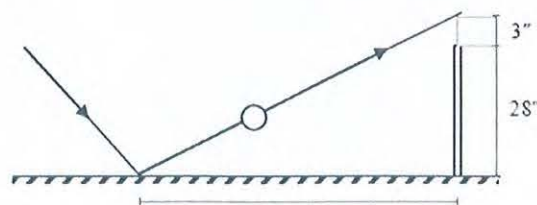


Fig.10

University of Asia Pacific
Department of Civil Engineering
Final Examination – Spring 2023
Program: B.Sc. Engineering (Civil)

Course Title: Surveying
 Time: 3 hours

Credit Hour: 4

Course Code: CE 105
 Full Marks: 200

[There are Total Eight (08) Questions. Answer All Questions]

1. a) Draw the contour lines for the followings: [4×5=20]
i. River ii. Overhanging Cliff iii. Ridge Lines iv. Valley Lines v. Pond
 b) Differentiate between Photogrammetry and Chain Surveying. 06
 c) Differentiate between Terrestrial and Aerial Photogrammetry. 06
 d) Explain Radiation and Intersection methods of plane table surveying. 06
 e) Describe the linkage of GIS to Remote Sensing. 06
 f) Describe six characteristics of contour in surveying 06

2. The following fore bearing and back bearing values were obtained during conducting a closed traverse round an obstacle: [20]

Line	F.B.	B.B.
AB	90°25'	269°15'
BC	130°35'	312°5'
CD	178°47'	358°47'
DE	240°25'	59°45'
EA	328°32'	148°32'

Calculate the interior angles and modify them by calculation from observational error. Assuming the observed bearing of line CD to be correct, also modify the bearings of the remaining sides by calculation.

3. A closed traverse was conducted round an obstacle and the following fore bearing and back bearing values were obtained. Compute the missing values. [20]

Line	Length (m)	F.B.	B.B.
AB	565	282° 27'	102° 27'
BC	?	345° 15'	165° 15'
CD	?	55° 05'	235° 05'
DE	472	113° 27'	293° 27'
EA	612	220° 13'	40° 13'

4. A road bend that deflects 75° is to be designed for a maximum speed of 28.7 m/sec, a maximum centrifugal ratio of 1/4, and a maximum rate to the change of acceleration of 78918 m/min³, the curve consisting of a circular arc combined with two cubic spirals. Calculate- [20]
 i. The radius of the circular arc
 ii. The requisite length of the transition curve

5. A land is 850'x 550' approximately and towards the end of the longitudinal side, there is a steep slope. At a distance of 160' from the left corner of the land, there is a temple and on the right corner, there is a railway. If you are the surveyor and [20]

you need to survey the entire land and also overcome the obstacle, select suitable method(s) for surveying.

6. a) Determine the values of stadia constants from the following observations: [05]

Instrument station	Staff Readings on	Distance (m)	Stadia Readings	
			Upper	Lower
O	A	150	2.75	1.255
	B	200	3.00	1.00
	F	250	3.255	0.751

- b) The following observations were made during a Tacheometric Survey where staff is held vertically: [20]

Instrument station	Height of Instrument	Staff Station	Vertical Angle	Hair Readings	Remarks
C	2.500	BM	-7°00'	0.742, 1.06 1, 2.235	RL of C = 447.600 m
C	2.500	D	+9°30'	0.956, 1.54 , 2.247	
D	2.778	E	+11°20'	1.175, 2.42 , 2.880	

Calculate the followings:

- The RLs of C, D and E.
- The horizontal distance CD and DE.

USE MISSING DATA CALCULATED IN QUESTION NO. 6 (a).

7. The following perpendicular offsets were taken from a chain line to an irregular boundary: [20]

Chainage(m)	0	10	25	42	60	75
Offset (ft)	14.7	28.5	35.9	23.7	31.0	31.5

Calculate the area between the chain line, the boundary, and the end offsets using two different methods and calculate the percentage of difference between the obtained results. Investigate the reason for such difference.

8. Calculate the missing data and determine the slopes between each station. [25]

Station	B. S.	I. S.	F. S.	Rise	Fall	R. L.	Remarks
1	1.32		?	?		?	B. M.
2		1.86			?	361.99	
3	1.71		?		0.68	361.31	
4	3.05		1.18	0.53		?	
5		?		1.86		363.7	
6	?		2.68		?	362.21	
7			1.53		?	362.14	

All units are in meter.

Necessary Formula for Question No. 6 (b)

$$V = \frac{f}{i} \times S \times \frac{\sin 2\theta}{2} + (f + d) \sin \theta \quad ; \quad D = \frac{f}{i} \times S (\cos \theta)^2 + (f + d) \cos \theta$$

University of Asia Pacific
Department of Basic Sciences and Humanities
Final Examination Spring 2023
Program: B.Sc. in Civil Engineering

Course Title: Physics II

Course Code: PHY 103

Time: 3.00 Hour

Credit Hour: 3.00

Full Marks: 150

There are **eight** questions. Answer **six** including **Q-1, Q-2 and Q-3**. All questions are of equal value. Figures in the right margin indicate marks.

1. a. State and explain the following laws: Faraday's law of induction and Lenz's law. [8+8]
b. A long solenoid has 400 turns and is 4 cm in length. It carries a current of 3 amp; its diameter is 3.0 cm. At its center, we place a 100-turn, close-packed coil of diameter 2.0 cm. This coil is arranged so that B at the center of the solenoid is parallel to the axis. The current in the solenoid is reduced to zero and then raised to 3 amp in the other direction at a steady rate over a period of 0.05 sec. Calculate the induced emf that appears in the coil while the current changes. [09]
2. a. Define inductance. Deduce an expression for the inductance of a solenoid. [3+13]
b. A solenoid is 1.0 meter long and 2.0 cm in mean diameter. It has five layers of windings of 100 turns each and carries a current of 1.0 amp. Evaluate the inductance of the solenoid. [09]
3. a. Define photo-electric effect. Describe an experiment by which the photo-electric effect is studied. [3+13]
b. Discuss the failure of the wave theory of light to explain the experimental facts observed in photo-electric effect. Explain these facts using Einstein's photo-electric equation given below: [09]
$$\frac{1}{2}mv^2 = hf - \phi$$
where h is the Plank's constant, f is the frequency of the incident light and ϕ is the work function of the metal.
4. a. Explain X-Ray Diffraction. Deduce the Bragg's law for X-ray scattering from a crystal lattice. [3+13]
b. X-rays of wavelength 0.5 \AA are detected at an angle of 5° in the first order. Measure the spacing between the adjacent planes of the crystal. Also, find out the angle at which the second maximum will occur. [09]

5. a. Using inverse Lorentz transformation equations, show that the interval of time observed in a moving frame of reference is less than in a stationary frame of reference and is given by the equation [16]

$$t = \frac{t_0}{\sqrt{1 - \frac{v^2}{c^2}}}$$

where v is the velocity of the moving frame of reference and c is the velocity of light.

- b. The time of an unstable particle at rest is $2.2 \mu\text{s}$. If at the instant of creation, it moves with a speed of $0.998 c$, find out the distance it will travel before decaying. [09]
6. a. Using inverse Lorentz transformation equations, show that the length of an object appears to contract when moving with a velocity comparable to the velocity of light and is given by the equation [16]

$$L = L_0 \sqrt{1 - \frac{v^2}{c^2}}$$

where v is the velocity of the moving frame of reference and c is the velocity of light.

- b. The length of a spaceship is measured to be exactly half its actual length. Calculate the speed of the spaceship. [09]
7. a. Define Miller indices. The intercepts along the three axes a , b and c are given below. Determine the Miller indices and draw the respective planes. [3+13]

(i) $\frac{1}{2}, 1, \frac{3}{4}$

(ii) $1, \infty, \frac{1}{2}$

- b. Calculate the packing efficiency and density of NaCl from the following data: [09]
- Radius of Na ion = 0.098 \AA , Radius of Cl ion = 1.81 \AA
 Atomic mass of Na = 22.99 amu , Atomic mass of Cl = 35.45 amu .
8. a. Write short notes on the followings: Hubble's law and red shift, laws of planetary orbits. [8+8]
- b. Explain the Big Bang theory of the universe. [09]