1-2

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2024
Program: B.Sc. in Civil Engineering
1st Year 2nd Semester

Course Title: English Composition and Communication | Course Code: HSS 103

Time: 3.00 Hours | Credit: 3.00 | Full Marks: 50

QUESTION 1 [5 MARKS]

Fill in the blanks with appropriate words.

[5]

a) The man walked with an unsteady _____ (gate/gait) after the accident.
b) Did the _____ (quite/quiet) in the therapist's office make you feel unnerved?
c) Karen, the _____ (weather/whether) forecaster predicts it might rain tomorrow.
d) _____ (Their/They're) summer house in the Hamptons is wonderful.
e) He always had a creative _____ (flair/flare) for composing musicals.
f) The first dish in their seven _____ (coarse/course) meal was made with sea urchins.
g) The play was banned by the _____ (sensor/censor) because of its controversial scenes.
h) The training airplane has _____ (dual/duel) controls.
i) The drug can be harmful if taken in _____ (access/excess).
j) Her new dress is a beautiful _____ (hue/hew) of purple.

QUESTION 2 [5 MARKS]

The following is a paragraph containing 10 grammatical errors (5 capitalization-related errors, 5 punctuation-related errors). Rewrite the text correctly and underline your changes.

[5]

from Andys arrival on the prison bus to the films end, we see only how others see him - red, who becomes his best friend Brooks the old librarian, the corrupt Warden norton, Guards and prisoners Red is our surrogate. He's the one we identify with, and the redemption, when it comes, is Red's. We've been shown by Andy's example that you have to keep true to yourself, not lose hope, bide your time, set a quiet example and look for your chance. "I guess it comes down to a simple choice, really, he tells Red. "get busy livin' or get busy dyin'."

QUESTION 3 [10 MARKS]

Fill in the blanks using the correct form of the words in brackets.

[10]

a) _____ (Current), the public are undergoing a very (b) _____ (favourable) situation in the market. The prices of daily necessaries are increasing (c) _____ (unabated). The (d) _____ (fluctuate) of market price is very (e) _____ (puzzle) to the (f)_____ (consume). This situation occurs due to the (g) _____ (irresponsible) and the (h) _____ (neglect) of the proper (i) _____ (author). We should take note that the (j) _____ (suffer) of this condition are mainly the poor class people

QUESTION 4 [10 MARKS]

Transform the sentences as instructed.

[10]

a. On seeing the teacher, the children stood up. (*Transform into Complex Sentence*)

b. At the age of six, she started learning music. (*Transform into Complex sentence*)

c. As Pitt is a voracious reader, he buys a lot of books. (*Transform into Simple sentence*)

d. Walk carefully lest you will fall down. (*Transform into Complex sentence*)

e. Besides being a dancer, she is a singer. (*Transform into Compound sentence*)

f. Since we didn't have enough money, we couldn't buy the new car. *(Transform into a simple sentence)*

g. Despite heavy rain, he decided to go out without an umbrella . *(Transform into a compound sentence)*

h. Besides helping her grandparents run the farm, Claire runs her own business. *(Transform into a complex sentence)*

i. Unless Patrick practices more, he will lose the tennis match. *(Transform into a simple sentence)*

j. Marina is too exhausted to go on a hike with her friends tomorrow. *(Transform into a compound sentence)*

QUESTION 5 [10 MARKS]

Write an event report on the "Annual Club Fair" recently held on UAP campus, on November 12, 2024, highlighting major attractions of the fair as they relate to your studies and potentially your future career.

[10]

QUESTION 6 [10 MARKS]

Write an essay within 450 - 500 words

[10]

High-rise buildings cannot be environmentally sustainable

Or,

Artificial Intelligence (AI) is causing more harm than good for students???

GOOD LUCK!

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Chemistry | Course Code: CHEM 111
Time: 3.0 hours | Credit Hours: 3.0 | Full Marks: 150

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

1. a. Define heat of formation. Calculate the heat of formation of CO_2 (g) from the following reactions and enthalpy changes: **[2+8]**

(i) C_4H_{10} (g) + $\frac{13}{2}$ O_2 (g) ⟶ $4CO_2$ (g) + $5H_2O$ (l) $\Delta H = -2878.8$ kJ

(ii) 4C (s) + $5H_2$ (g) ⟶ C_4H_{10} (g) $\Delta H = -124.7$ kJ

(iii) H_2 (g) + $\frac{1}{2}$ O_2 (g) ⟶ H_2O (l) $\Delta H = -285.9$ kJ

b. State and explain Hess's law. Show the Born-Haber cycle for the formation of MgO crystal lattice. **[5+10]**

2. a. Derive the integrated rate equation for a second order reaction. Show that the half-life of a second order reaction is dependent on the initial concentration of the reactant. **[10+5]**

b. 50% of a first-order reaction is completed 26.4 seconds. Calculate the time required for the concentration of the reactant to fall to $\frac{1}{8}$th of its initial reaction. **[10]**

3. a. Consider the following reaction: PCl_5 (g) ⇌ PCl_3 (g) + Cl_2 (g). Explain why a change in the pressure will have an effect on the equilibrium for the reaction. Also predict the direction in which the equilibrium will shift when the pressure is increased. **[10+5]**

b. The equilibrium constant for the synthesis of ammonia (NH_3) by Haber-Bosch process is 1.45×10^{-5} at 773 K. Calculate the equilibrium constant at 673 K if the enthalpy of the reaction is -105.2 kJ. [Molar gas constant, R = 8.314 $Jmol^{-1}K^{-1}$] **[10]**

4. a. Define linear and crosslinked polymers. Explain how vulcanization enhances the stiffness and durability of rubber. **[2+8]**

b. Show the mechanism of addition polymerization mentioning all the steps involved. **[15]**

5. a. Briefly outline different types of paint failures and suggest on how they can be avoided. [15]

b. Define pigments. Discuss the criteria for a good pigment. [2+8]

OR

6 a. Explain the Tyndall effect and the phenomenon of electric double layer formation exhibited by colloidal particles. [15]

b. Define emulsion. Explain how emulsifiers ensure the stability of an emulsion. [2+8]

7. a. Define BOD and COD. Discuss the process of Eutrophication. [2+8]

b. A 300 mL water sample was tested for its dissolved oxygen content using the Winkler's titration method. If 12.5 mL of 0.025 N sodium thiosulfate was required for the titration of the liberated iodine, calculate the dissolved oxygen in the water sample in mg/L. [Molecular weight of O_2 is 32 g/mol] [15]

OR

8. a. Define rust. Explain how galvanization prevents rusting of iron. [2+8]

b. A buried aluminium pipe is coupled with a copper pipe in wet soil. Explain mathematically why aluminium will corrode. If the cell operates at a current of 0.25 ampere for 24 hours, calculate how much aluminium will corrode. [$E^0_{Al^{3+}/Al}$ = -1.66 V, $E^0_{Cu^{2+}/Cu}$ = +0.34 V, Molar mass of aluminium = 26.98 g/mol] [15]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring-2024
Program: B.Sc. in Civil Engineering

Course Title: Mathematics-II. Course Code: MTH 103
Time: 3.00 Hours Credit Hour: 3.00 Full Marks: 150

There are **eight (8) questions**. Answer **six (6)** questions including **Q1, Q2, Q3 and Q4**. Figures given in the right margin indicate the marks of the respective questions.

1. a. Find constants a, b, c so that **15**
$\vec{F} = (x + 2y + az)\hat{\imath} + (bx - 3y - z)\hat{\jmath} + (4x + cy + 2z)\hat{k}$
is irrotational and find it's scalar potential.

b. Find the angle between the surfaces $x^2 - y^2 - z^2 = 11$ and **10**
$xy + yz - zx = 18$ at the point $(6, 4, 3)$.

2. a. Suppose, $F = (2x + 3y^2)\hat{\imath} - 7zy\hat{\jmath} + 5xz^2\hat{k}$. Evaluate $\int_c F.dr$ **15**
i. The straight lines from (0, 0, 0) to (2, 0, 0) then to (2, 2, 0) and then to (2, 2, 2).
ii. The straight line joins (0, 0, 0) and (2, 4, 2).

b. Evaluate $\iint_S \overrightarrow{F}.\hat{n}\,ds$ if $\vec{F} = 18z\hat{\imath} - 12\hat{\jmath} + 3y\hat{k}$ and S is the surface of the plane $2x + 3y + 6z = 12$ in the first octant. **10**

3. a. State Green's theorem. Evaluate $\int_C (y - sinx)dx + cosxdy$ using Green's theorem where C is the triangle with vertices (0, 0), $(\frac{\pi}{2}, 0)$, $(\frac{\pi}{2}, 1)$. **15**

b. State Stoke's Theorem. Using Stoke's theorem, evaluate **10**
$\int_C [(2x - y)dx - yz^2dy - y^2zdz]$, where C is the circle $x^2 + y^2 = 1$ corresponding to the surface of the sphere of unit radius.

4. a. Verify Gauss divergence theorem for **25**
$\vec{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ taken over the region bounded by the cylinder $x^2 + y^2 = 4$ and the plane $z = 0$, and $z = 3$.

5. a. Find the directional derivative of the function $\varphi = x^2yz + 4xz^2$ in the direction of $2\hat{\imath} - \hat{\jmath} - 2\hat{k}$ at $(1, -2, -1)$. **10**

b. If $\varphi(x, y, z) = xyz^2$ and $\vec{P} = xy\hat{\imath} - xz^2\hat{\jmath} + y^2z\hat{k}$, find $\frac{\partial^3}{\partial y \partial z^2}(\varphi\vec{P})$ at the point (1, -2, 1). **15**

OR

6 a. Find the volume of parallelepiped whose edges are $\vec{A} = 3\hat{\imath} - 2\hat{\jmath} + 4\hat{k}$, $\vec{B} = 3\hat{\imath} + 2\hat{\jmath} - \hat{k}$ and $\vec{C} = \hat{\imath} - \hat{\jmath} + 2\hat{k}$. **10**

b. A particle moves along the curve $x = 2t^2$, $y = t^2 - 4t$, $z = -t - 5$ where t is the time. Find the projection of its velocity at time $t = 1$ in the direction $\hat{\imath} - 2\hat{\jmath} + 2\hat{k}$. **15**

7. a. Find the two tangent planes to the sphere $7x^2 + 7y^2 + 7z^2 - 28x + 14y - 42z + 35 = 0$ which is parallel to the plane $2x + 2y = z$. **15**

b. Show whether the plane $x - 2y + 2z - 1 = 0$ cuts or touches the sphere $x^2 + y^2 + z^2 - 6x - 4y + 10z + 22 = 0$. **10**

OR

8. a. Find the equation of plane which is passing through the intersection of two planes $x - 2y + z - 6 = 0$, $2x + y - 2z - 3 = 0$ and is perpendicular to $3x + 4y - 3z - 5 = 0$. **15**

b. Find the equation of the plane passing through the point (2, 6, 1) and the normal vector is $\hat{\imath} + 4\hat{\jmath} + 2\hat{k}$. **10**

University of Asia Pacific
Department of Civil Engineering
Final Examination Spring 2024
Program: B.Sc. Engineering (Civil)

Course Title: Engineering Mechanics II | Credit Hours: 3.0 | Course Code: CE 103
Time: 3 hours | Full Marks: 100

ANSWER ALL THE QUESTIONS

1. In ***Figure 1***, the coefficients of friction between block *A* and the wedge *B* is $\mu_1 = 0.25$ and between the wedge *B* and block *C* is $\mu_2 = 0.3$. Assuming wedge *B* to be weightless calculate the force *Q* required to raise block *A* by pushing the wedge *B* to the right. Given, $W_A = 500$ lb. **10**

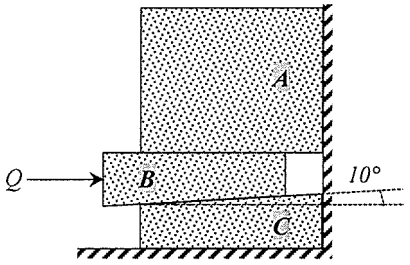


Figure 1

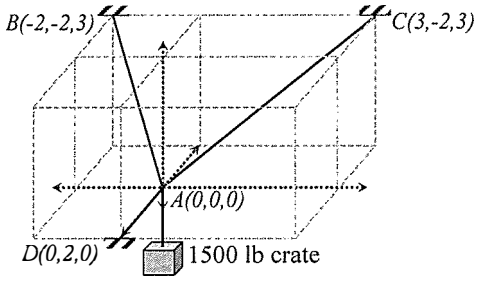


Figure 2

2. Calculate the force in cord *AB*, *AC* and *AD* used to support the 1500 lb crate shown in ***Figure 2.*** **10**

3. Calculate and locate the resultant of the noncoplanar parallel force system shown in ***Figure 3.*** Each small square on the grid represents *(2'×2')* area. **10**

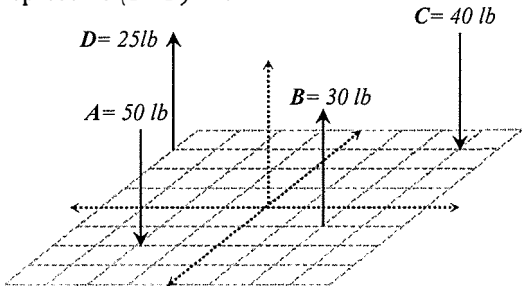


Figure 3

4. A jet of steam issued from a nozzle with a velocity of 600 fps and the absolute rate of w lb per sec. It enters a moving blade with a velocity v_B fps. The blade is shaped as shown in ***Figure 4*** and has a negligible frictional loss. **10**
If the resultant force on the blade is $R_x = 15$ lb and $R_y = 10$ lb, calculate v_B and w.

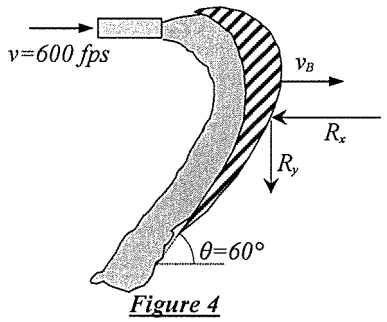


Figure 4

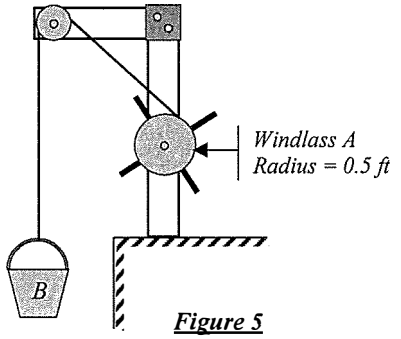


Figure 5

5. A 50 lb bucket *B* is connected to a Windlass A as shown in ***Figure 5.*** The Windlass *A*, weighing 35 lb, has a radius of gyration of 0.30 ft.
If *B* is released from rest, calculate the following after it has fallen a distance of 10 ft.
   a. Velocity of Bucket *B* and angular velocity of *A* **6**
   b. Normal acceleration and tangential acceleration of *A* **4**

6. The driver applies brake on a car which was moving towards a wall at 50 fps. From that point, it decelerates at 10 fps2 and travels 40 ft to hit a straight rigid wall.
If coefficient of restitution is 0.7, calculate
   a. Velocity of car just after direct impact
   b. Impulsive force exerted by the wall if the period of deformation is 0.05s. *10*

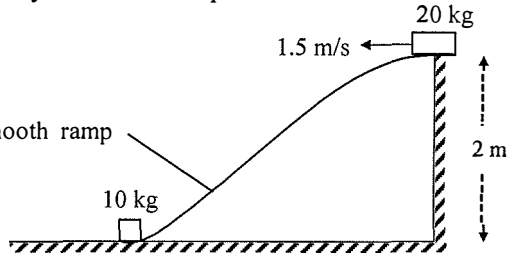


Figure 6

7. The 20 kg package has a speed of 1.5 m/s when it is delivered to a smooth ramp. After sliding down the ramp it lands onto a 10 kg package as shown in ***Figure 6.*** *10*
Calculate the combined speed of the packages right after collision at the end of smooth ramp.

8. Two smooth spheres A and B of equal diameter and on a horizontal plane, collide with oblique central impact as shown in ***Figure 7.*** Given: weight of A= 15 N, weight of B = 12 N.
   a. Calculate velocity of each sphere just after impact. *7*
   b. Calculate the loss of kinetic energy. *2*
   c. Calculate impulse during deformation and restitution. *5*

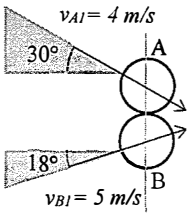


Figure 7

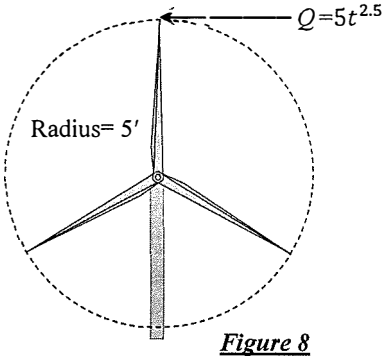
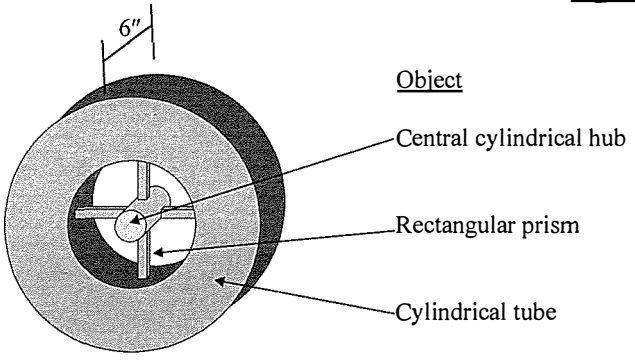


Figure 8

9. A 500 *lb* wind turbine shown in ***Figure 8*** is rotating clockwise with a velocity ω = 50 $rads^{-1}$. It is acted upon by a time-dependent force Q = $5t^{2.5}$lb (t is in seconds) towards left. If radius of gyration of the turbine is 3.5 ft, calculate its angular velocity after 20 seconds. *8*

10. Calculate moment of inertia of the wheel shown in ***Figure 9*** with respect to its instantaneous center. *10*



Object	Dimension		Unit wt
Central cylindrical hub	Radius	1.5″	490
	Length	6″	lb/ft^3
Rectangular prism	X-section	1″ × 1″	45 lb/ft^3
	Height	10″	
Cylindrical tube	Outer radius	24″	45 lb/ft^3
	Inner radius	11.5″	
	Height	6″	

Figure 9

University of Asia Pacific
Department of Civil Engineering
Final Examination – Spring 2024
Program: B.Sc. Engineering (Civil)

Course Title: Surveying | Course Code: CE 105
Time: 3 hours | Credit Hour: 4 | Full Marks: 180

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

1. a) Draw the appropriate contour lines for the followings: [12]
   i. Vertical Cliff ii. Ridge Lines
   iii. Gentle Slope iv. Steep Slope
   b) Differentiate between Open Traverse Surveying and Close Traverse Surveying. [06]
   c) Explain Radiation and Intersection methods of plane table surveying. [12]
   d) Differentiate between Terrestrial and Aerial Photogrammetry. [08]
   e) Describe the linkage of GIS to Remote Sensing. [06]
   f) Explain Local Attraction and Magnetic Declination. [10]

2. The following observations were obtained while conducting a closed traverse surrounding an obstacle. Compute the missing values in the table given below: [18]

Line	Length (m)	Bearing
AB	384	76° 18′
BC	401	105° 34′
CD	?	233° 49′
DE	?	316° 05′
EA	489	358° 13′

3. In a closed traverse survey, local attractions were observed while obtaining the following Fore Bearings (F.B.) and Back Bearings (B.B.) [20]

Line	Fore Bearing (F.B)	Back Bearing (B.B)
PQ	89°23′	270°31′
QR	127°31′	308°07′
RS	177°05′	357°47′
ST	226°32′	46°50′
TP	330°41′	150°27′

Calculate the corrected interior angles and corrected magnetic bearings of all lines.

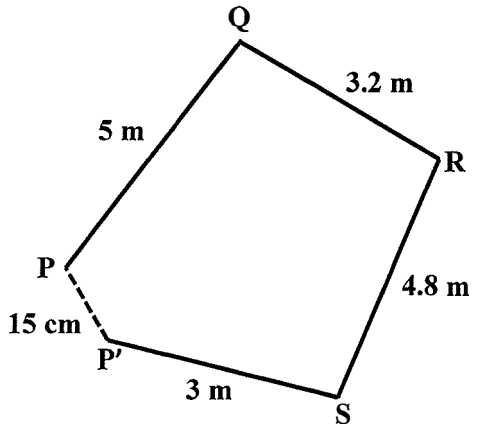
4. The following perpendicular offsets were taken from a chain line to an irregular boundary: [20]

Chainage(m)	0	10	25	42	60	75
Offset (ft)	13.5	29.5	36.9	21.7	31.0	31.9

Calculate the area between the survey line, the hedge and the end offsets by
(a) Trapezoidal rule (b) Simpson's rule.

5. A road bend which deflects 62° is to be designed for a maximum speed of 122 km/hr., a maximum centrifugal ratio of 1/4 and a maximum rate to the change of acceleration of 35 cm/sec^3, the curve consisting of a circular arc combined with two cubic spirals. Determine the followings: [4+4+6+6]
   i. The radius of the circular arc.
   ii. The requisite length of transition curve.
   iii. The total length of combined curve.
   iv. The chainages of the beginning and end of transition curve, and of the junctions of the transition curves with the circular arc if the chainage of the Point of Intersection (P.I.) is 56823 meters.

6. Compute necessary calculations to eliminate the closing error (PP′) in the following traverse survey by using **Graphical Method**. Also draw the corrected traverse. [8+4]



7. The following observations were made during a tacheometric survey where staff is held normal to the line of sight. The stadia constants are 98 and 0.145. [18]

Inst. station	Height of Instrument	Staff Station	Vertical Angle	Hair Readings	Remarks
X	1.052	BM	-5°47′	0.942,1.624,1.983	RL of BM= 378.700 m
X	1.052	Y	-8°52′	0.806,1.064,1.238	
Y	1.628	Z	-10°32′	0.905,1.452,1.997	

Calculate the gradient of the line joining **Station X and Station Z**.

$$\mathbf{D = \frac{f}{i} \times S \cos\theta + (f + d) \cos\theta + h \sin\theta}$$

$$\mathbf{D = \frac{f}{i} \times S \cos\theta + (f + d) \cos\theta - h \sin\theta}$$

$$\mathbf{V = \frac{f}{i} \times S \sin\theta + (f + d) \sin\theta}$$

8. While conducting levelling, the given staff readings were obtained as: 1.876, 1.973, 2.889, 1.762, 1.347, 3.012, 1.671, 2.766, 1.294, 2.703, 1.529. The instrument has been moved after third, fifth and eighth readings. Calculate the Reduced Levels of all stations using **Height of Instrument Method** if the first reading was taken with a staff held on a bench mark with reduced level 468.89 m. [18]

University of Asia Pacific
Department of Civil Engineering
Final Examination, Spring 2024
Program: B.Sc. in Civil Engineering

Course Title: Physics II | Course Code: PHY 103
Time: 3 hours | Credit Hour: 3.00 | Full Marks: 150

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

1. a) Define co-efficient coupling of inductor. Show that the equivalent inductance in series combination with mutual inductance is $L_{eq} = L_1 + L_2 \pm 2M$, where symbols have their usual meaning. **[20]**

b) Two coils connected in a series-aiding manner have a total inductance of 275 mH. When connected in a series-opposing manner have a total inductance of 125 mH. If the inductance of one coil is three times the other, Calculate the coupling coefficient. **[05]**

2. a) Describe the result of Michelson-Morley experiment. Show that Einstein mass-energy equivalence is $E = mc^2$, where the symbols have their usual meaning. **[20]**

b) A clock seems to be slow by 1 minute in one hour. Calculate the speed of the clock. **[05]**

3. a) Derive Einstein photoelectric equation and hence show that the kinetic energy of the photoelectrons is $K.E = 12{,}400\left(\frac{1}{\lambda} - \frac{1}{\lambda_0}\right) eV$. **[20]**

b) Light of a wavelength 2000 Å falls on a metal surface with work function 4.2 eV. Calculate **[05]**

(i) threshold wavelength and
(ii) stopping potential.

4. a) Show that the change in wavelength in Compton scattering is **[20]**

$$\Delta\lambda = \lambda' - \lambda = \left(\frac{h}{m_0 c}\right)(1 - \cos\theta),$$

where symbols have their usual meaning.

b) Show that electron can't be present inside the nucleus. **[05]**

5. a) Recall the properties of x-rays. **[05]**

b) Explain Bragg's law of x-ray diffraction. **[15]**

c) Compute the wavelength of the most energetic photons emitted by an X-ray tube operated at potential of 80,000 volts. Calculate the glancing angle in which photons will be reflected in the first order from the sodium planes of spacing 2.81×10^{-10} m. **[05]**

OR

6. a) Distinguish between Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics. **[05]**

b) Define unit cell. Show that the packing fraction for body centered cubic lattice is 0.68. **[15]**

c) NaCl crystals have FCC crystal structure. If the density of NaCl is 2.18 g/cm^3, calculate the distance between two adjacent atoms. Atomic weight of Na is 23 and that of Cl is 35.5. **[05]**

7. a) State and explain Hubble's law. **[07]**

b) Explain the approximate timeline for the evolution of the universe from the Big Bang to the present. **[18]**

OR

8. a) State and explain the Kepler's law of planetary motion. **[07]**

b) Define escape velocity. Derive the expression for escape velocity. **[13]**

c) Write a short note on Supernova. **[05]**