

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.

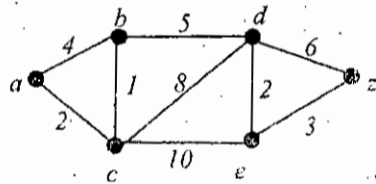
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

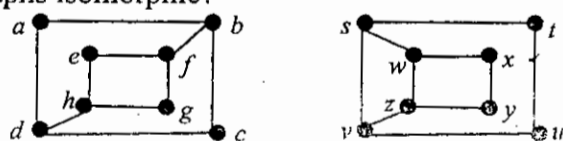
1. a) Define "proposition". Show using truth table that neither the converse nor inverse of an implication are not equivalent to the implication. (08)
- b) Express the following statements in the logical arguments using quantifiers, connectives and predicates. (09)
 "All lions are fierce, creatures do not drink coffee", "Some fierce creatures do not drink coffee".
- c) Name and discuss about the Rules of Inference for propositional logic. (12)
- d) Define "Contrapositive" and "Inverse" propositions using example. (06)

2. a) Let m be a positive integer. If $a \equiv b \pmod{m}$ and $c \equiv d \pmod{m}$, then prove that $a + c \equiv b + d \pmod{m}$ and $ac \equiv bd \pmod{m}$. (12)
- b) If a and b are positive integers, then prove that $\gcd(a, b) \times \text{lcm}(a, b) = a \times b$, where symbols have their usual meaning. (08)
- c) Show that the hypotheses "If you send me an e-mail, then I will finish writing the program", "If you do not send me an e-mail, then I will go to sleep early", and "If I go to sleep early, then I will wake up feeling refreshed". Lead to conclusion "If I do not finish writing the program, then I will wake up feeling refreshed". (10)
- d) Find $GCD(287, 91)$ using Euclidian Algorithm. (05)

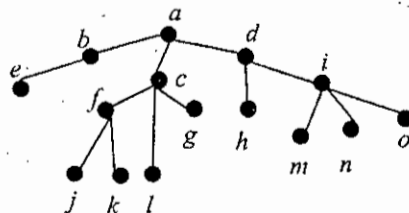
3. a) What is a graph? Show that, "An undirected graph has an even number of vertices of odd degree". (10)
- b) Find the shortest path between a to z in the following graph using Dijkstra's Algorithm. (15)



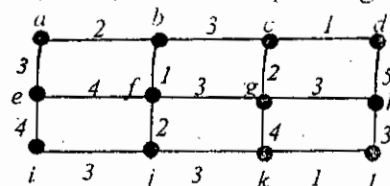
- c) What are the necessary and sufficient conditions for two graphs to be isomorphic? Are the following two graphs isomorphic? (10)



4. a) Define "decision tree". Draw a decision tree that orders the element of the list a, b, c. (07)
- b) Find the in order traversal to visit the vertices in the following ordered rooted tree. (12)



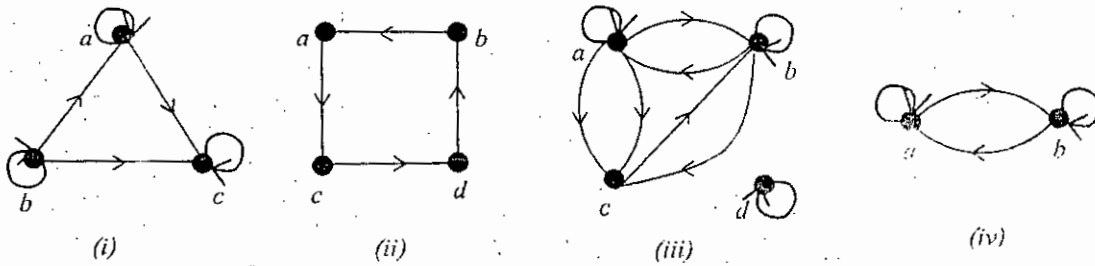
- c) What is the value of the postfix expression $7\ 2\ 3\ * -\ 4\ \uparrow\ 9\ 3\ / +?$ (07)
- d) Using Kruskal's Algorithm, find a minimum spanning tree from the following weighted graph. (09)



SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Define injective function. If the composite function $g \circ f$ is onto, does it follow that g is so? (07)
 b) Briefly explain the significance of floor function and ceil function with example. (10)
 c) What do you mean by relation? Discuss the role of relation in database. (08)
 d) Determine symmetric, asymmetric and anti-symmetric relation from the following graphs. (10)

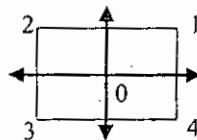


6. a) Define equivalence relation. Determine whether the relations mentioned in the following matrices are equivalent or not. (08)

$$\begin{matrix}
 \begin{bmatrix} 1 & 1 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix} & \begin{bmatrix} 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 \end{bmatrix} & \begin{bmatrix} 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \\
 (i) & (ii) & (iii)
 \end{matrix}$$

- b) Let α and β be distinct root of characteristic equation $x^2 - c_1x - c_2 = 0$, where $c_1, c_2 \in \mathbb{R}$ and $c_2 \neq 0$. Then every solution of the Linear Homogeneous Recurrence relation with Constant Co-efficient (LHRRWCC) $a_n = c_1a_{n-1} + c_2a_{n-2}$, $a_0 = c_0$ and $a_1 = c_1$ is of the form $a_n = A\alpha^n + B\beta^n$. Prove this theorem. Here A and B are constant. (12)
- c) Solve the following LHRRWCC with initial condition $a_0 = 2, a_1 = 5$, and $a_2 = 15$. (08)
 $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$.
- d) Differentiate among the delimited form, generalized sigma form and inversion form of sum. (07)
7. a) Let a valid code word is an n -digit number in decimal notation containing an even number of 0's. Let a_n denotes the number of valid code words of length n with initial condition $a_1 = 9$ and recurrence criteria $a_n = 8a_{n-1} + 10^{n-1}$. Use generating function to find an explicit formula for a_n . (15)

- b) Let S be the square in the plane \mathbb{R}^2 mentioned in the following figure with its center at origin 0. The vertices of S are numbered counter clockwise from 1 to 4. For $\alpha = 0^\circ, 90^\circ, 180^\circ$ and 270° . Let $r(\alpha)$ be the symmetry obtained by rotating S about its center α degree and let $r(\alpha)$ be the symmetry obtained by reflecting S about the Y-axis and rotating S about its center α degree. Show the permutation group for S_4 . (10)



- c) Define Abelian group. Show that the algebraic system $G(Q^+, *)$ is an abelian group, where Q^+ is the set of all positive rational numbers and operation $*$ is defined as $a * b = \frac{ab}{2}$ for all $a, b \in Q^+$. (10)
8. a) What is algebraic system? What are the conditions needed for an algebraic system to be a group? Give example. (07)
 b) What are the conditions that an algebraic system to be a ring? Give example. (08)
 c) Use generating functions to determine the number of different ways fifteen identical stuffed animals can be given to six children so that each child receive at least one but no more than three stuffed animals. (10)
 d) Find an explicit formula for the Fibonacci numbers. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2019
 Department of Computer Science and Engineering
 EEE 1107
 Basic Electrical Engineering

TIME: 3 hours

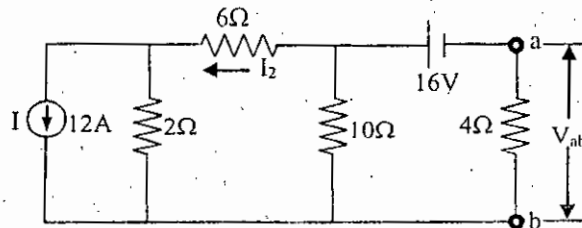
FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
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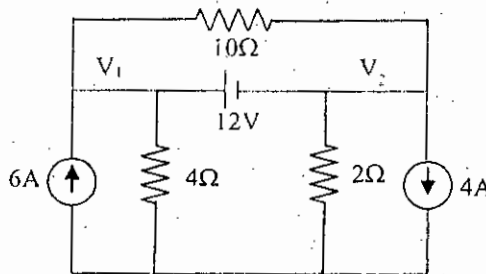
SECTION A

(Answer **ANY THREE** questions from this section in Script A)

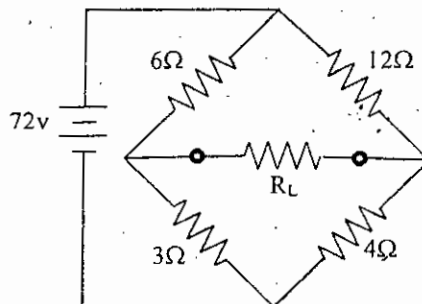
1. a) Define resistance, voltage, node, and linear bilateral element. (10)
 b) Using mesh analysis determine the value of I_2 and V_{ab} of the following circuit. (12)



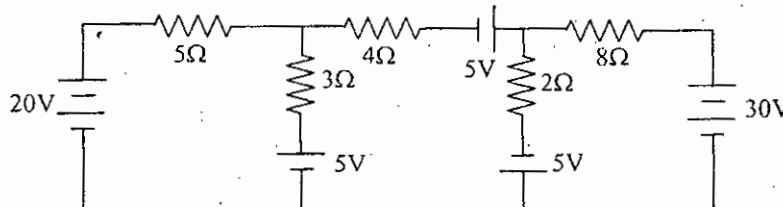
- c) Define supernode. Use nodal analysis to find the value of V_1 and V_2 as shown in the below figure. (13)



2. a) Find the Thevenin's equivalent circuit for the network shown below across R_L . (13)



- b) Determine the current supplied by each battery in the following circuit. (15)



- c) What is electrical source? Classify electrical sources. Define independent and dependent sources. (07)
3. a) Transfer a delta network to equivalent wye network, and find each of the wye connected resistances in terms of delta resistances. (10)
 b) Explain the methods of range extension of an ammeter and a voltmeter. (12)
 c) State and explain Ampere circuital law. Define (i) Permeability, (ii) Reluctance, and (iii) Magnetomotive force. (13)

4. a) Write the principle of generator and motor. Describe a practical dc generator. (10)
- b) A 4-pole, long-shunt, lap-wound generator supplies 25kw at a terminal voltage of 500V. The armature resistance is 0.03Ω , series field resistance is 0.04Ω and shunt field resistance is 200Ω . The brush drop may be taken as 1.5V. Determine the emf generated. Also, calculate the number of conductors if the speed is 1200 rpm and flux per pole is 0.02wb. Neglect armature reaction. (10)
- c) Classify dc generators according to their excitation with necessary diagrams. Describe the three important characteristic curves of dc generator. (08)
- d) What is back emf? What is the significance of it? Derive the condition for maximum efficiency of a dc motor. (07)

SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Explain the following terms with necessary illustration. (10)
(i) Oscillating current, (ii) Periodic current, (iii) Alternating current, (iv) Period, and (v) Cycle.
- b) Define impedance. Derive the equation of impedance of R and L branch. Show the graphical representation of voltage, current, and power variation in that branch. (15)
- c) What is phasor? Write the significance of operator j. Express the complex expression $\sqrt[3]{4.5 - j7.79} + \log_e 10 \angle 172^\circ$ as a single number. (10)
6. a) Obtain the value of crest factor and form factor of pure sine wave. (10)
- b) Obtain the expressions for the amount of energy stored during a quarter cycle of an inductor and a capacitor. (12)
- c) A voltage $v = 200 \sin 377t$ is applied to an inductive branch and the maximum current is 10 ampere. (13)
i) Find the value of L in milihenrys and ii) If it is known that this inductive coil has the resistance of 1Ω , what will be the actual value of L?
7. a) Calculate real power and reactive power employing complex forms. The voltage of a circuit is $v = 200 \sin(\omega t + 30^\circ)$ and the current is $i = 50 \sin(\omega t + 60^\circ)$. What are the power factor, reactive factor and volt-amp? (12)
- b) Why is transfer rating in KVA? Describe the open circuit test and short circuit test of a single phase transformer. (13)
- c) What are the differences between alternator and synchronous motor? Write the advantages of stationary armature in an alternator. Describe v-curves. (10)
8. a) Write the working principle of a transformer. Mention some applications of it. What are the main components of a transformer? Describe them. (12)
- b) What are the losses in a transformer? Define efficiency and find the condition for maximum efficiency. (08)
- c) What are the different types of 3- ϕ transformer connections? Describe them briefly. Write advantages and disadvantages of 3- ϕ transformer. (15)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2019
Department of Computer Science and Engineering
HUM 1107
English and Human Communication

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer ANY THREE questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.

SECTION A

(Answer ANY THREE questions from this section in Script A)

1. a) Complete the sentences with subordinate clauses as directed. (14)
- i) I quite believe (Noun clause)
 - ii) poverty is a curse. (Noun clause)
 - iii) She wants to appoint someone (Adj. clause)
 - iv) This is the car (Adj. clause)
 - v), you may go home. (Adverb clause of time)
 - vi) The committee was formed (Adverb clause of purpose)
 - vii), I shall attend the party. (Adverb clause of condition)
- b) Make sentences using the following words as directed. Last (as noun); Last (as adjective); Last (as verb); Last (as adverb); Fast (as adverb); Fast (as verb). (12)
- c) Change the following words as directed and make sentences with the changed words. (09)
Ferocious (into noun); General (into verb); Hand (into adjective); Part (into noun); Immense (into noun); Immense (into adverb).
2. a) Make sentences expressing the following notions/emotions. (14)
i) Annoyance, ii) Approval, iii) Anger, iv) Apology, v) Hatred, vi) Wish, vii) Good wish.
- b) Make a new word with each of the following prefixes and suffixes and make sentences with them. (12)
For....., Fore....., In.....,ence,ic,some.
- c) Make sentences with the following phrases and idioms. (09)
In a body; en masse; For good; On and on; To and fro; Null and void.
3. a) Frame wh questions from the underlined parts of the following answers. (14)
- i) Death is preferable to dishonor.
 - ii) He is dismissed for his anti-state involvement.
 - iii) I am very glad to meet you.
 - iv) Air raids were taking place every night.
 - v) The teacher rebuked the student.
 - vi) He went home to see his father.
 - vii) He has had his meal in a hotel.
- b) Transform the following sentences as directed. (12)
- i) What a win Bangladesh achieved against South Africa (Assertive).
 - ii) He has his meal. (interrogative)
 - iii) They are not so wise as the magi. (comparative)
 - iv) They brought valuable gifts. (complex)
 - v) I know English more than you. (positive)
 - vi) I know why he is absent. (simple)
- c) Define participle, gerund and infinitive. Give two examples of each of them in sentences. (09)
4. a) Fill in the gaps with appropriate Modal verbs given in the box. (14)
- Could, May, May be, Dare, Be to, Had better, Need, Must
- i) I borrow your pen for a minute?
 - ii) It raining in Khulna now.
 - iii) You fill in this form for registration.
 - iv) There is for you to hurry.
 - v) How you speak to me so rudely?
 - vi) He tried to lift the box but not.
 - vii) You start early because the train leaves timely.

- b) Make sentences on the following structures using the verbs given in brackets. (10)
- i) Subj. + Intransitive verb + adverbial (Go as verb)
 - ii) Subj. + Linking verb + adjective complement (Turn as verb)
 - iii) Subj. + Linking verb + noun complement (Turn as verb)
 - iv) Subj. + Transitive verb + gerund as object (Stop as verb)
 - v) Subj. + Transitive verb + obj. + adj. complement (Turn as verb)
 - vi) Subj. + Transitive verb + obj. + noun complement. (Prove as verb)
- c) Supply a suitable word to fill in the gaps. (11)
- i) It is time then to start.
 - ii) He is busy to his friends.
 - iii) He prides on his achievement.
 - iv) do you think the boys love most?
 - v) had we left the station when the train left.
 - vi) We know of it.

SECTION B

(Answer ANY THREE questions from this section in Script B)

5. a) Read the passage and answer the following questions: (20)
- People are social beings. We need to talk with and do things with other people. We often understand ourselves better when we discuss our opinions, emotions and activities with other people. We need to make meaningful connections with friends and family. These connections help us put aside our frustrations and worries. We can focus on things that are important: the people we care about.
- Our local community is the area near our home. It's where we work, play and go to school. It is the neighborhood where our family makes connections with other people. It's the places we feel we belong to. However, communities grow and change over time. Families move from one city to another because of work or family matters. Older adults often move to smaller homes after their children have grown up. Their children move out to start families of their own. Basic services, such as police, fire, post office, hospital and schools are in almost every community.
- The local city government is usually an elected mayor and city council. It is their job to listen to the people of the community and help them. Some individuals may move on, but the community remains.
- i) Why does a local community has a strong connection with the people?
 - ii) How do we understand ourselves or people around us?
 - iii) Name something special about your own community.
 - iv) What changes did you notice in your community in the last few years?
- b) Make a précis of the above passage. (15)
6. a) Amplify the idea contained in of the following statement. (20)
Freedom of speech does not mean licence to say whatever you like.
- b) Write a contrast paragraph on family life and hostel life. (15)
7. a) Bloomberg is looking for a software developer who will innovate new and better ways to give financial professionals the best possible services. Prepare your CV and apply for the post in Bloomberg. (20)
- b) Suppose you are the owner of a shopping center in a five star hotel. Write a memo to your staffs to increase shopping facilities to attract more foreigners. (15)
8. Write a free composition on any one of the followings: (35)
- i) Modern technologies and modern life.
 - ii) Apolitical Education.
 - iii) Negative effect of social media.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2019
 Department of Computer Science and Engineering
 MATH 1107
 Differential and Integral Calculus

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
 ii) Figures in the right margin indicate full marks.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. Integrate the followings: (35)

$$(i) \int e^{3x} \left\{ \frac{3x^2 + 27x + 59}{(x+4)^2} \right\} dx, (ii) \int \sqrt{\frac{1+x}{1-x}} \text{ and } (iii) \int \tan^{-1} x dx.$$

2. a) Evaluate $\int_0^1 \frac{\log(1+x)}{1+x^2} dx$. (12)

b) Evaluate $\int_0^{\pi/2} \frac{x}{\sin x + \cos x} dx$. (13)

c) Evaluate $\lim_{n \rightarrow \infty} \frac{1}{\sqrt{n}} \left[1 + \frac{1}{\sqrt{2}} + \dots + \frac{1}{\sqrt{n}} \right]$. (10)

3. a) Evaluate $\int_0^{\infty} \frac{\log(1+a^2x^2)}{1+b^2x^2} dx$ by using the rule "Differentiation under the integral sign". (12)

b) Evaluate $\iint (x^2 + y^2) dx dy$ over the positive quadrant to the circle $x^2 + y^2 = a^2$ by using the Jacobian formula. (12)

c) Obtain a reduction formula for $I_{m,n} = \int \cos^m x \cos nx dx$. (11)

4. a) Show that $\int_0^a \int_0^x \int_0^y dz dy dx = \frac{1}{2} \int_0^a (a-t)^2 dt$. (12)

b) Show that $\int_0^{\pi/2} \sin^p \theta \cos^q \theta d\theta = \frac{\left(\frac{p+1}{2} \right) \left(\frac{q+1}{2} \right)}{2 \left(\frac{p+q+2}{2} \right)}$ and hence find the value of $\int_0^{\pi/2} \sin^4 \theta d\theta$. (13)

c) Evaluate $\int_0^{\infty} e^{-2x^2} dx$. (10)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What are the conditions of a function to be differentiable? Test the continuity and differentiability of the following function when $a = 1$. (15)

$$f(x) = \begin{cases} 1, & x = 0 \\ \sin^2 ax / x^2, & x \neq 0 \end{cases}$$

b) If $x^y + (\sin x)^{\cos y} = x + y$, then find $\frac{dy}{dx}$. (10)

c) Find the value of $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{\frac{1}{x}}$. (10)

6. a) If $y = \sin ax + \cos ax$, then find y_n . (10)
- b) If $y = \tan^{-1} x$, then prove that $(1+x^2)y_{n+1} + 2nxy_n + (n-1)ny_{n-1} = 0$. Also, find $(y_n)_0$. (13)
- c) Find the lengths of the subtangent and subnormal of the curves $x = a(\theta + \sin \theta)$, $y = a(1 - \cos \theta)$ at ' θ '. (12)
7. a) Find the value of $\sin 48^\circ$. (12)
- b) Verify Rolle's theorem for $f(x) = e^x(\sin x - \cos x)$ in $(-\frac{\pi}{4}, \frac{\pi}{4})$. (11)
- c) If $u = x^n F(\frac{y}{x}, \frac{z}{x})$, then find the value of $x \frac{\partial u}{\partial x} + y \frac{\partial u}{\partial y} + z \frac{\partial u}{\partial z}$. (12)
8. a) Find maximum and minimum values of $f(x) = 8x^5 - 15x^4 + 10x^2$. (12)
- b) Find the radius of curvature on $ay^2 = x^3$ at (x, y) . (10)
- c) Find the asymptotes of $x^4 - x^2y^2 + x^2 + y^2 - a^2 = 0$. (13)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2019
Department of Computer Science and Engineering
PHY 1107
Physics

TIME: 3 hours

FULL MARKS: 210

- N.B. i) Answer **ANY THREE** questions from each section in separate scripts.
ii) Figures in the right margin indicate full marks.
iii) Assume reasonable data if missing any.

SECTION A

(Answer **ANY THREE** questions from this section in Script A)

1. a) How did Einstein's photoelectric equation explain the effect of intensity and potential on photoelectric current? How did this equation account for the effect of frequency of incident light on stopping potential? (12)
b) What is meant by phase velocity and group velocity of matter waves? Derive the relation between them. Also find their relation in dispersive and non-dispersive medium. (13)
c) The photo electric threshold for a metal is 3000\AA . Find the kinetic energy of an electron ejected from it by radiation of wavelength 1200\AA . (10)
2. a) Why the Sommerfeld's relativistic atom model and vector atom model was introduced instead of Bohr's atom model? Explain. (10)
b) Explain the physical significance of the different quantum numbers used in the vector model of the atom. Write down the electronic configuration of Cu (29). (15)
c) Calculate the de-Broglie wavelengths of (i) a smoke particle of mass 10^{-9} gm moving at 1 cm/s and (ii) an electron with a kinetic energy of 1 eV . (10)
3. a) State uncertainty principle. Show that the presence of electron in a nucleus is impossible. (10)
b) Show that the Schrodinger equation is a wave equation. Write down the time dependent and time independent Schrodinger equation and explain different terms involve in it. (15)
c) Using Bohr's formula (i) calculate the longest wavelengths in the Balmer series and (ii) between what wavelengths limits does the Balmer series limit? (10)
4. a) Explain the terms 'spherical aberration' and 'chromatic aberration' with suitable ray diagrams. (10)
b) Describe Young's double slit experiment and hence find an expression of resultant intensity distribution due to the interference. (15)
c) The object glass of a telescope is an achromal of focal length 90cm . If the magnitude of the dispersive powers of the two lenses are 0.024 and 0.036 , calculate their focal lengths. (10)

SECTION B

(Answer **ANY THREE** questions from this section in Script B)

5. a) What do you mean by symmetry operation? Prove that a crystal cannot have five fold symmetry. (12)
b) What is reciprocal lattice? How is reciprocal lattice constructed? List its important properties. (13)
c) The primitives of a crystal are 1.2\AA , 1.8\AA and 2\AA along whose Miller indices $[2\ 3\ 1]$ cut intercepts 1.2\AA along X-axis. What will be the lengths of intercepts along Y- and Z-axes? (10)
6. a) What is the difference between photons and phonons? Explain normal process and Umklapp process. (10)
b) Establish an expression of Einstein specific heat of solid and hence discuss the validity of this model at high and low temperature. (15)
c) In Bragg's law set up, X-rays were diffracted by an fcc crystal having lattice constant 0.407nm at an angle $2\theta = 64.7^\circ$ from the (220) planes. Find the wavelength of X-rays. (Assume first order diffraction). (10)
7. a) Obtain an expression for the electrical conductivity from the free electron theory of the metal. (10)
b) Derive the expression for Fermi energy of a free electron gas in the three dimensions. (15)

- c) Copper has a mass density $\rho_m = 8.89 \text{ gm/cm}^3$ and an electrical resistivity $\rho = 1.62 \times 10^{-8} \Omega\text{-m}$ at room temperature. Calculate (i) the Fermi energy (ii) the concentration of the conduction electron (iii) the mean free time (iv) the Fermi velocity and (v) the mean free path. (10)
8. a) Discuss in detail the concept of directionality, monochromality, intensity and coherence of LASER light. (12)
- b) Explain induced absorption and stimulated emission. What is population inversion? How it can be achieved? (13)
- c) A LASER beam has a wavelength of $8 \times 10^{-7} \text{ m}$ and aperture $5.2 \times 10^{-3} \text{ m}$. The LASER beam is sent to the moon is $4 \times 10^5 \text{ km}$ from the earth. Calculate (i) the angular spread of the beam and (ii) the axial spread when it reaches the moon. (10)