

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2015
 Department of Computer Science and Engineering
 CSE 1107

Discrete Mathematics

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

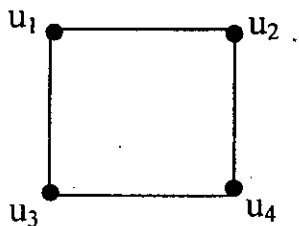
(Answer **ANY THREE** questions from this section in Script A)

1. a) What is an implication? Write down the converse and inverse of each implication. (10)
 - i) The calculator is working only if the battery is good.
 - ii) My insurance company will pay me if the flood or fire destroys my house.
- b) What is contradiction? Define the following proposition as a tautology or contradiction (10)

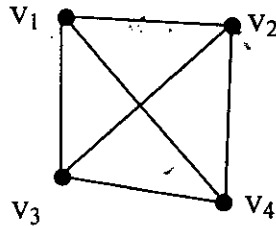
$$[(p \vee q) \wedge (p \rightarrow r) \wedge (q \rightarrow r)] \rightarrow r$$
- c) Show that the hypotheses "It is not sunny this afternoon and it is colder than yesterday," "We will go swimming only if it is sunny," "If we do not go swimming, then we will take a canoe trip," and "If we take a canoe trip, then we will be home by sunset" lead to the conclusion "We will be home by sunset." (15)
2. a) What is mathematical induction? Use mathematical induction to prove that (10)

$$1 + 2 + 2^2 + \dots + 2^n = 2^{n+1} - 1.$$
- b) List the rules of inferences for the propositional logic. (10)
- c) There is a number which when divided by 3, the remainder is 2; when divided by 5, the remainder is 3; and when divided by 7, the remainder is 2. Determine the number. (10)
- d) Give examples of "Converse" and "Contrapositive" statements. (05)
3. a) Let m be a positive integer. If $a \equiv b \pmod{m}$ and $c \equiv d \pmod{m}$, then prove that (08)

$$ac \equiv bd \pmod{m}.$$
- b) Decrypt the message "EOXHMHDQOV" that was encrypted using the Caesar cipher. (10)
- c) Let $a=252$ and $b=198$. Find two integers s and t such that $\gcd(a,b)=sa+tb$. (08)
- d) Show that the graphs $G=(V,E)$ and $H=(W,F)$ displayed in the following figures are (09) isomorphic.



G



H

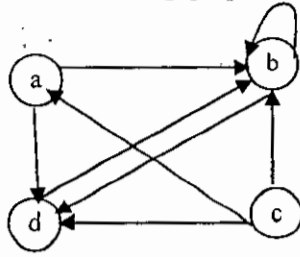
4. a) What is "Recursion"? Give at least one example for each of the followings: recursively defined (i) Sequences, (ii) Functions and Sets. (08)
- b) Give a recursive definition of the sequence $\{a_n\}$, $n = 1, 2, \dots, n$ if (i) $a_n = 2n + 1$, (ii) $a_n = 10^n$. (10)
- c) Give a direct proof of the Theorem, "If $3n+2$ is odd, then n is odd". (10)
- d) What do you mean by proof techniques? Classify the proof techniques. (07)

SECTION B

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

5. a) Use a venn diagram to show the subset of odd integers in the set of all positive integers not exceeding 10. (10)
- b) Let ' f ' is a function from Z to R and ' $f(x) = \lfloor \sqrt{x} \rfloor$ ', determine whether ' f ' is injective. (12)
 Here Z is a set of integer numbers and R is a set of real numbers.
- c) Prove that, "when the composition of a function and its inverse is formed, in either order, an identity function is obtained." (13)

6. a) Let $G = (V, E)$ be an undirected graph with e edges. Then prove that $2e = \sum_{v \in V} \deg(v)$. (10)
- b) Compare the following graphs: (10)
- (i) Simple graph, (ii) Multigraphs, (iii) Pseudograph, (iv) Directed graph and (v) Directed multigraphs.
- c) Define the degree of a vertex in an undirected graph. Determine the in-degrees and out-degrees of the vertices a, b, c, d of the following graph: (07)

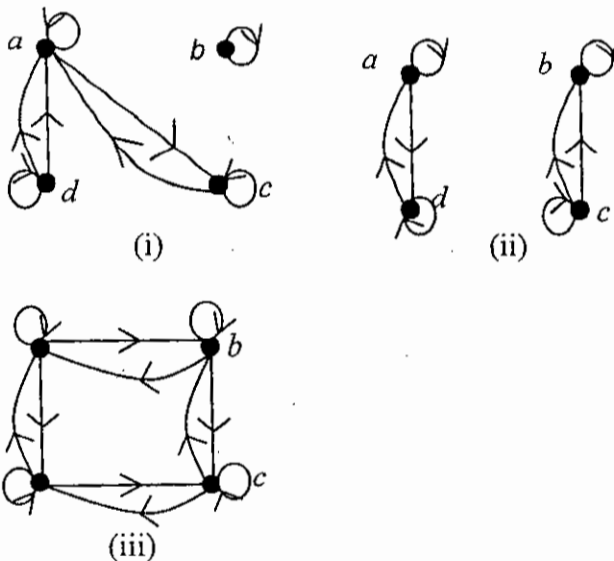


- d) List the different methods to represent the graphs. Draw the graphs for the following adjacency matrices: (08)

i)
$$\begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 0 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix};$$

ii)
$$\begin{bmatrix} 1 & 1 & 1 & 0 \\ 0 & 0 & 1 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

7. a) Determine whether the relation with the directed graphs shown as follows is an equivalence relation. (09)



- b) Construct a Hasse Diagram for the poset $(\{1, 2, 3, 4, 6, 8, 12\}, |)$. Show the following parameters: (18)
- i) maximal and minimal elements.
- ii) upper and lower bound of $\{1, 2, 3\}$; $\{1, 3, 4, 6\}$.
- iii) Is the poset a lattice?
- c) Let P be the set of all non-negative real numbers. Define $\&$ on P by $a \& b = (a+b)/(1+a*b)$. (08) Prove that $(P; \&)$ is a monoid.

8. a) Let $(S, *)$, (T, Δ) and (V, \oplus) be three semigroups and $f: S \rightarrow T$ and $g: T \rightarrow V$ be semigroup homomorphism. Then, show that $h = g \circ f$ is a semigroup homomorphism from $(S, *)$ to (V, \oplus) . (07)
- b) Let each user on a computer system has a password, which is six to eight character long, (08) where each character is an uppercase letter or a digit. Each password must contain at least one digit and no letter is repeated twice in the password. How many possible passwords are there?
- c) Find the solution of the recurrence relation, $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$ with the initial (08) conditions $a_0 = 2$, $a_1 = 5$ and $a_2 = 15$.
- d) Using generating function, determine the number of different ways 10 identical balloons can (12) be given to four children if each child receives at least two balloons.

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) B-H curve will be supplied if needed.

SECTION A

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

1. a) State and explain KVL, KCL and ohm's Law. (09)
 b) Determine the current supplied by each battery in the circuit shown in Fig. 1(b). (13)

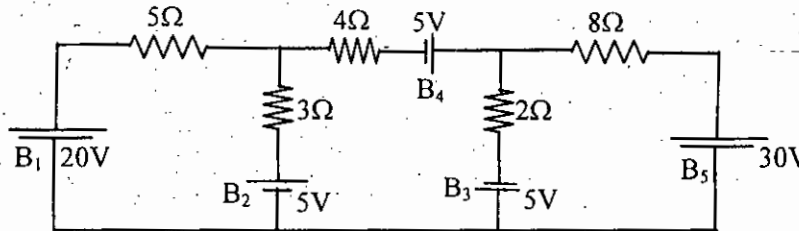


Fig. 1(b)

- c) State the conditions for applying superposition theorem to a circuit. Using superposition theorem, find the value of the output voltage v_0 in the circuit of Fig. 1(c). (13)

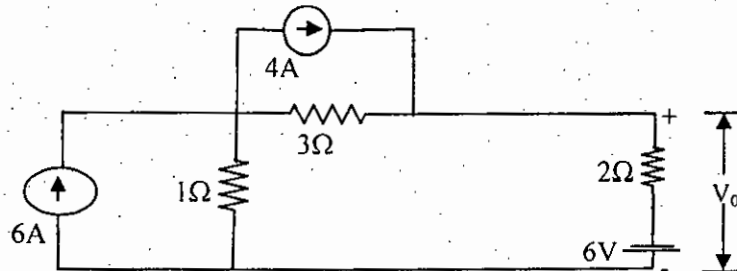


Fig. 1(c)

2. a) For transformation from "delta network" to equivalent "wye network" find each of the "wye" connected resistances in terms of three "delta" connected resistance. (08)
 b) State Thevenin's theorem and by using Thevenin's theorem, replace the network shown in Fig. 2(b) with reference to terminals A and B. (15)

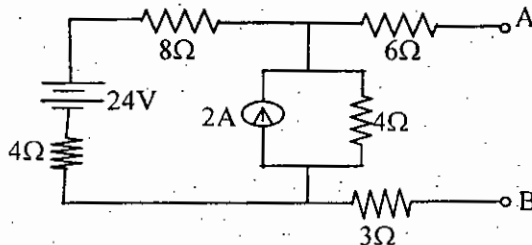


Fig. 2(b)

- c) A battery which gives 40 Amperes on short circuit will supply a current of 9.5 amperes to a resistance of 1Ω connected between its terminals. (i) What is the electromotive force of the battery? (ii) What is its internal resistance? (09)
 d) State Millman's theorem. (03)
3. a) "The power delivered to a load will be maximum when the load resistance is equal to the Thevenin resistance"-prove. Also show that at maximum power the efficiency is only 50%. (08)
 b) Define magnetic field, flux density and permeability. (06)
 c) State ohm's law for magnetic circuit. Compare between the electric and magnetic circuit. (09)
 d) Find the magnetic field intensity at a point 5 cm distant from the midpoint of a straight wire 20 cm long and carrying a current of 10 amp. (12)
4. a) Write the principle of generator and motor. Describe a practical dc generator. (10)
 b) Classify dc generators according to their excitation with necessary diagrams. Describe the open circuit characteristic of a dc generator. (08)
 c) Write the significance of the back emf of a dc motor. Write the necessity of a starter in it. (07)
 d) What are the factors controlling motor speed. Describe flux control method. (10)

SECTION B

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

5. a) What is phase and phase difference? Find the angle of phase difference between $v = 310 \cos(\omega t + 30^\circ)$ and $i = -2 \sin(\omega t - 60^\circ)$; which lags? (10)
- b) Define impedance. Derive the equation for impedance and power for an R-L branch. Show graphical representation of voltage, current and power variation in that branch. (15)
- c) Find the amount of energy stored by a capacitor during a quarter cycle. (10)
6. a) Define: (i) Form Factor (ii) Crest Factor (iii) Power Factor. (09)
- b) What is phasor? Write the significance of operation j. Find all possible roots of
$$\sqrt[3]{\frac{10 \angle 45^\circ 5e^{j60^\circ} (-4.047 - j2.94)}{1 - j1.732}}$$
 (14)
- c) Show that the crest factor of sine wave is $\sqrt{2}$ and the form factor of the same wave is 1.11. (12)
7. a) Define with necessary diagrams (i) Oscillating current (ii) Periodic current and (iii) Alternating current (iv) Period and (v) Cycle. (10)
- b) Calculate the real power and reactive power employing complex forms. (10)
- c) Find the impedance of an L branch from its dynamic equilibrium equation. (07)
- d) A voltage $v = -150 \sin 377t$ is applied to a particular circuit element and it is found that $i = 10 \cos 377t$ amp. Make a Sketch of v and i . Find the nature and magnitude of circuit parameter. (08)
8. a) Show that e.m.f/turn is the same in both the primary and secondary windings of a transformer. (07)
- b) Describe transformer on (i) No-load condition and (ii) on-load condition. Draw necessary vector diagrams. (08)
- c) Mention the main parameters of a transformer. Briefly explain the open-circuit and short circuit tests of a single phase transformer to calculate these parameters. (12)
- d) What are the losses in a transformer? Define efficiency and find the condition for maximum efficiency of a transformer. (08)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2015
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) Frame Wh questions from the underlined parts of the following sentences (14)
- i) Children play cricket on Sundays.
 - ii) He visits his mother every week.
 - iii) She can speak Bangla, English, and Arabic.
 - iv) She comes from Khulna.
 - v) The boy can't go out because of severe cold.
 - vi) I found him in the library.
 - vii) I talked to Karim.
- b) Make one sentence using each of the following words as directed: (12)
Visit (as Noun); go (as Noun); post (as verb); post (as Adj.); use (as Noun); That (as Adj.);
- c) Change the following words as directed and use the changed words in sentences. (09)
post (into Noun); use (into Noun); Differ (into Adj.); people (into Verb); people (into Adverb); people (into Noun)
2. a) Expressing the following notions/emotions, make one sentence with each of them. (14)
i) Imprecation, ii) Annoyance, iii) Farewell, iv) Apology, v) Seasonal greetings, vi) Approval, vii) promise.
- b) Correct the following sentences. (12)
- i) He insisted to go there.
 - ii) Is he capable to do it?
 - iii) I saw a dead cow walking in the field.
 - iv) He will avail the opportunity.
 - v) He was accused for murder.
 - vi) He need not to go there.
- c) Supply a suitable word to fill in the blanks of the following sentences. (09)
- i) Sweet the fruits of adversity.
 - ii) What do children most?
 - iii) Read diligently lest you fail.
 - iv) reading more, you cannot pass.
 - v) He kept the man outside for a long time.
 - vi) What cannot be must be endured.
3. a) Write sentences: (14)
- i) Suggesting advisability.
 - ii) Implying compulsion or necessity.
 - iii) Expressing strong possibility.
 - iv) Expressing arrangement.
 - v) Implying that one does not have the courage to do something.
 - vi) Implying a past unnecessary action.
 - vii) Implying a past duty which was not discharged.
- b) Make sentences on the following structures. (12)
- i) subj. + vit + adverbial
 - ii) subj. + Linking verb + adjective complement + extension.
 - iii) subj. + Linking verb + Noun complement + extension.
 - iv) subj. + vt + gerund as object.
 - v) subj. + vt + infinitive as object.
 - vi) subj. + vt + object + Noun complement.
- c) Define Intransitive, Transitive and Linking verbs. Give two examples of each of them. (09)

4. a) Transform the following sentences as directed. (14)
- Alas! Our beloved leader is dead. (assertive)
 - I know the time of his departure. (complex)
 - He confessed that he was guilty. (simple)
 - He said that he was glad. (passive)
 - People say that honesty is the best policy. (positive)
 - Nobody should pay heed to rumour. (interrogative)
 - None but the heroes of liberation war can uphold our honour. (affirmative)
- b) Complete the sentences with subordinate clauses. (12)
- Call him (Adj. clause)
 - The man has died. (Adj. clause)
 - I do not believe (Noun clause)
 - I know (Noun clause)
 -, I would have helped you. (Adv. clause of condition)
 -, you need not come. (Adv. clause of cause)
- c) Make one sentence with each of the following phrases and idioms: (09)
- At times; Hand and glove; In a fix; Out and out; En masse; Make room.

SECTION B

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

5. a) Read the passage and answer the following questions: (20)
- An intellectual is one who is enlightened and being an enlightened person, he has to give light to others who are in need of it. In every society, we find intellectuals such as philosophers, scientists, writers, critics etc. and they as enlightened men, have a great responsibility towards society. In a society all cannot be intellectuals. So those who are intellectuals have the giant responsibility of guiding others on to the right path. If today we have our civilization and culture, if we have order and security in life and if life is now better than that of our primitive ancestor, it is because the intellectuals from time to time have been guiding humanity on the path of felicity and amity. The intellectuals should, therefore, come out of their ivory towers and try to elevate others to their level. He has the duty of seeing the truth, and teaching it to others. And perception of truth which is almost identical with perception of beauty as Keats says in his world famous poem, can bring about a tranquil exaltation of the mind. Hence the duty of an intellectual is to experience himself first ~~this~~ or beauty and then reveal it to others.
- Who are the intellectuals according to the writer?
 - What is their giant responsibility?
 - What is ivory tower and what is its symbolic significance?
 - What is the social and moral duty of the intellectuals?
- b) Make a precise of the above passage. (15)
6. a) Write a listing paragraph on 'Qualities of a good student'. (15)
- b) Amplify the idea contained in the following statement: (20)
- "Behave as you like to be behaved".
7. a) Suppose there is a post of lecturer vacant in your Department. Prepare your CV and application for the post. (20)
- b) Write a dialogue between two brothers about the demerits of technology in entertainment. (15)
8. Write a free composition on any one of the following (35)
- Bribery: A social problem in Bangladesh.
 - The role of computer Engineers in the national development.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2015
 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. a) Define limit and differentiability of a function. A function $f(x)$ is defined as follows: (15)

$$f(x) = x^2 \sin \frac{1}{x}, \text{ when } x \neq 0$$

$$= 0, \text{ when } x = 0.$$
 Show that $f(x)$ is continuous and differentiable at $x=0$.
- b) If $\sin y = x \sin(a + y)$, prove that $\frac{dy}{dx} = \frac{\sin^2(a + y)}{\sin a}$. (10)
- c) Evaluate $\lim_{x \rightarrow 0} \frac{(e^x - 1) \tan x}{x^2}$. (10)

2. a) Define tangent and normal. If $x \cos \alpha + y \sin \alpha = P$ touch the curve $\frac{x^m}{a^m} + \frac{y^m}{b^m} = 1$, show that (13)

$$(a \cos \alpha)^{\frac{m}{m-1}} + (b \sin \alpha)^{\frac{m}{m-1}} = P^{\frac{m}{m-1}}.$$
- b) State Leibnitz's theorem. If $y = \sin(m \sin^{-1} x)$, then find the relation between (13)

$$y_{n+2}, y_{n+1}, y_n.$$
- c) If $u = e^{xyz}$, then show that $\frac{\partial^3 u}{\partial x \partial y \partial z} = (1 + 3xyz + x^2 y^2 z^2) e^{xyz}$. (09)

3. a) Define maximum and minimum of a function. Find the maximum and minimum values of (13)

$$1 + 2 \sin x + 3 \cos^2 x, (0 \leq x \leq \frac{\pi}{2}).$$
- b) State Euler's theorem. If $u = F(x^2 + y^2 + z^2) f(xy + yz + zx)$ then show that (13)

$$(y - z) \frac{\partial u}{\partial x} + (z - x) \frac{\partial u}{\partial y} + (x - y) \frac{\partial u}{\partial z} = 0.$$
- c) Define subtangent and subnormal. Show that in the curve $by^2 = (x + a)^3$, the square of (09) subtangent varies as the subnormal.

4. a) Define radius of curvature. Show that for the curve $r^m = a^m \cos m\theta$ the radius of curvature (13)

$$\text{is } \rho = \frac{a^m}{(m + 1)r^{m-1}}.$$
- b) Define asymptotes. Determine the asymptotes of (13)

$$x^3 + x^2 y - xy^2 - y^3 + 2xy + 2y^2 - 3x + y = 0.$$
- c) Find y_{20} , where $\frac{1}{x^2 + x + 1}$. (09)

SECTION B

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

5. Answer **ANY THREE** of the followings: (35)

(i) $\int \frac{dx}{(2x+3)\sqrt{x^2+3x+2}}$

(ii) $\int (3x-2)\sqrt{(x^2-x+1)}dx$

(iii) $\int \frac{2\sin x + 3\cos x}{3\sin x + 4\cos x} dx$

(iv) $\int \frac{x}{(x-1)(x^2+4)} dx$

6. Evaluate **ANY THREE** of the followings: (35)

(i) $\int_0^{\pi/4} \frac{dx}{5+4\sin 2x}$

(ii) $\int_{-1}^{1/2} \frac{dx}{(1-x)\sqrt{(1-x^2)}}$

(iii) $\int_0^{\pi/2} \frac{\cos^2 x}{\sin x + \cos x} dx$

(iv) $\lim_{n \rightarrow \infty} \left\{ \left(2 + \frac{1^2}{n^2}\right)^{1/n^2} \left(2 + \frac{2^2}{n^2}\right)^{2/n^2} \left(2 + \frac{3^2}{n^2}\right)^{3/n^2} \dots \left(2 + \frac{n^2}{n^2}\right)^{n/n^2} \right\}$

7. a) Define Beta and Gamma functions. Find the relation between them. (15)

b) Establish a reduction formula for $\int \sin^n x dx$, hence evaluate $\int \sin^6 x dx$. (10)

c) Show that $\int_0^2 x \sqrt[3]{8-x^3} dx = \frac{16\pi}{9\sqrt{3}}$ (10)

8. a) Find the area bounded by the cycloid $x = a(\theta - \sin \theta)$, $y = a(1 + \cos \theta)$ and its base (15)

b) Find the length of arc of the parabola $y^2 = 12x$ cut off by its latus rectum (10)

c) Find the volume of the ellipse formed by the revolution of the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ about the x axis. (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2015
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.

SECTION A

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

1. a) What is Compton effect? Explain and derive an expression for Compton shift on the basis of quantum theory. (15)
- b) Prove that the De-Broglie wavelength of the orbital electron is $\lambda = \frac{h}{e} \sqrt{\frac{4\pi\epsilon_0 r}{m}}$, where the symbols have their usual meanings. (10)
- c) What is the frequency of an X-ray photon whose momentum is 1.1×10^{-23} kg.m./s? (10)
2. a) Discuss vector atom model. Write down the names of all quantum number associated with vector atom model. (15)
- b) Show that in a privileged orbit the magnetic moment of the electron must be $-\left(\frac{e}{2m}\right)\bar{L}$, where \bar{L} is the angular momentum. (10)
- c) Find the possible quantum numbers l, j and m_j of the outer electron that correspond to each of the following states: $^1S_0, ^3P_2, ^2P_{1/2}, ^2D_{3/2}, ^2S_{1/2}$. (10)
3. a) State uncertainty principle. Show that the presence of electron in a nucleus is impossible. (10)
- b) Show that the probability current for a free particle is simply the product of its probability density and its speed. (15)
- c) A particle limited to the x axis has the wave function $\psi = ax$ between $x = 0$ and $x = 1$; $\psi = 0$ elsewhere. (10)
 - (i) Find the probability that the particle can be found between $x = 0.45$ and $x = 0.55$.
 - (ii) Find the expectation value $\langle x \rangle$ of the particles position.
4. a) What is achromatism? Derive and discuss the conditions of achromatism for two thin lenses placed in contact. (12)
- b) Describe Newton's rings experiment and explain how it is used to determine the wavelength of sodium light. (13)
- c) Newton's rings are observed in reflected light of $\lambda = 5.9 \times 10^{-5}$ cm. The diameter of the 10th dark ring is 0.5 cm. Find the radius of curvature of the lens and the thickness of the air film. (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 folds symmetry? (10)
- b) What are Miller indices? Discuss in brief the procedure for finding Miller indices. (12)
- c) What is density of Packing? Calculate the relative density of Packing of simple cubic, body centered cubic and face centered cubic structure atom. Give some examples. (13)
6. a) Explain the concept of phonon. Show that the dispersion relation for the lattice waves in a mono atomic linear lattice of mass m spacing a and nearest neighbor interaction f is (15)
- $$\omega = \sqrt{\frac{4f}{m}} \left| \sin\left(\frac{ka}{2}\right) \right| \text{ where } \omega \text{ is the angular frequency and } k \text{ the wave vector.}$$
- b) Derive an expression for the thermal conductivity from the free electron theory of metals. (10)
- c) Show that the average Kinetic energy of an electron at absolute zero is $\overline{E_0} = \frac{3}{5} E_{F_0}$. (10)
7. a) Following Einstein theory deduce an expression for the lattice heat capacity. Discuss the successes and failures of this model. (15)
- b) Define a reciprocal lattice. State the properties of a reciprocal lattice. (10)
- c) An x-ray beam of wavelength 3 \AA is diffracted from $[001]$ planes of a cubic crystal. The first order diffraction is obtained at an angle of 42° . Determine the spacing between the $[011]$ planes and the volume of the unit cell. (10)
8. a) Discuss in detail the concept of directionality, monochromaticity, intensity and coherence of LASER light. (12)
- b) Give the brief outlines of the form of input energy of a LASER. Explain the terms (i) induced absorption (ii) spontaneous emission and (iii) stimulated emission. (13)
- c) A LASER beam has a power of 100 mW . It has an aperture of $5 \times 10^{-3} \text{ m}$ and it emits light of wavelength 6943 \AA . The beam is focused with a lens of focal length 0.1 m . Calculate the area and the intensity of the image. (10)