

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2018
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) Define "Contrapositive" and "Inverse" propositions using example(s). (08)
- b) Find a proposition that is equivalent to $p \rightarrow q$ which uses the basic connectives. Hence prove its validity. (09)
- c) What are logical quantifiers? Prove the expression with example: $\neg \forall x Q(x) \Leftrightarrow \exists x \neg Q(x)$ (10)
- d) Suppose that we have an array of size 5×5 . Are these statements equivalent? (08)

$$\forall \text{ row } x \exists \text{ column } y A(x, y) = 1$$

$$\exists \text{ row } x \forall \text{ column } y A(x, y) = 1$$

Justify your answer.

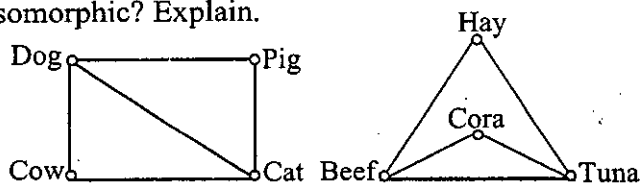
2. a) What is induction method? Explain the idea of it. (10)
- b) Use induction method to find the orderings of all n -bit strings in such a way that two consecutive n -bit strings differed by only one bit. (10)
- c) Provide the recursive definition of the sequence $\{a_n\}$, $n = 1, 2, 3, \dots$, if (10)
(i) $a_n = 3n + 1$, (ii) $a_n = 3^n$
- d) Draw the recursive Fibonacci evaluation tree for $f(5)$, where (05)
 $f(0) = 0, f(1) = 1$ and $f(n) = f(n-1) + f(n-2)$ for $n = 2, 3, 4, 5, \dots$

3. a) What is a graph? Let $G = (V, E)$ be a graph with directed edges. Then prove that (10)
 $\sum_{v \in V} \text{deg}^-(v) = \sum_{v \in V} \text{deg}^+(v) = |E|$.

- b) Name the different methods to represent graphs. Draw the graphs for the following matrices: (13)

$$(i) A_G = \begin{bmatrix} 0 & 1 & 1 & 2 \\ 1 & 1 & 0 & 1 \\ 1 & 0 & 0 & 3 \\ 2 & 1 & 3 & 0 \end{bmatrix}; \quad (ii) A_G = \begin{bmatrix} 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 \\ 1 & 1 & 1 & 0 \end{bmatrix}$$

- c) What are the necessary and sufficient conditions for two graphs to be isomorphic? Are the following two graphs isomorphic? Explain. (12)



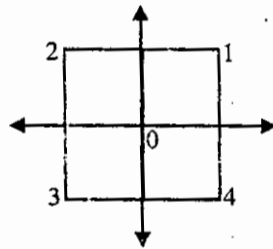
4. a) What is linear congruential method. Use this method to find pseudo random numbers within the limit 5 to 20. (10)
- b) Let m be a positive integer. If $a \equiv b \pmod{m}$ and $c \equiv d \pmod{m}$, then prove that $ac \equiv bd \pmod{m}$. (08)
- c) Produce a secret message from the message "SEE YOU IN THE LOBBY" using the Caesar cipher method. (10)
- d) If a and b are positive integers. Then prove that $\text{gcd}(a, b) \times \text{lcm}(a, b) = a \times b$, where the symbols have their usual meaning. (07)

SECTION B

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

5. a) What is a function? "A function must possess one-to-one correspondence property if it wish to have an inverse." – justify the statement. (12)
- b) Describe the applications of floor function and ceil function with example. (13)
- c) Discuss the various representations of a sum. Mention the pros and cons of the representations. (10)

6. a) Show that the set of odd positive integers is a countable set. (10)
 b) "Relations are a generalization of functions" – justify the statement with example. (08)
 c) Let R be a reflexive relation. Is R^n (where $R^n = R^{n-1} \circ R$) necessarily reflexive? Give a reason for your answer. (10)
 d) What do you mean by n -ary relation? Mention some applications of an n -ary relation with example. (07)
7. a) Let n be a positive integer and S be a set of strings. R_n is a relation on S such that $s R_n t$ if and only if $s = t$ or both s and t have at least n characters and first n characters of s and t are the same where $s, t \in S$. Is R_n an equivalence relation on S ? Explain. (10)
 b) During a month with 30 days, a baseball team plays at least one game a day, but no more than 45 games. Show that there must be a period of some consecutive days during which each team must play exactly 14 games. (10)
 c) Define Algebraic System. Discuss the properties of the operations of an Algebraic System. (09)
 d) Define Monoid. Prove that (\mathbb{N}, \times) is a Monoid. (06)
8. a) Suppose that a valid codeword is n -digit number in decimal notation containing an even number 0s. Let a_n denote the number of valid codewords of length n . The sequence $\{a_n\}$ satisfies the recurrence relation $a_n = 7a_{n-1} + 2$ where $a_0 = 5$. Use generating function to find an explicit formula for a_n . (10)
 b) Let S be the square in the plane \mathbb{R}^2 mentioned in the figure below, with its center at the origin (10)
 0. The vertices of S are numbered counterclockwise 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 $\gamma(\alpha)$ 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 .



- c) Consider the ring $Z_{10} = \{0, 1, 2, \dots, 9\}$ of integer modulo 10. (10)
 i) Find the units of Z_{10} .
 ii) Find -3 , -8 and 3^{-1} .
 iii) Let $f(x) = 2x^2 + 4x + 4$. Find the roots of $f(x)$ over Z_{10} .
 d) Define injective function. If composite function $g \circ f$ is onto, does it follow that g is so? (05)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2018
 Department of Computer Science and Engineering
 EEE 1107
 Basic Electrical Engineering

TIME: 3 hours

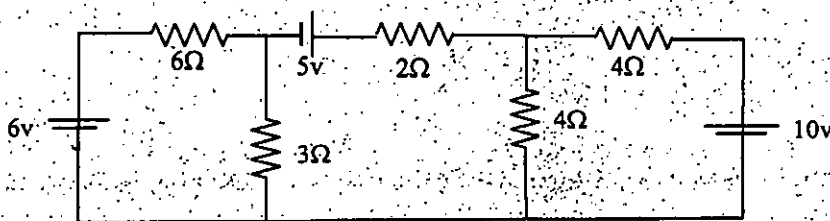
FULL MARKS: 210

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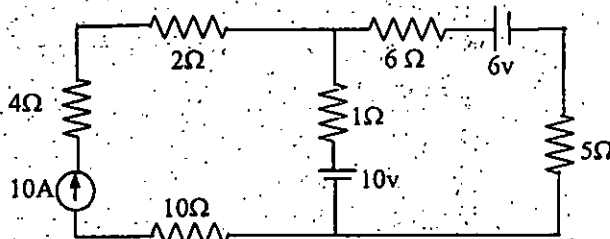
SECTION A

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

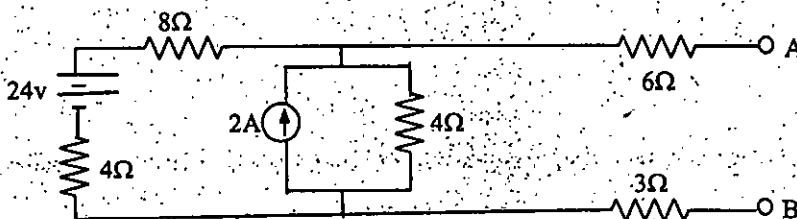
1. a) State and explain Ohm's law, KVL and KCL. (09)
- b) Deduce the condition for maximum power transmission and find the equation for maximum power. (11)
- c) Find all the branch currents using nodal analysis for the following circuit. (15)



2. a) State super position theorem. Find the current through 5ohm resistance using super position theorem for the following circuit. (13)



- b) State Thevenin's theorem and by using the theorem, replace the following network with reference to terminal AB. (13)



- c) For transmission from delta network to equivalent wye network, find each of the wye connected resistances in terms of delta resistances. (09)
3. a) Define measuring instrument and classify. What are the techniques of range extension of ammeter and voltmeter? (11)
 - b) State and explain Ampere circuital law. Compare between electrical circuit and magnetic circuit. (12)
 - c) Define (i) Permeability, (ii) Permittivity, (iii) Magnetic field, (iv) Electric field intensity and (v) Right hand rule. (12)
4. a) What are the factors that determine the induced voltage in a conductor? Derive the equation of generated emf of a DC generator. (12)
 - b) Derive the condition for maximum efficiency of a DC motor. What is meant by back emf? (11)
 - c) What are the factors that control motor speed? A 220V dc machine has an armature resistance of 0.6Ω . If full load armature current is 32A, find the induced emf when the machine acts as (i) motor (ii) generator. (12)

SECTION B

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

5. a) What is phase? Find the angle of phase difference between $v = 100 \cos(\omega t - 30^\circ)$ and $i = -10 \sin(\omega t - 60^\circ)$. Which wave lags? (05)
- b) Define impedance. Find the impedance of an L branch from its dynamic equilibrium equation. (10)
- c) A voltage $v = -150 \sin 377t$ is applied to a particular circuit element and it is found $i = 10 \cos 377t$ amp. Make a sketch of v and i waves. Find the nature and magnitude of the circuit parameter. (10)
- d) Define phasor. Write the significance of j . Express the complex expression as a single number $\sqrt[3]{4.5 - j7.79} + \log_e 10 \angle 172^\circ$. (10)
6. a) Find the equations for energy delivered to an inductor and to a capacitor during a quarter cycle. (10)
- b) Deduce the value of crest factor and form factor of sinusoidal waves. (08)
- c) Calculate real power and reactive power employing complex form. (08)
- d) What are the differences between alternator and synchronous motor? Write the advantages of stationary armature in an alternator. Describe v-curves. (09)
7. a) Write down the principle of operation of single phase transformer. Draw the different equivalent circuits of a transformer. (11)
- b) Describe short circuit test and open circuit test of a single phase transformer. (12)
- c) Describe transformer on no load. Show that for maximum efficiency of a transformer, Cu loss must be equal to the iron loss. (12)
8. a) Mention some application of transformer. What are the main components of a transformer? (07)
- b) Deduce the expression for induced e.m.f. in a transformer and find voltage transformation ratio. (07)
- c) What are different types of 3- ϕ transformer connections? Describe any two of them. (11)
- d) Write down the principle of operation of a synchronous motor. Why synchronous motor is not self-starting? (10)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2018
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) Fill in the blanks with an appropriate modal verb maintaining the sequence of tenses. (14)
- i) You make such a noise that I _____ not work.
 - ii) He asked again whether supper _____ be ready soon.
 - iii) In order that he _____ learn the language quickly, he engaged a teacher.
 - iv) He said that he _____ do it.
 - v) The thieves stole whatever they _____ find in the house.
 - vi) I wished that I _____ come earlier.
 - vii) He worked hard so that he _____ win the prize.
- b) Make sentences expressing the following emotions/notions: (12)
- i) Apology, ii) Annoyance, iii) Approval, iv) Good wish, v) Imprecation, vi) Invitation.
- c) Make sentences using the following phrases and idioms: (09)
- At large; A lot of; By the by; Draw the line; In a fix; Ad interim.
2. a) Make a new word with each of the following prefixes and suffixes and use them in sentences: (14)
- Am..., Be..., De..., Pro..., ...age, ...ling, ...ship.
- b) Make sentences using the following Modal as directed: (12)
- i) Could (To express opportunity in the past which was not executed).
 - ii) Must (To express internal obligation).
 - iii) Must (To express logical deduction in the present).
 - iv) Had better (To express preference).
 - v) Be to (To express command).
 - vi) Be going to (To express strong possibility).
- c) Fill in the blanks with a suitable word. (09)
- i) He went _____ foot.
 - ii) If you boil water, it _____.
 - iii) Would that I _____ fly in the sky.
 - iv) I don't mind _____ bribe.
 - v) How long have you _____ here.
 - vi) _____ of them are genius.
3. a) Frame *wh* questions from the underlined parts of the following sentences. (14)
- i) My relative has come here to stay.
 - ii) The farmer looked very tired at the end of the day.
 - iii) To drive a car requires care and skill.
 - iv) A burnt child dreads the fire.
 - v) A burnt child dreads the fire.
 - vi) Dhaka is the capital of Bangladesh.
 - vii) My father is a school teacher.
- b) Make sentences using the words as directed: Fast (as noun); Fast (as adverb); Present (as verb); Second (as verb); Minute (as noun); Chair (as adjective) (12)
- c) Change the words as directed and make sentences with the changed words: Glass (into verb); (09)
- Able (into verb); Able (into noun); Mouth (into adjective); Village (into adjective); Harmonics (into noun).
4. a) Complete the sentences with subordinate clauses as directed (14)
- i) _____, remains a mystery. (noun clause)
 - ii) I will certain _____. (noun clause)
 - iii) This is the book _____. (adjective clause)
 - iv) This is my teacher _____. (adjective clause)
 - v) _____, you may go home. (adverb clause of time)
 - vi) We eat _____. (adverb clause of purpose)
 - vii) _____ I would go there. (adverb clause of condition)

- b) Transform the following sentences as directed: (12)
- i) I shall always remember you. (negative)
 - ii) She liked ice-cream. (interrogative)
 - iii) I wish I had the wings of a bird. (exclamatory)
 - iv) The man who is reported is a terrorist. (simple)
 - v) He is too poor to lead a decent life. (complex)
 - vi) Gold is more precious than most other metals. (positive)
- c) Correct the following sentences: (09)
- i) One should do his duty.
 - ii) Either of the pen will do.
 - iii) The rich is not always happy.
 - iv) I did not know when he will come.
 - v) He need not to go there.
 - vi) I borrowed my friend's book who is a singer.

SECTION B

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

5. a) Read the passage and answer the following questions: (20)
- In the wild, it often comes down to predator and prey, the hunter and the hunted. As you can imagine, most organisms want to stay alive. They have developed ways of adapting to severe habitats, and hiding or escaping from those who would like to eat them. So how do they do it?
- One very helpful adaptation is called camouflage. You may have been surprised by an animal that using camouflage in the past. It blended into its surroundings so well that you nearly missed seeing it at all. Its coloring, markings, or the physical features resemble its habitat so much that you can look directly at it without seeing it at first. This is often good enough to fool a predator. This helps prey to hide from its predator. But did you know that it often works the other way around, too? Predators can use camouflage to trap their prey. If a predator wants to eat a certain animal, and that animal cannot see it lying in wait, it can pounce on its prey unexpectedly devouring it before it even knows what is happening.
- Another popular adaptation is mimicry. It is when an animal has markings or other physical characteristics that allow it to look like some other kind of animal or plant. If it can make its predators believe that it is something that preys on them, or would at least be difficult or painful to catch, its predator will often go off in search of an easier target.
- Sometimes animals are able to survive when their habitat changes because they adapt to the new conditions. For example, raccoons easily adapt to residential area that have taken over their woodland homes. They often help themselves to any food they can grab, whether it is in trashcans, or inside people's homes!
- i) What is the main idea of the text? Write in one sentence.
 - ii) List two supporting details for the main idea.
 - iii) Write down the adaptations given in the passage.
 - iv) What adaptation did you need to accommodate yourself in Khulna?
- b) Make a précis of the above passage. (15)
6. a) Write a list paragraph on the importance of skilled immigrants. (15)
- b) Amplify the idea contained in the statement: "A bad workman quarrels with his tools". (20)
7. a) Suppose TAL Group Inc Toronto is hiring a Web Engineer on a full time basis. This role will create simple, clean code to power new user-facing product features, refactor and improve existing code etc. Required experience is solid practical experience using any modern JavaScript framework. Prepare your CV and apply for the post. (20)
- b) Your department arranges a discussion session with top national and international companies recruiting CSE graduates. The aim is to reduce job stress, workplace harassment and to enhance skills as required by the companies. Write a memo to inform all the students about the session and attend it mandatorily. (15)
8. a) Write a free composition on any one of the followings: (35)
- i) Your sudden acts of kindness, and ii) Engineering wonders of the world.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2018
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 continuity of a function. A function $f(x)$ is defined as follows: (15)

$$f(x) = \begin{cases} x + \sqrt{2}a \sin x & \text{for } 0 \leq x < \pi/4 \\ 2x \cot x + b & \text{for } \pi/4 \leq x < \pi/2 \\ a \cos 2x - b \sin x & \text{for } \pi/2 \leq x \leq \pi \end{cases}$$

If $f(x)$ is continuous in the interval $0 \leq x \leq \pi$, find the values of a and b .

- b) State Rolle's theorem. Verify Rolle's theorem for $f(x) = 2x^3 + x^2 - 4x - 2$ over $[-\sqrt{2}, \sqrt{2}]$. (12)

- c) Evaluate: $\lim_{x \rightarrow 0} \left(\frac{1}{x} - \frac{1}{xe^x} \right)$. (08)

2. a) State Leibnitz's theorem. If $y = e^{m \sin^{-1} x}$, then show that (13)

$$(1 - x^2)y_{n+2} - (2n + 1)xy_{n+1} - (n^2 + m^2)y_n = 0.$$

- b) Find the relative extreme values (maxima/minima) of the following function using second derivative test: $f(x) = x^3 - 6x^2 + 9x + 5$. (12)

- c) Define subtangent and subnormal. Prove that for the curve $by^2 = (x + a)^3$, the square of the subtangent varies as the subnormal. (10)

3. a) State Euler's theorem. If $u = f(x^2 + 2yz, y^2 + 2zx)$, prove that (14)

$$(y^2 - zx) \frac{\partial u}{\partial x} + (x^2 - yz) \frac{\partial u}{\partial y} + (z^2 - xy) \frac{\partial u}{\partial z} = 0.$$

- b) Define tangent and normal. Find the equation of tangent and normal of the curve $x^3 + y^3 = 3axy$ at $(\frac{3a}{2}, \frac{3a}{2})$, where $a > 0$. (12)

- c) Find $\frac{dy}{dx}$, when $y = x^{\cos^{-1} x} + (\sin x)^{\log x}$. (09)

4. a) Find the nth derivative of $y = \frac{1}{x^2 - 5x + 6} + \cos 2x \cos x$. (12)

- b) Find the Taylor series with remainder of $\sin x$ about $(x - \pi/2)$. (12)

- c) Find the radius of curvature at the origin of the curve $3x^4 - 2y^4 + 5x^2y + 2xy - 2y^2 + 4x = 0$. (11)

SECTION B

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

5. a) Calculate $\int \frac{dx}{(x^2 + 1)\sqrt{x^2 - 4}}$. (12)

- b) Calculate $\int \sin^{-1} \left(\sqrt{\frac{x}{2+x}} \right) dx$. (13)

- c) Calculate $\int (4x + 15)\sqrt{x^2 + 6x + 10} dx$. (10)

6. a) Obtain a reduction formula for $\int \sin^m x \cos^n x dx$. (11)

b) If $U_n = \int_0^1 x^n \tan^{-1} x dx$, then prove that $(n+1)U_n + (n-1)U_{n-2} = \frac{\pi}{2} - \frac{1}{n}$. (12)

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

7. a) Evaluate $\int_0^{\pi} x \log \sin x dx$. (12)

b) Evaluate $\int_0^{\frac{\pi}{4}} \frac{x dx}{1 + \cos 2x + \sin 2x}$. (12)

c) Evaluate $\int_0^2 x(8-x^3)^{1/3} dx$. (11)

8. a) Evaluate: $\lim_{n \rightarrow \infty} \left[\frac{1}{\sqrt{n^2-1^2}} + \frac{1}{\sqrt{n^2-2^2}} + \dots + \frac{1}{\sqrt{n^2-(n-1)^2}} \right]$. (09)

b) Define Gamma and Beta function. Find the relation between Gamma and Beta function. (15)

c) Using double integral to find the area of common portion of the curves $y^2 = 12x$ and $x^2 = 12y$. (11)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2018
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 ultra violet catastrophe? What is the significance of it in the development of modern physics? (10)
- b) Show that the spectral distribution of black body radiation derived by Plank is (15)
$$n(\nu)d\nu = \frac{8\pi h\nu^3}{c^3} \frac{1}{\exp\left(\frac{h\nu}{kT} - 1\right)} d\nu$$

Derive Wein's law and Rayleigh-Jeans law as a function of frequency for high and low frequency limit respectively.
- c) The longest wavelength of light that will cause photo emission from sodium is approximately 540nm. (10)
 - i) Find the work function of sodium.
 - ii) Find the maximum kinetic energy for photo electrons emitted when light of wave length 400nm strikes a sodium plate.
2. a) Why was a change in the Bohr model of atom required? Mention the quantum numbers associate with vector atom model. (10)
- b) Explain Compton effect and show that Compton shift depends only on the angle of scattering and it is independent of the wavelength of the incident photons. (15)
- c) In a Compton effect experiment in which the incident X-ray have wavelength of 10pm, the scattered X-ray at a certain angle have a wavelength of 10.5pm. Find the momentum (magnitude & direction) of the corresponding recoil electrons. (10)
3. a) What is quantum mechanics? What are the old and new 'quantum mechanics'? (10)
- b) What is the need of Schrodinger's wave equation? Develop time-dependent and time-independent Schrodinger's wave equations. (15)
- c) Find the first excited state of the harmonic oscillator. (10)
4. a) What are the common defects in the images produced by a single lens? Obtain the conditions for achromatism of two thin lenses of the same materials placed at a distance apart. (12)
- b) Why, in Young's double slit experiment, the slit-slit separation should be small and the slit-screen separation large? (13)
- c) The radius of the 10th dark ring in Newton's ring apparatus changes from 60 to 50 mm when a liquid is introduced between the lens and the plate. Calculate the refractive index of the liquid. (10)

SECTION B

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

5. a) Define the terms (i) Unit cell (ii) Polycrystalline (iii) Basis (iv) Miller index and (v) Amorphous solid. (15)
- b) Define atomic packing fraction. Find the atomic packing fraction in a crystals for (i) Simple cubic, (ii) Body centered cubic and face centered cubic structures, treating the atoms as spherical. (10)
- c) In Bragg's law set up, X-rays were diffracted by a fcc crystal having lattice constant 0.407nm at an angle $2\theta = 26.697^\circ$ from the (220) planes. Find the wavelength of X-rays. (Assume first order diffraction). (10)
6. a) Discuss the inelastic scattering photons by phonons and obtain an expression for the frequency of phonon emitted in the process. (10)

- b) Following Einstein theory deduce an expression for the lattice heat capacity. Discuss the successes and failures of this model. (15)
- c) The Debye temperature of carbon (diamond structure) is 1850K. Calculate the specific heat per k-mole for diamond at 20K. Also compute the highest lattice frequency involved in the Debye theory. (10)
7. a) What are the outstanding properties of metals in the case of free electron model? Obtain an expression for the thermal conductivity from the free electron theory of metals. (15)
- b) Derive the expression for Fermi energy of a free electron in the three dimensions. (10)
- c) Show that the average kinetic energy of an electron at 0K is $\frac{3}{5} E_f$, where E_f is the Fermi energy at Fermi surface. (10)
8. a) What are temporal and spatial coherence? Which properties of the LASER they lead to? (10)
- b) Explain the terms (i) Induced absorption (ii) Spontaneous emission and (iii) Stimulated emission. Describe the working principle of Ruby LASER with suitable diagram. (15)
- c) A LASER beam has a power of 50 mw. It has an aperture of 5.1×10^{-3} m and it emits light of wavelength 7200 Å. The beam is focused with a lens of focal length 0.1m. Calculate the area and the intensity of the image. (10)