

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2016
 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", "Converse" and "Inverse" propositions using example(s). (09)
 b) Find a proposition that is equivalent to $p \rightarrow q$, but that uses only the connectives \neg , \wedge , and \vee . (08)
 Hence, prove its validity.
 c) What are logical quantifiers? Give the physical example(s) for the following relations: (10)
 (i) $\neg \exists x P(x) \Leftrightarrow \forall x \neg P(x)$ (ii) $\neg \forall x Q(x) \Leftrightarrow \exists x \neg Q(x)$
 d) Suppose that we have an array of size 6×6 . 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 do you mean by "Rules of Inference" in mathematical reasoning? List the rules of (10)
 inferences for mathematical reasoning.
 b) Express the following statements in the logical arguments using quantifiers, connectives and (10)
 corresponding predicates.
 "All lions are fierce"
 "Some lions do not drink coffee"
 "Some fierce creatures do not drink coffee".
 c) What is linear congruential method? Use this method to find pseudo random numbers within (10)
 the limit 0 to 12.
 d) Let a be an integer and d a positive integer. Then prove that there are unique integers q and r , (05)
 with $0 \leq r < d$, such that $a = dq + r$.

3. a) Explain the idea of induction method using example. (10)
 b) Use induction method to find an ordering of all the n -bit strings in such a way that two- (10)
 consecutive n -bit strings differed by only one bit.
 c) Provide a recursive definition of the sequence $\{a_n\}$, $n = 1, 2, 3, \dots$, if (i) $a_n = 3n + 1$ (10)
 (ii) $a_n = 2^n$.
 d) The Fibonacci numbers f_0, f_1, f_2, \dots are defined by the equations $f(0) = 0, f(1) = 1$ and (05)
 $f(n) = f(n-1) + f(n-2)$ for $n = 2, 3, 4, \dots$. Draw the recursive Fibonacci evaluation tree for
 $f(5)$.

4. a) What is a graph? Let $G = (V, E)$ be a graph with directed edges. Then prove that (10)

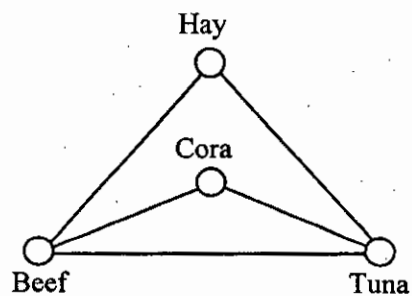
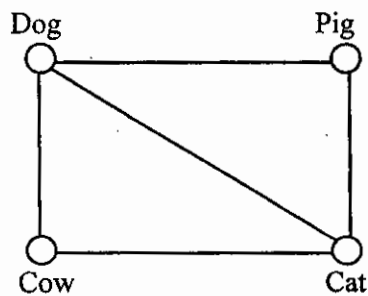
$$\sum_{v \in V} \text{deg}^-(v) = \sum_{v \in V} \text{deg}^+(v) = |E|$$

 b) In a round-robin tournament, each team plays against each other team exactly once. Suppose (08)
 that Alpha, Beta, Gamma and Theta teams are registered for the tournament. Represent the
 result of the tournament (which team beats which other team) using a proper graph. Hence,
 find the in-degrees and out-degrees of the teams.
 c) Name the different methods to represent graphs. Draw the graph for the following adjacency (10)
 matrices:

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

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

- d) What are the necessary and sufficient conditions for two graphs to be isomorphic? Are the (07)
 following two graphs isomorphic? Explain.

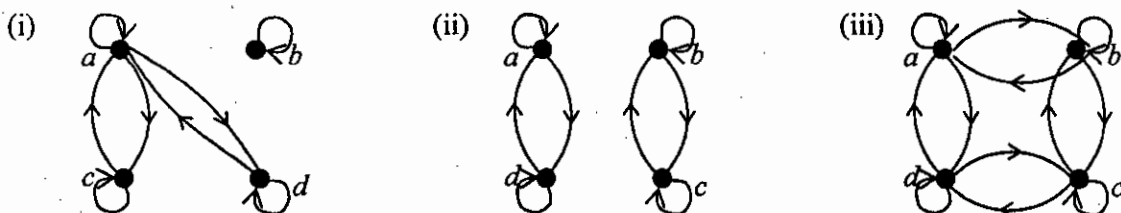


SECTION B

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

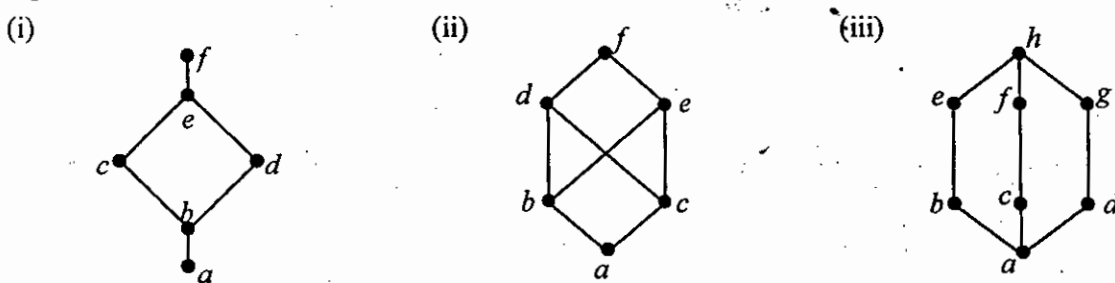
5. a) What is a tree? Prove that a tree with n vertices has $n-1$ edges. (08)
- b) What is power set? Prove De Morgan's law by membership table. (05)
- c) Let " f " is a function from Z^+ to R such that $f(x) = \lfloor \sqrt{x} \rfloor$. What is the domain and co-domain (10) of " f "? Determine whether " f " is injective or surjective. Explain.
- d) Prove that if x is real number then $\lfloor 2x \rfloor = \lfloor x \rfloor + \lfloor x + \frac{1}{2} \rfloor$. (12)

6. a) Let $A = \{1, 2, 3, 4\}$ and R is a relation on A such that $R = \{(a, b) \mid a \text{ divides } b\}$, show the (10) different representations of R .
- b) What is equivalence relation? Determine whether the relation with the directed graphs shown (12) as follows is an equivalence relation. Explain.



- c) Using proper steps draw a Hasse diagram of the poset $(\{2, 4, 5, 10, 12, 20, 25\}, |)$ and find (13) the followings:
 - i) Maximal elements
 - ii) Minimal elements
 - iii) Greatest and least element
 - iv) Upper and lower bound of $\{4, 10\}$

7. a) Define Lattice. Determine whether the posets with the following Hasse diagrams are Lattices. (10) Explain.



- b) Define sequence. Sum of the geometric series a, ar, ar^2, \dots, ar^k is given by $S = \sum_{i=0}^k ar^i$, where (12) $a, r \in R$. Reduce the closed form of S .
- c) Define product rule. How many bit strings of length eight either start with a 1 or end with the (08) two bits 00?
- d) Draw the tree diagram for finding the number of bit strings of length 4 that do not have two (05) consecutive 0's.

8. a) What is algebraic system? What are the conditions needed for an algebraic system to be a (09) group? Give example.
- b) Suppose that a person deposits \$10,000 in a savings account at a bank yielding 12% per year (08) with interest compounded annually. How much will be in the account after 40 years?
- c) Find the solution of the recurrence relation $a_n = 6a_{n-1} - 11a_{n-2} + 6a_{n-3}$, with the initial (10) conditions $a_0 = 2, a_1 = 5$ and $a_2 = 15$.
- d) Using Generating function determine the number of different ways eight identical balloons (08) can be distributed among three distinct children if each child receives at least two balloons and no more than four balloons.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
 B.Sc. Engineering 1st Year 1st Term Examination, 2016
 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.
 ii) Figures in the right margin indicate full marks.
 iii) B-H curve may be supplied if necessary.

SECTION A

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

1. a) Define: (i) node (ii) mesh (iii) linear circuit. (06)
 b) Using mesh analysis, determine the currents for the network in Fig. 1(b). (12)

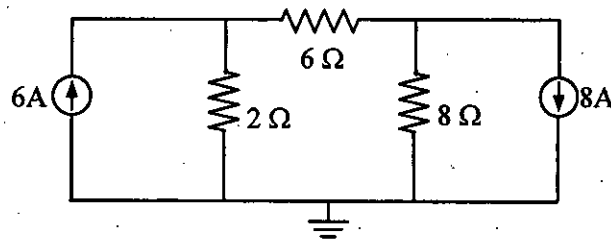


Fig. 1(b).

- c) Deduce the condition for maximum power transfer. Under maximum power transfer (11) conditions, show that the power transfer efficiency is 50%.
 d) Arrange seven resistors each having a magnitude of 4 ohm in such a way so that the (06) equivalent circuit resistance will be 7 ohm.
2. a) Mention three conditions for applying superposition theorem in a circuit. Using (13) superposition theorem, find the current through 10Ω resistor of Fig. 2(a).

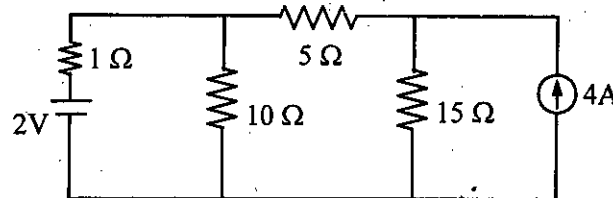


Fig. 2(a).

- b) Find the Thevenin's equivalent circuit for the network shown in Fig. 2(b) across the R_L . (12)

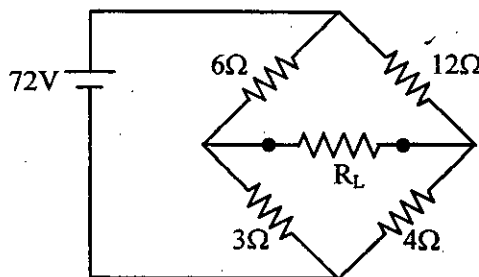


Fig. 2(b).

- c) For transformation from 'delta network' to equivalent 'wye network' find each of the 'wye' (10) connected resistance in terms of three 'delta' connected resistances.
3. a) Define magnetic field, flux density and permeability. State Ampere's circuital law for (10) magnetic circuit and give an example.
 b) Write the principle of generator and motor. Describe a practical dc generator. (12)
 c) Classify dc generators according to their excitation with necessary diagrams. Describe the (13) three important characteristic curves of dc generator.
4. a) Describe armature reaction and its effects. (06)
 b) Define critical resistance and explain voltage build up of a shunt generator. (10)
 c) Define counter e.m.f. and write its significance. (07)
 d) Mention the methods of speed control of a dc motor. Describe any one of them. (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. Show that at no time the power in a pure resistance reach negative values. (06)
- c) Find the impedance of an L branch from its dynamic equilibrium equation. (12)
- 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 the v and i waves. Find the nature and magnitude of the circuit parameter. (12)
6. a) Show that the crest factor of sine wave is $\sqrt{2}$ and the form factor is 1.11. (10)
- b) Find the equations for the amount of energy during a quarter cycle of an inductor and a capacitor. (15)
- c) Find the equation of instantaneous power delivered to the R-L branch and from the equation define real and reactive power. Also represent the power graphically. (10)
7. a) What is phasor? Write the significance of operator j . (04)
- b) 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 p.f., reactive factor and volt-amp? (12)
- c) Why is transformer rating in KVA? Describe the open circuit test and short circuit test of a single phase transformer. (13)
- d) What are the differences between alternator and synchronous motor? Write the advantages of stationary armature in an alternator. (06)
8. a) Write the working principle of a transformer. Define step up and step down transformer. Write some applications of them. (12)
- b) What are the losses in a transformer? Define efficiency and find the condition for maximum efficiency of a transformer. (08)
- c) Describe transformer on (i) no-load and on (ii) load conditions. Draw necessary vector diagrams. Give constructional details of a transformer and write also the methods of cooling of it. (15)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2016
Department of Computer Science and Engineering
HUM 1107
English & 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 W/H questions from the underlined parts of the following answers. (14)
- i) On a rainy day, the little boys want to go out.
 - ii) I read in Khulna B.L. college.
 - iii) Banga Bandhu was a man of tolerant view.
 - iv) Nobody believes a liar.
 - v) The book being costly, I could not buy yesterday.
 - vi) KUET is at Fulbarigate, Khulna.
 - vii) The train is running slowly.
- b) Make sentences using the following words as directed. (12)
So (as adverb); So (as conjunction); Wrong (as verb); Wrong (as adverb); What (as adjective); What (as pronoun).
- c) Change the following words as directed and use them in sentences. (09)
Feeble (into verb); Grass (into verb); Mouth (into adjective); Knowledge (into adjective); Hospital (into noun); Abnormal (into noun);
2. a) Make a new word with each of the following prefixes and suffixes and use them in (14) sentences.
Out....., Post....., Se....., De.....,en,ling,ty.
- b) Frame sentences expressing the following emotions/notions. (12)
i) Approval ii) Disapproval iii) Good wish iv) Condolence v) Regret vi) Greeting
- c) Make sentences using the following phrases and idioms. (09)
Ad hoc; A slow coach; Small talk; Snake in the grass; Come of; Brown study.
3. a) Complete the following sentences with subordinate clauses as directed. (14)
- i) He came here (Subordinate Adv. Clause of purpose)
 - ii) I shall go (Adverb clause of place)
 - iii) Had I been rich, (Adverb clause of condition)
 - iv) I know (Noun clause)
 - v) I know the place (Adjective clause)
 - vi) I wonder (Noun clause)
 - vii) This is KUET (Adjective clause)
- b) Write one synonym and one antonym of each of the following: (12)
Authentic; Contented; Eternal; Liberty;
- c) Supply a suitable word to fill up the gap of the following sentences. (09)
- i) The boy in study should not be disturbed.
 - ii) a nice time we had.
 - iii) I shall do it to your direction.
 - iv) My father was much by my conduct.
 - v) The man died overeating.
 - vi) The new comer asked KUET is.
4. a) Put the verb into the correct form. (14)
- i) I don't mind home but I would rather get a taxi. (walk)
 - ii) I can't make a decision. I keep my mind. (change)
 - iii) He had made his decision and refused his mind. (change)
 - iv) Did I really tell you that I was unhappy? I don't remember that. (say)
 - v) The water here was not very good. I would avoid if I were you. (drink)
 - vi) How do you make this machine? (work)
 - vii) How old were you when you learnt (drive)

- b) Make sentences using Modal auxiliaries following the instructions given below. (12)
- To express opportunity in the past.
 - To express obligation in the present.
 - To express inference.
 - To express unnecessary action in past.
 - To express strong possibility.
 - To express guess about the present.
- c) Name the parts of speech of the underlined words of the following sentences. (09)
- Respect your bettors.
 - I know English better than French.
 - His action surprised the by-standers.
 - The train has passed by.
 - Sit by me.
 - Few know where he is.

SECTION B

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

5. a) Read the passage and answer the following questions: (20)
- We have a big, well-equipped library in our university. There is a librarian in charge of it. Students may borrow books from this library, but they may not lend them to others without the permission of the librarian. Students may borrow two books at a time. They may keep these books for any length of time up to a fortnight. If they do not return them by the end of this period, they may be refused permission to borrow any more.
- The library has a reference section. The books in this section may not be taken away. There are also magazines and newspapers in the library. These, like the reference books, may not be borrowed.
- There are a number of rules for behavior in the library. The librarian thinks that students ought to put back the books in their correct places on the shelves. They ought to leave the magazines and newspapers in good order. They ought to treat the books carefully and keep them in good condition. Students may not talk in the library or disturb others there. They ought also to keep reasonably quiet when they are passing along outside the library.
- Why do you think borrowers may not keep their books for longer than a fortnight?
 - Why must students put books back in their proper places?
 - Why does the librarian not allow students to talk in the library?
 - Why may students not take reference books away?
- b) Make a précis of the above passage. (15)
6. a) Write a list paragraph on importance of computer in modern medical treatment. (15)
- b) Amplify the idea contained in of the following: (20)
- Eternal vigilance is the price of liberty.
7. a) Write a composition on any one of the following: (35)
- Antisocial activities in educational institutions.
 - Uses and abuses of smart phones in English lab.
8. a) Write an informal report to your Head of the department for arranging computer fairs by CSE (15) students in different high schools.
- b) Suppose there is a post of computer Engineer vacant in Bangladesh Bank. Prepare your CV (20) and apply for the post.

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2016
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 of a function. Discuss the continuity and differentiability of the function (15)
 $f(x) = |x-2| + |x+4|$ at $x = -4$.
- b) Differentiate $x^{\sin x}$ with respect to $(\sin x)^x$. (08)
- c) If $y = e^{a \sin^{-1} x}$ then find $y_{n+2}(x)$. (12)
2. a) State Rolle's theorem. Expand $\sin(m \sin^{-1} x)$ in ascending powers of x . (15)
- b) Define maxima and minima of a function. Given $xy = 4$, find the maximum and minimum values of $4x + 9y$. (10)
- c) If $u = e^{xyz}$, then prove that $\frac{\partial^3 u}{\partial x \partial y \partial z} = (1 + 3xyz + x^2 y^2 z^2) e^{xyz}$. (10)
3. a) Define homogeneous function. If $u = F(y-z, z-x, x-y)$, then prove that $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} + \frac{\partial u}{\partial z} = 0$. (15)
- b) Evaluate $\lim_{x \rightarrow 0} \left(\frac{\tan x}{x} \right)^{\frac{1}{x}}$. (10)
- c) Find $\frac{dy}{dx}$, $\sin x^{\cos y} + \cos x^{\sin y} = 0$ (10)
4. a) Find where the tangent is parallel and perpendicular to the x -axis for the curve (15)
 $ax^2 + 2hxy + by^2 = 1$.
- b) Find the equations of the normal at $\theta = \pi/2$ to the curve $x = a(\theta + \sin \theta)$, $y = a(1 + \cos \theta)$. (10)
- c) Find the radius of curvature of the curve $\sqrt{x} + \sqrt{y} = \sqrt{a}$ at the point where $y = x$ cuts it. (10)

SECTION B

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

5. Integrate any three of the followings: (35)

i) $\int \frac{1}{x^4 - 1} dx$

ii) $\int \frac{1}{(x^2 + 1)\sqrt{x^2 + 4}} dx$

iii) $\int \frac{4x - 1}{\sqrt{6x^2 + 6x + 1}} dx$

iv) $\int e^x \frac{(1 + \cos x)}{(1 + \sin x)} dx$

6. Evaluate any three of the followings: (35)

i) $\int_0^{\pi/2} \frac{dx}{1 + \sqrt{\cot x}}$

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

iii) $\int_0^{\pi/2} \ln(\sin x) dx$

iv) $\lim_{n \rightarrow \infty} \left[\frac{1}{n^4 + 1} + \frac{2^3}{n^4 + 2^4} + \frac{3^3}{n^4 + 3^4} + \dots + \frac{1}{2n} \right]$

7. a) Obtain the reduction formula for $\int e^{ax} \sin^n x dx$. (13)
- b) Define Beta function and Gamma function. Prove that $\Gamma(\frac{1}{2}) = \sqrt{\pi}$. (12)
- c) Find the area of a loop of the curve $a^2 y^2 = x^2(a^2 - x^2)$. (10)
8. a) Find the volume and the surface area of the solid generated by revolving the cardioide $r = a(1 - \cos\theta)$ about the initial line. (15)
- b) Find the length of the perimeter of the astroide $x^{2/3} + y^{2/3} = a^{2/3}$. (14)
- c) Define proper and improper integral with examples. (06)

KHULNA UNIVERSITY OF ENGINEERING & TECHNOLOGY
B.Sc. Engineering 1st Year 1st Term Examination, 2016
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 any missing.

SECTION A

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

1. a) Distinguish between photoelectric effect and Compton effect. Discuss their significance in the development of modern physics. (10)
- b) Derive an expression for the Compton shift and give reason how it supports the concept of photon. (15)
- c) The longest wavelength of light that will cause photo emission from sodium is approximately 540 nm. (10)
 - i) Find the work function of sodium.
 - ii) Find the maximum kinetic energy for photo electrons emitted when light of wavelength 400 nm strikes a sodium plate.
2. a) According to Bohr model under what condition an electron can radiate electromagnetic energy? Mention the quantum numbers associated with vector atom model. (12)
- b) What is wave packet? What do you understand by phase velocity and group velocity of the matter waves? Derive a relation between them. (13)
- c) What is the de-Broglie wavelength of Ping-Pong ball of mass 2.0g after it is slammed across the table with speed 5m/s? (10)

3. a) The one-dimensional time-independent Schrödinger equation is (25)

$$\left(-\frac{\hbar^2}{2m}\right)\frac{d^2\psi(x)}{dx^2} + V(x)\psi(x) = E\psi(x)$$

- i) Give the meanings of the symbols in this equation.
- ii) A particle of mass "m" is contained in a one-dimensional box of width "a". The potential energy V(x) is infinite at the walls of the box (x = 0 and x = a) and zero in between (0 < x < a). Solve the Schrödinger equation for this particle and hence show that the normalized solution have the form $\Psi_n(x) = \sqrt{\frac{2}{a}} \sin\left(\frac{n\pi x}{a}\right)$, with energy $E_n = \frac{\hbar^2 n^2}{8ma^2}$, where "n" is an integer.
- iii) Sketch the wave functions and the probability density distribution for the cases n = 1, 2 and 3.

- b) Find $\langle P \rangle$ and $\langle P^2 \rangle$ for the ground state wave function of the infinite square well. (10)

4. a) What is spherical aberration? How is it minimized when two thin lenses are placed at a distance from each other? (10)
- b) Obtain the condition for maximum and minimum intensity of light in Young's double slit experiment. Find the average intensity of the interference pattern and show that it is exactly that which would exist in the absence of interference. (15)
- c) In a Newton's ring's experiment the radius of curvature of the lens is 5 m and its diameter is 20 mm. How many bright rings are produced in the reflected rays? The wavelength of light used is 589 nm. (10)

SECTION B

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

5. a) In practice how many crystal systems are possible? Give the names starting the relationship (15) between crystallography axes and the angle between them.
- b) State the properties of a reciprocal lattice. How is a reciprocal lattice constructed from a direct (10) lattice?
- c) In a unit cell of simple cubic structure, find the angle between the normal to pair of planes (10) whose Miller indices are (i) [211] & [110] and (ii) [111] & [312].
6. a) What is the difference between photons and phonons? Explain 'Normal' process and (10) 'Umklapp' process.
- b) What are the assumptions of Debye model for the lattice specific heat? Calculate the lattice (15) specific heat according to the Debye theory.
- c) Calculate the maximum phonon frequency generated by scattering of visible light of (10) wavelength $\lambda = 4000 \text{ \AA}$. Given that velocity of sound in medium is $5 \times 10^5 \text{ cm/s}$ and refractive index is 1.5.
7. a) What are static and transport properties in the case of free electron model? Obtain an (12) expression for the electrical conductivity of a metal on the basis of free electron theory. Hence prove Ohm's law.
- b) Show that the density of states of free electron is given by $D(E) = \frac{V}{2\pi^2} \left(\frac{2m}{\hbar^2} \right)^{\frac{3}{2}} E^{\frac{1}{2}}$. Use this (13) expression to discuss number of filled states between electronic energy levels.
- c) Aluminium metal crystallizes in *fcc* structure. If each contributes single electron as free (10) electron and the lattice constant ' a ' is 4.1 \AA . Calculate treating conduction electrons as free electron Fermi gas (i) Fermi energy and Fermi vector, (ii) Total kinetic energy of free electron gas per unit volume at $0K$ [$\hbar = 1.054 \times 10^{-27} \text{ erg-sec}$, Electron rest mass = $9.11 \times 10^{-28} \text{ gm}$].
8. a) Give brief outlines of generation of coherent radiation. Discuss the characteristics of a (12) LASER light.
- b) Describe briefly the principle, construction and working of a ruby LASER. (13)
- c) The coherence length for sodium light is $2.84 \times 10^{-2} \text{ m}$. the wavelength of sodium light is (10) 5890 \AA . Calculate (i) the number of oscillation corresponding to the coherence length and (ii) the coherence time.