

University of Dhaka  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester B. Sc Final Examination, 2016  
CSE-1101: Fundamentals of Computers and Computing

Time: 2.5 Hours

Total Marks: 60

(Answer any Four (4) of the following Questions)

1. a) How many bits (binary digits) do you need to uniquely represent all the students in your class? Explain briefly. 4
- b) Write a flow chart to read the time in a clock. Assume you have a regular clock with three hands. Long one for minutes, short one for hours and thin one for seconds. (If you can't write the flow chart, write the algorithm (solution steps) for partial marking) 6
- c) Write a recursive algorithm (step by step description) to find the sum of digits of a given number. 5
2. a) Convert the following numbers in the most efficient way possible:
  - i.  $(1101001)_2 = (?)_{10}$  1+
  - ii.  $(1304)_{10} = (?)_4$  1+
  - iii.  $(110.1002)_3 = (?)_{10}$  1+
  - iv.  $(13.5625)_{10} = (?)_4$  2
  - v.  $(13.75)_{64} = (?)_2$
- b) Perform the following operations without converting the numbers in decimal. Show all the intermediate steps.
  - i.  $(FA02)_{16} + (1A5)_{16}$  2+
  - ii.  $(FA02)_{16} - (1A5)_{16}$  2+
  - iii.  $(FA02)_{16} \times (1A5)_{16}$  2+
  - iv.  $(5573)_8 \div (15)_8$  3
3. a) What do you mean by input and output devices? Write down some examples of input and output devices. 4
- b) What happens when we press a key in a keyboard? Explain in details with an example. 5
- c) Describe the working procedure of a laser printer. 6
4. a) What is a kernel? Describe its responsibilities. 5
- b) Compare between Star, Ring, Mesh topologies in terms of cost, efficiency and vulnerability to failure. 6
- c) As more RAM increases the performance of a system, why do we bother to buy a hard disk? State reasons as to why we need both RAM and hard disk in our machine. 4
5. a) Write output for the following code segment. 3
 

```
double a, b;
int x, y;
a = 3.14159625;
b = 3.97;
x = a + b;
y = (int)a + (int)b;
printf("%lf %d %lf", a, x, b, y);
```
- b) Write a program that will take the radius and height of a cylinder as input and output its volume. 4
- c) Write scanf statement for taking input for the following scenarios:
  - i. Two integers separated by spaces. 5
  - ii. Three integers separated by commas.
  - iii. A time (Format h:m:s)
  - iv. A date (Format d/m/y)
  - v. Two 2 digit integers and One 1 digit integers not separated by spaces.
- d) Write how the following expression will be evaluated. You need to mention the data type of each individual operation. 3
 

```
int a = 3, b = 4;
double d = 5.4;
char c = 100;
double res = (((a * c) / b) / (int)d) * d;
```

6. a) Write output for the following code segment.

```
int a = 3, b = 5;

void sum() {
    a = a + b;
    b = b + 1;
    printf("%d %d\n", a, b);
}

main() {
    sum();
    sum();
    sum();
    return 0;
}
```

- b) Given a time in 24 hour format, find which part of day is it. The parts are: Dawn (5:00 to 7:00), Morning (7:01 to 11:45), Noon (11:46 to 15:00), Afternoon (15:01 to 17:30), Evening (17:31 to 19:15) and Night. 7
- c) Write a function XOR, which takes two values as input (0 or 1) and returns the logical XOR of those values. You can't use the logical or bitwise operators in C to write the function. Also show the appropriate calling of XOR function from main function. 5



University of Dhaka  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester B. Sc Final Examination, 2016  
CSE-1102: Discrete Mathematics

Time: 2.5 Hours

Total Marks: 60

(Answer any Four (4) of the following Questions)

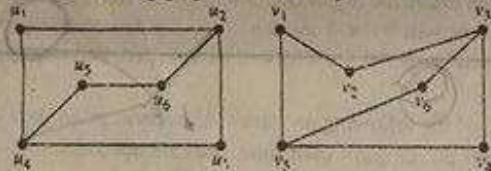
1. a) Let  $A = \{1, 3, 5, 7, 9\}$  and  $B = \{2, 4, 6, 8, 9\}$ . Find symmetric difference of A and B. 1.5  
 b) Define partition. 2.5  
 c) Mention main two differences between relation and function. 2  
 d) Find cardinal number of the set:  $A = \{5, 8, 11, 14, \dots\}$ . 1.5  
 e) Let  $xy = 36$  is a relation on the positive integers  $N$ . Is the relation i) Reflexive? 4  
 ii) Symmetric? iii) Antisymmetric? iv) Transitive? Justify your answers. 3.5  
 f) Consider a set  $S = \{a, b, c\}$  and the relation  $R$  on  $A$  defined by  
 $R = \{(a, c), (b, b), (c, a), (c, b)\}$  Find reflexive (R) and transitive (R). 2
2. a) Are the propositions logically equivalent?  $(p \rightarrow (q \vee r))$  and  $(p \wedge q) \leftrightarrow r$  1  
 b) State contrapositive of the implication:  
 If tortoise can run fast then  $1+1=3$ . 3  
 c) Express the following statements using logical connectors and quantifiers.  
 i) Some propositions are tautology.  
 ii) All Bangladeshi movies are not funny. 4.5  
 d) Using rules of inferences prove the argument: If it does not rain or if it is not foggy, then the sailing race will be held and the lifesaving demonstration will go on. If the sailing race is held, then the trophy will be awarded. The trophy was not awarded. It rained. 2  
 e) Draw the conclusion(s) of the following premises: All rodents gnaw their food. Mice are rodents. Rabbit do not gnaw their food. Bats are not rodents. 1.5  
 f) Translate the following statements into logical expressions: +1  
 i) "You can have lunch at TSC cafeteria only if you are a computer science student or you are not an MS student"  
 ii) "The product of two negative integers is always positive"
3. a) Solve each linear congruence equation: 5  
 i)  $3x \equiv 1 \pmod{7}$  ii)  $3x \equiv 3 \pmod{9}$  iii)  $3x \equiv 2 \pmod{9}$   
 b) Find the smallest positive integer  $x$  such that when  $x$  is divided by 3 it yields a remainder 2, when  $x$  is divided by 5 it yields a remainder 3, and when  $x$  is divided by 7 it yields a remainder 2? 3  
 c) What is the difference between induction and strong induction? 1  
 d) Using mathematical induction prove that  $(n^3 - n)$  is divisible by 6 whenever  $n$  is a nonnegative integer. 3  
 e) Using strong induction prove that every amount of postage of 12 taka or more can be formed just using 4 taka and 5 taka stamps. 3
4. a) Is  $A = \{x; x \text{ is a prime}\}$  closed under the operation of addition? 1  
 b) Let  $*$  be the operation on the set  $S = N \times N$  defined by  $(x, y) * (p, q) = (xq + yp, yq)$  6.5  
 i) Is  $(S, *)$  a semigroup? Is it commutative?  
 ii) Find the identity element.  
 iii) Which elements have inverses and what are they?  
 Define  $f: (S, *) \rightarrow (Q, +)$  by  $f(x, y) = x/y$ . Show that  $f$  is a homomorphism.  
 c) Consider the group  $G = \{1, 2, 3, 4, 5, 6\}$  under multiplication modulo 7. Is  $G$  cyclic? 2  
 d) Define subgroup. 2



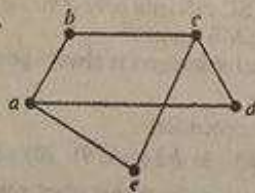
- e) Consider the ring  $Z_{15} = \{0, 1, 2, \dots, 14\}$ . Find the units of  $Z_{15}$ . Find  $-3$  and  $3^{-1}$ . 2.5  
 f) Consider the symmetric group  $S$ . Let  $\alpha = \begin{pmatrix} 1 & 2 & 3 & 4 & 5 & 6 \\ 3 & 6 & 2 & 5 & 1 & 4 \end{pmatrix}$ . Find  $\alpha^{-1}$ . 1

5. a) What is the minimum number of students required in a discrete mathematics class to be sure that at least six will receive the same grade, if there are five possible grades, A, B, C, D and F? 1.5  
 b) Suppose repetitions are not permitted. How many three-digit numbers can be formed from the six digits 2, 3, 5, 6, 7 and 9? How many of these numbers are less than 400? 2.5  
 c) Find the number of mathematics students in a college taking at least one of the languages French, German and Russian given the data: 62 study French, 45 study German, 40 study Russian, 20 study French and German, 23 study French and Russian, 15 study German and Russian, 5 study all three languages. 2.5  
 d) Suppose that a saleswoman has to visit eight different cities. She must begin her trip in a specified city, but she can visit other seven cities in any order she wishes. How many possible orders can the sales woman use when visiting these cities? 3  
 e) How many 7 bit binary numbers start with 1 or end with 0? 2  
 f) Is it possible to draw a graph with vertices of degrees 1, 2, 2, 4, 5? 1+  
 For which values of  $m$  and  $n$ ,  $K_{m,n}$  becomes regular? 1+  
 Find number of vertices and edges of  $W_{20}$ . 1.5

6. a) Mention two main differences between graph and tree. 2  
 b) Prove that the following graphs are isomorphic to each other. 5



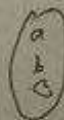
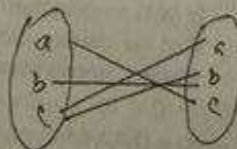
c)



Is it a bipartite graph?

- d) Draw  $G$  and its planar representation. 1.5  
 e) Is it possible to exist a Euler circuit in the following graph? If possible show the circuit. 2.5

Using Welch-Powell algorithm find chromatic number of this graph. 1.5





University of Dhaka  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester B. Sc Final Examination, 2016  
EEE-1103: Electrical Circuits

Total Marks: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

1. a) On which factors the resistance of a material depends? Relate those factors to find the resistance of a material. 3
- b) Determine the resistance of the thin-film resistor in Fig. 1.1 if the sheet resistance  $R_s$  (defined by  $R_s = \rho/d$ ) is  $100 \Omega$ . 3

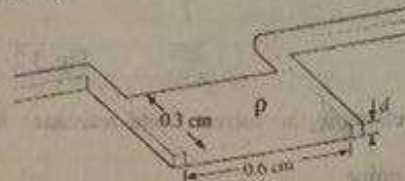


Fig. 1.1

- c) Describe the temperature effect on the resistance of conductors, semiconductors, and insulators. 4
  - d) Define power and energy. How much energy (in kilowatt hours) is required to light a 60 W bulb continuously for 1 year (365 days)? 3+2
2. a) State voltage divider rule. Verify the statement with the help of a series circuit and Ohm's law. 4
  - b) For the series circuit in Fig. 2.1: 4
    - i) Determine  $V_2$  using Kirchhoff's voltage law.
    - ii) Determine current  $I_2$ .
    - iii) Find  $R_1$  and  $R_2$ .

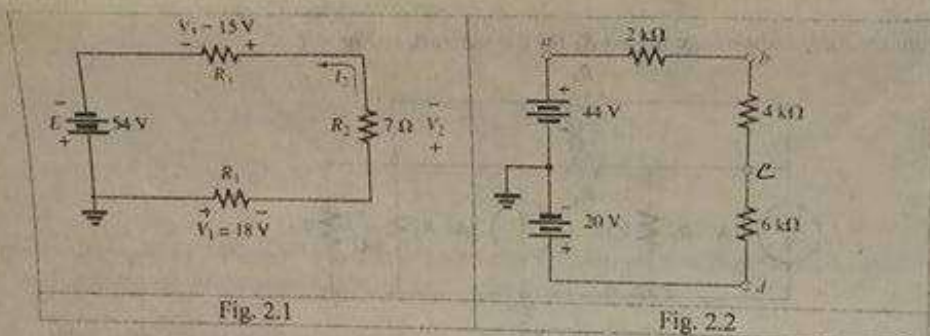


Fig. 2.1

Fig. 2.2

- c) For the network in Fig. 2.2, determine the voltages: 4
  - i)  $V_a, V_b, V_c, V_d$
  - ii)  $V_{ab}, V_{cb}, V_{cd}, V_{ca}$
- d) Using Kirchhoff's voltage law, find the unknown voltages for the configurations in Fig. 2.3. 3

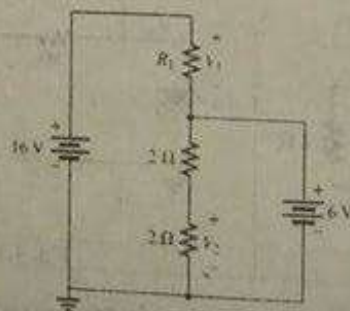


Fig. 2.3

$V = IR$   
 $I = \frac{V}{R}$

3. a) State Kirchhoff's current law using a suitable figure.  
Given the information provided in Fig. 3.1, find the unknown quantities:  $E$ ,  $R_1$ , and  $I_3$ .

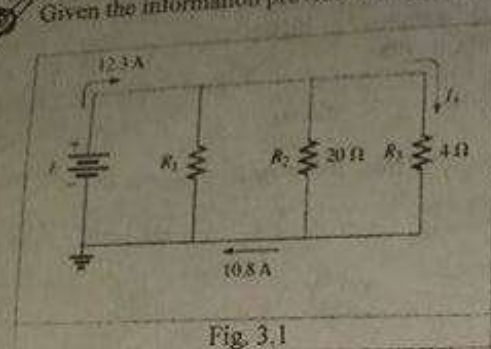


Fig. 3.1

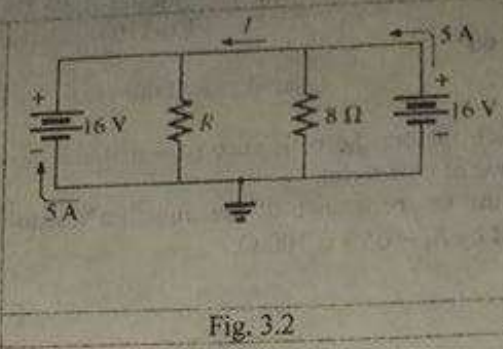


Fig. 3.2

- c) Assuming identical supplies, determine the current  $I$  and resistance  $R$  for the parallel network in Fig. 3.2.  
d) For the network in Fig. 3.3, determine:  
i) the short-circuit currents  $I_1$  and  $I_2$ .  
ii) the voltages  $V_1$  and  $V_2$ .  
iii) the source current  $I_s$ .

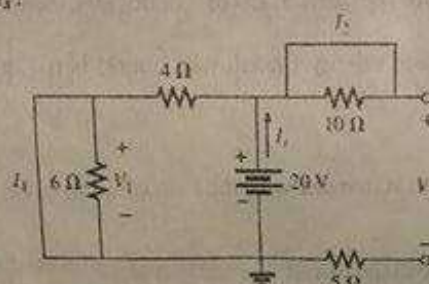


Fig. 3.3

4. a) Find current through and voltage across  $R_3$  for the network in Fig. 4.1.

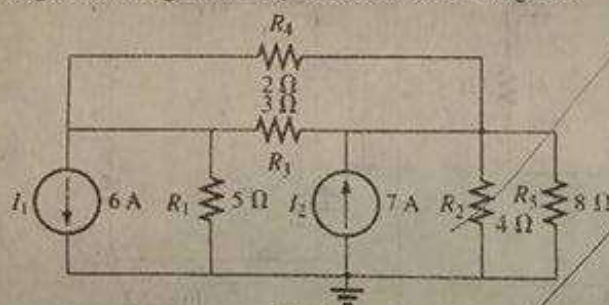


Fig. 4.1

- b) For the network in Fig. 4.2:  
i) Write the nodal equations and solve for the nodal voltages.  
ii) Find current through and voltage across  $R_4$  using mesh analysis.

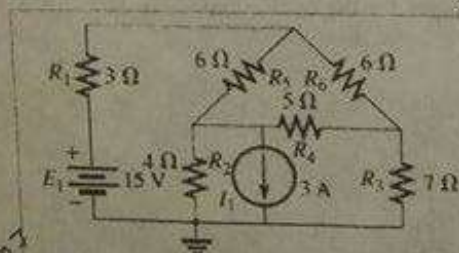


Fig. 4.2

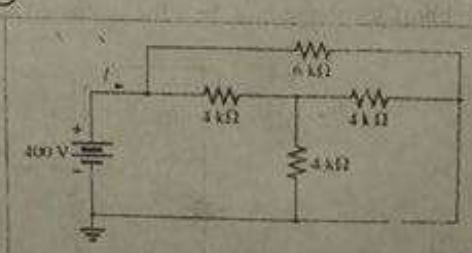


Fig. 4.3

- c) Using a  $\Delta$ -Y or Y- $\Delta$  conversion, find the current  $I$  in each of the networks in Fig. 4.3.



- a) State Reciprocity Theorem. For the network in Fig. 5.1 determine the current  $I$ .

4

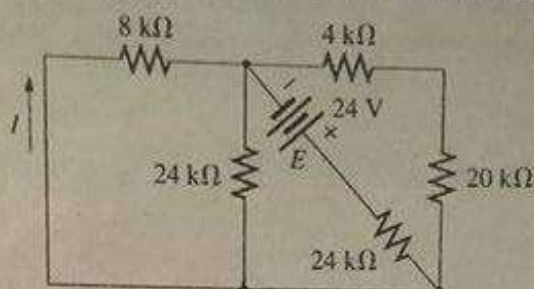


Fig. 5.1

- b) Find the Thévenin equivalent circuit for the network external to the resistor  $R$  for the network in Fig. 5.2.

4

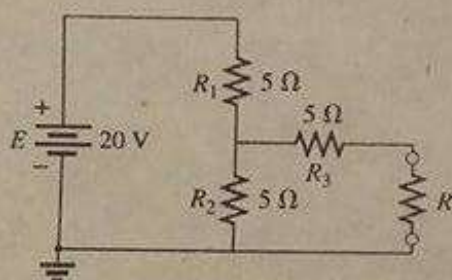


Fig. 5.2

- c) Using Millman's theorem, find the current through and voltage across the resistor  $R_L$  in Fig 5.3.

4

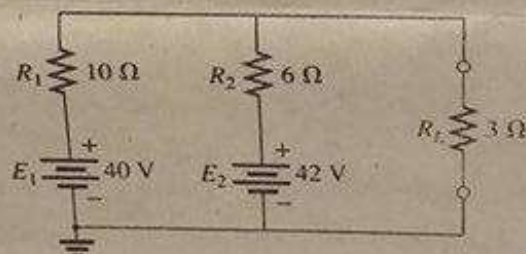


Fig. 5.3

- d) "The larger the inductance and/or the more rapid the change in current through a coil, the larger will be the induced voltage across the coil." – explain.
6. a) What is the impact of inserting insulating materials between parallel plates of a capacitor? What do you understand by permittivity and relative permittivity?
- b) Describe the transient behavior of a capacitive network in charging phase.
- c) Derive the total capacitance if capacitors are placed
- in series and
  - in parallel.

3

3

6

3+3

University of Dhaka  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester B. Sc Final Examination, 2016  
CSE-1105: Differential and Integral Calculus

Total Marks: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

1. a) What do you mean by  $\lim_{x \rightarrow a} f(x)$  and  $f(a)$ ? 3  
 b) Test the continuity and differentiability of a function  $f(x)$  at a point  $x = 1$ , 12  
 where  $f(x) = |x| + |x-1|$ .
  
2. a) (a) Find the differential coefficients of the following functions: 3×3  
 (i)  $\sin x = \frac{2t}{1+t^2}$ ,  $\tan y = \frac{2t}{1-t^2}$  (ii)  $y = \sin^{-1}(3x-4x^3)$  (iii)  $y = \frac{\cos x - \sin x}{\sqrt{1 - \sin 2x}}$   
 b) State Leibnitz's theorem. If  $y = (\sin^{-1} x)^2$  then show that 1+5  
 (i)  $(1-x^2)y_2 - xy_1 - 2 = 0$ . (ii)  $(1-x^2)y_{n+2} - (2n+1)xy_{n+1} - n^2y_n = 0$ .
  
3. a) State L'Hopitals rules. Apply this rule to evaluate 6  
 (i)  $\lim_{x \rightarrow 0} \frac{x - \tan x}{x^3}$  (ii)  $\lim_{x \rightarrow 0} \frac{e^x - e^{-x} - 2x}{x^2 \sin x}$   
 b) If  $y = e^{ax} \sin bx$ , then show that  $y_2 - 2ay_1 + (a^2 + b^2)y = 0$ . 5  
 c) Differentiate  $\tan^{-1} \frac{2x}{1-x^2}$  with respect to  $\sin^{-1} \frac{2x}{1+x^2}$ . 4
  
4. c) Find the maximum and minimum values of  $1 + 2 \sin x + 3 \cos^2 x$ ,  $0 \leq x \leq \pi/2$ . 7.5  
 b) State Taylor's series and Mean value theorem. Verify Mean value theorem 7.5  
 for the function  $f(x) = x^3 - x^2 - 4x + 4$  in the interval  $(-2, 2)$ .
  
5. a) State and prove the fundamental theorem of calculus. 5  
 b) Evaluate the following indefinite integrals: 5  
 i)  $\int \frac{1}{1 + \sin \theta} d\theta$  ii)  $\int x^2 \sqrt{x-1} dx$   
 c) Evaluate the following definite integrals: 5  
 i)  $\int_1^2 (2x-3) dx$  ii)  $\int_0^{10} \sqrt{10x-x^2} dx$
  
6. a) Find the area of the quadrant of the ellipse  $\frac{x^2}{16} + \frac{y^2}{9} = 1$  between the major 7.5  
 and minor axes.  
 b) Find the area bounded by the parabolas  $y^2 = 16x$  and  $x^2 = 16y$ . 7.5



University of Dhaka  
Department of Computer Science and Engineering  
1<sup>st</sup> Year 1<sup>st</sup> Semester B. Sc Final Examination, 2016  
PHY-1104: Physics

Total Marks: 60

Time: 2.5 Hours

(Answer any Four (4) of the following Questions)

1. a) Illustrate the concept of temperature in the light of Zeroth Law of Thermodynamics? 3
- b) A quantity of dry air at  $27^{\circ}\text{C}$  is compressed (i) slowly and (ii) suddenly to  $1/3$  of its volume. Find the change in temperature in each case assuming  $\gamma$  to be 1.4 for dry air. 4
- c) Derive the Gas Equation During an adiabatic process and establish a relationship between Temperature and Volume of a gas during that adiabatic process? 7
- d) What is Enthalpy? 1
2. a) Prove that heat and work is a path function and their difference is a point function. 5
- b) Show that the difference between the enthalpy at the two states points for a close system gives the heat interaction between the system and surrounding. 4
- c) A piston cylinder arrangement with stops contains air at 250 kPa,  $300^{\circ}\text{C}$ . The height of the stops from the bottom of the cylinder is 25 cm. The 50 kg piston has a dia of 0.1m and initially pushes against the stops. The atmospheric pressure is 100 kPa and the temperature is  $20^{\circ}\text{C}$ . The cylinder cools as heat is transferred to ambient. 6
  - (i) At what temperature does the piston begin to move down?
  - (ii) How far has the piston dropped when the temperature reaches ambient,  $20^{\circ}\text{C}$ .
3. a) Differentiate between heat engine and heat pump. 4
- b) What is Carnot's theorem? Prove it. 6
- c) A Carnot refrigerator takes heat from water at  $0^{\circ}\text{C}$  and discards it to a room at  $27^{\circ}\text{C}$ . 1 Kg of water at  $0^{\circ}\text{C}$  is to be changed into ice at  $0^{\circ}\text{C}$ . 5
  - (i) How many calories of heat are discarded to the room?
  - (ii) What is the work done by the refrigerator in this process?
  - (iii) What is the coefficient of performance of the machine? (latent heat of fusion of ice = 80 cal/gm)
4. a) Show that a spring-mass system is a simple harmonic motion system. Explain its displacement, velocity, acceleration and time period. 6
- b) Prove that total energy of the spring-mass system is constant and proportional to the square of the amplitude of the motion. 5
- c) A point is executing simple harmonic motion with a period  $\pi$ s. When it is passing through the center of its path, its velocity is 0.1 m/s. What is its velocity when it is at a distance of 0.03 m from the mean position? 4
5. a) What is damped harmonic oscillator? Derive the equation of motion of a damped spring-mass system and explain the three damping conditions. 7
- b) Define group velocity and phase velocity. 4
- c) Explain superposition principle of two waves of same frequency. 4
6. a) What do you understand by light interference? Show that the intensity distribution  $I$  due to interference of plane monochromatic light waves coming from two sources of equal intensity  $I_0$  is given by  $I = 4I_0 \cos^2 \frac{\delta}{2}$ . 8
- b) Prove that for single slit Fraunhofer diffraction the intensity pattern follows the relation,  $I = I_0 \frac{\sin^2 \beta}{\beta^2}$ . 7