NATIONAL INSTITUTE OF TECHNOLOGY PATNA
END SEMESTER EXAMINATION July-Dec 2023

SUBJECT: Introduction to Computing
SUBJECT CODE: CS18101 / CS19101
SECTION: Physics and Chemistry

DURATION: 3 Hrs.
FULL MARKS: 60
SEMESTER: FIRST

Attempt All Questions

		Marks	CO	BL
Q1.	(a) What are the types of printers?	[5]	CO1	Remember
	(b) What is E-commerce? Explain the B2C model.	[5]	& CO2	
Q2.	(a) What are the different language processors like compiler, interpreter, and assembler?	[5]	CO2 & CO3	Remember & Understand
	(b) Write a program in C to sort elements of an array in ascending order.	[5]		
Q3.	(a) Explain the while and do-while loop with a suitable example.	[5]	CO2 & CO4	Understand
	(b) Write a program in C to swap two numbers using a function call by value and call by reference.	[5]		
Q4.	(a) Explain the memory hierarchy in detail. What are the different types of RAM and ROM?	[5]	CO2	Understand & Apply
	(b) Write a program in C to display a pattern like a right-angle triangle using an asterisk. The pattern like: * * * * * * * * * *	[5]		
Q5.	(a) Write a program in C to demonstrate the use of the & (address of) and *(value at address) operators.	[5]	CO4	Understand
	(b) Write a program in C to perform arithmetic operations using pointers.	[5]		
Q6.	(a) Write a program in C to read n number of values in an array and display them in reverse order. (b) WAP in C to check whether a number is Armstrong.	[5]	CO3	Understand & Apply
		[5]		

National Institute of Technology Patna

End sem Examination Dec. 2023

Time allotted: 3 Hours   Full Marks: 60

Subject: Engineering Physics   Subject code: PH18101/17101/19101

The figures in the margin indicates full marks

Attempt all questions. All questions carry equal marks

1. (a) Derive and solve the differential equation of a forced harmonic oscillator. Discuss the case when frequency of driving force is higher than the frequency of the forced oscillator.   [6+3]

   (b) A wave along a string is y= 0.02sin(30t-4.0x) m (here, x in metres and t in seconds). Find the speed of the wave.   [3]

2. (a) Show that the tangential component of the electric field remains continuous across the boundary of two dielectrics. Dielectric constant of a gas is 1.00074 at N.T.P. Calculate dipole moment of each atom of the gas subjected to an external field of $3\times 10^4 V/m$. [Formula: $P=\chi\varepsilon_0 E$]   [3+2]

   (b) Using Maxwell's equations derive the wave equations for an electromagnetic wave in dielectric medium & estimate the velocity of this wave.   [5+2]

3. (a) Show that population inversion is not possible by direct excitation from a lower energy level to higher energy level.

   (b) Describe the construction and working of Ruby laser with a neat energy level diagram.

   (c) The metastable state of a ruby laser is at 1.786eV. Calculate the wavelength of light emitted.   [3+6+3]

4. (a) Explain the Planck's quantum hypothesis.

   (b) Derive an expression for the Compton shift in wavelength for a photon scatters from a free electron at an angle θ.

   (c) X-ray with wave length 1 Å are scattered from a Carbon block. The scattered radiation is viewed at 90° to the incident beam. Obtain the Compton shift. Given: h= 6.62×10^{-34} J/s   [4+5+3]

5. Write short notes of any two of the following: [6×2]

   (a) Poynting vector (b) Einstein's A & B coefficients (c) de- Broglie hypothesis & Heisenberg Uncertainty principle (d) Fraunhoffer diffraction due to single slit.

------- Best of Luck -------

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
PATNA BIHAR

END-TERM EXAMINATION 2023

COURSE: B. TECH **BRANCH: EE/PCM** **SEM 1ˢᵗ**

ELEMENT OF ELECTRONICS (EC16102/ EC17101/EC 18101/EC19101)

TIME: THREE HOURS **MAX MARKS: 60**

Attempt Any four questions.

1. (a) Explain the energy band of silicon with a suitable diagram, split of energy state and formation of bands.

(5 Marks) [CO 1]

(b) A silicon sample uniformly doped with donor impurity with a concentration of $10^{16}/cm^3$. Electron and hole mobilities are 1200 cm^2/V-sec and 400 cm^2/V-sec, and an electric field 10^3 V/m finds the conductivity, resistivity and current.

(5 Marks) [CO 1]

(b) Determine the concentration of holes and electrons in a silicon sample with donor impurity at 300 K of $5x10^{14}/cm^3$ and $Ni = 1.45x10^{10}/cm^3$

(5 Marks) [CO 1]

2. Explain each for three mark

(a) Differentiate depletion and enhancement type MOSFET. [CO 2,3]

(b) Differentiate diffusion and transition capacitance for the diode. [CO 1]

(c) Explain MOSFET as a capacitor. [CO 2,3]

(d) Explain the diode as a switch [CO 1,2]

(e) Explain the transistor as a two-port model. [CO 2,3]

3. (a) Explain the working operation of BJT as an amplifier with voltage follower configuration with derivation of impedance (in and out), voltage and current gain

(5 Marks) [CO 1,2]

(b) Compare the operation of BJT and MOSFET with any biasing configuration

(5 Marks) [CO 1,2]

(c) Explain the working principle of the inverter using NMOS and PMOS.

(5 Marks) [CO 1,2]

4. (a) Explain the working principle of n-channel Enhancement MOSFET with input, output and transfer characteristics.

(5 Marks) [CO 2]

(b) Find the DC analysis parameters of the circuit Fig.1 with a current gain of 100- and 0Amp base current and R_E 200 ohms

(5 marks) [CO 2]

(c) Find the voltage gain of circuit Fig. 1 with a current gain of 100- and 0Amp base current
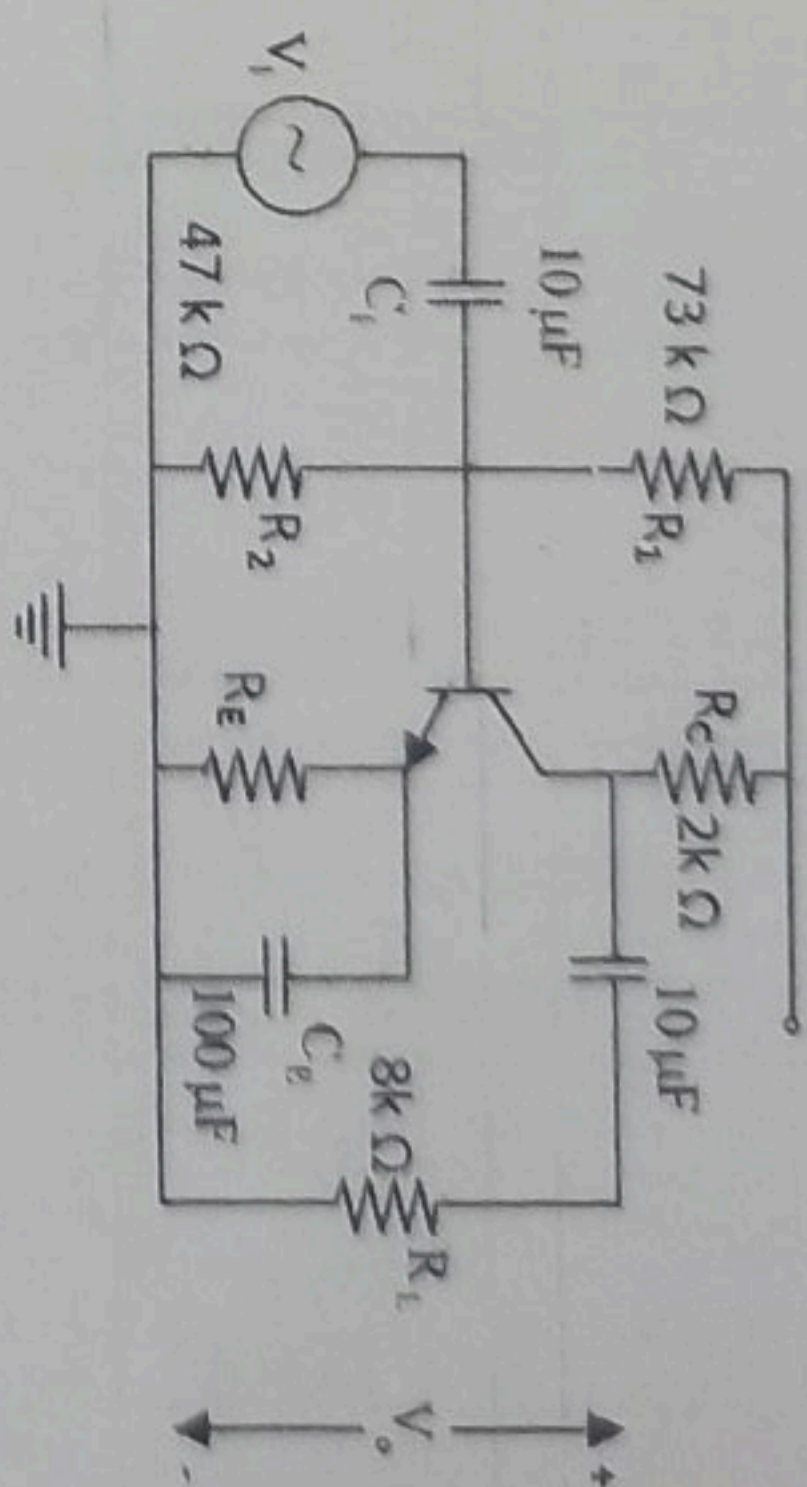
(5 marks) [CO 2]

Fig. 1

5. (a) Explain the working principle of an Operational amplifier with the concept of virtual ground, inverting and non-inverting input-output relationship.

(6 Marks) [CO 4,5]

(b) In the circuit Fig.2, $V_0 = V_{OA}$ for switch SW in position A and $V_0 = V_{OB}$ for SW in position B. Assume that the Op-amp is ideal. Find the ratio of the output at position A and V_{OB}/V_{OA}
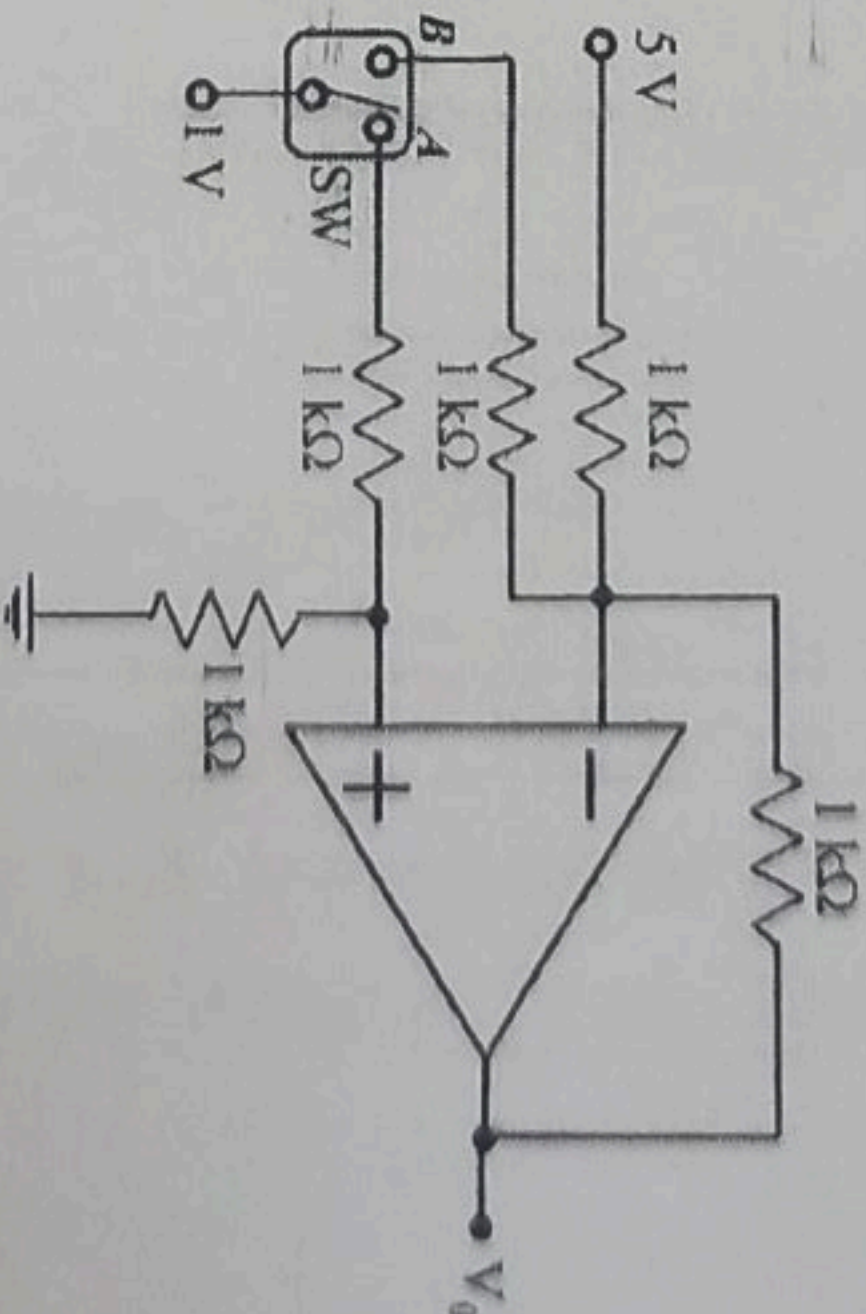
(6 Marks) [CO 4,5]

Fig. 2

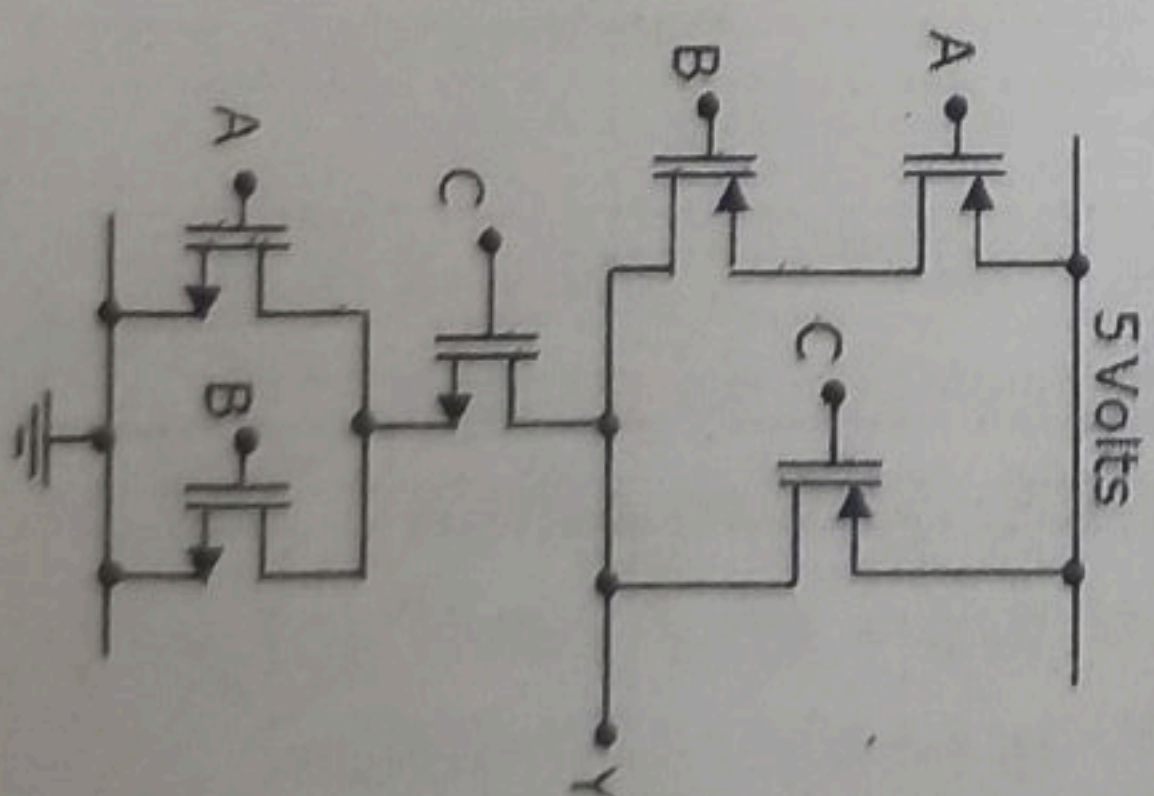(c) Find the output Y in terms of A, B, and logic gate inputs.

(3 Marks) [CO 4,5]

Fig. 3

National Institute of Technology Patna

Department of Mathematics

END-SEM-EXAMINATION: 13th DEC., 2023

Course Name: **Eng. Mathematics**

Program: B.Tech(CSE, Material Science and Eng.)

Duration: 3 Hrs.

Course Code: MA14102/MA18101

Full Marks:60

ANSWER ALL QUESTIONS

1. For the function f defined by

$$f(x,y) = xy\frac{x^2 - y^2}{x^2 + y^2}, \quad \text{for } (x,y) \neq (0,0)$$
$$= 0, \quad \text{for } (x,y) = (0,0)$$

Verify $f_{xy}(0,0) = f_{yx}(0,0)$. [6M]

2. If $u = \tan^{-1}\{\frac{x^2+y^2}{\sqrt{x}+\sqrt{y}}\}$ then show that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \frac{3}{4}$. [6M]

3. Expand $x^3 + 3x^2y + 2xy^2$ in powers of x and (y-1) using Taylor series. [6M]

4. Show that the function f defined by

$$f(x,y) = xy\frac{x^2 - y^2}{x^2 + y^2}, \quad \text{for } (x,y) \neq (0,\dot{0})$$
$$= 0, \quad \text{for } (x,y) = (0,\dot{0})$$

is continuous at origin. [6M]

5. Find all the solutions of the system $x + y + 2z = 3$, $2x - y + 4z = 3$, $4x + 3y + 6z = 1$ by finding all solutions of corresponding homogeneous system. [6M]

6. Show that the following ODE is exact and then solve it:

$$x(x^2 + y^2 - a^2)dx + y(x^2 - y^2 - b^2)dy = 0.$$

[6M]

7. Find the integrating factor of the following ODE and then solve it:

$$(xy\sin xy + \cos xy)ydx + (xy\sin xy - \cos xy)xdy = 0.$$

[6M]

8. Solve the following ODES:

$$x^2(x^2 - 1)\frac{dy}{dx} + x(x^2 + 1)y = x^2 - 1,$$

$$(1 - x^2)\frac{dy}{dx} - xy = x^2y^2.$$

[12M]

9. Find the matrix P such that $P^{-1}AP = D$(diagonal matrix), where $A = \begin{bmatrix} 1 & 2 & -2 \\ 2 & 1 & -4 \\ 1 & -1 & -2 \end{bmatrix}$. [6M]

*****ALL THE BEST*****

NATIONAL INSTITUTE OF TECHNOLOGY PATNA
Department of Humanities and Social Sciences
Ashok Rajpath, Patna-800 005

END-SEMESTER EXAMINATION DECEBER 2023

Course Name: Communicative English

Course Code: HS12101 (A)/ HS13101, HS17101 & HS18101

Group: BTech (CE A&B, ME-A, M&C, M&T)
Faculty: Dr Zeeshan Ali

Full Marks: 45
Time: 3 Hours

Instructions: **Answer all the questions in your own words.**

1. "Public speaking is as much about non-verbal communication as it is about its verbal aspects.' Elucidate the statement with proper examples.   (7.5 marks) CO5

2. 'Everybody knows how to read. But not everybody knows how to read skilfully and artfully.' Illustrate the statement and point out the major hurdles in effective reading.   (7.5 marks) CO6

3. Your placements are going to commence next month. What preparations will you make to get through the interview? Also, write short notes on the following topics
   i. Your strengths and weaknesses
   ii. Your long term and short-term goals   (7.5 marks) CO8

4. Discuss the personality traits that are evaluated in a GD. Read and prepare arguments on the following topics: (7.5 marks) CO8

   a) Can we dream of hosting the Olympics?
   b) One Nation One Election.

[Note: In your answers add examples to explain your points]