

**AUTUMN END SEMESTER EXAMINATION-2022**1st Semester B.Tech**BASIC ELECTRICAL ENGINEERING****EE10002****(For 2022 Admitted Batch)**

Time: 3 Hours

Full Marks: 50

*Answer any SIX questions.**Question paper consists of four SECTIONS i.e. A, B, C and D.**Section A is compulsory.**Attempt minimum one question each from Sections B, C, D.**The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable
and all parts of a question should be answered at one place only.***SECTION-A**

1. Answer the following questions. [1 × 10]
 - (a) Define the term (a) Active Network (b) Passive Network.
 - (b) Discuss the purpose of using MCB in an electrical installation.
 - (c) State and Explain the faraday's laws of electromagnetic induction.
 - (d) List the applications of a 1 phase Induction motor.
 - (e) Draw the B-H curve of magnetic material.
 - (f) Define the terms "Form Factor and Peak Factor" in a.c circuits.
 - (g) A current of $5 \sin(314t - \pi/4)$ A is drawn from a supply voltage of $230 \sin(314t + \pi/4)$ V. Calculate the active power supplied from the source.
 - (h) Describe the advantages of 3 phase system over single phase system.

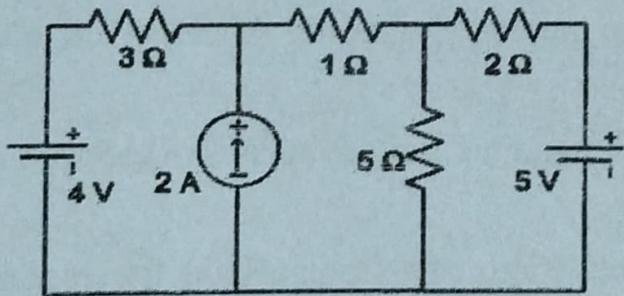
- (i) Define ohm's law with an example and writes its limitations.
- (j) Explain the purpose of using fuse in an electrical installation.

SECTION-B

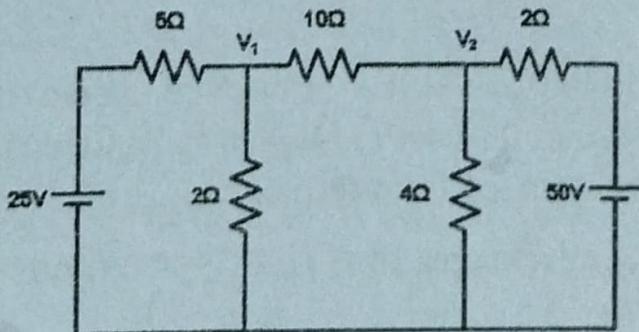
2. (a) State and Explain the Superposition Theorem with suitable example? [4]
- (b) Explain the principle of operation of a three phase induction motor. [4]
3. (a) List out the analogy of various quantities between the electric circuit and magnetic circuit. [4]
- (b) Define a Transformer. Explain the principle of operation of a single phase transformer. [4]

SECTION-C

4. (a) Solve and find the current in 2Ω resistor using superposition principle. [4]



- (b) Solve and Find the current flowing through 10Ω resistance using nodal analysis. [4]



5. (a) Derive an expression for the average power consumed in a pure resistive circuit and a pure inductive circuit. [4]

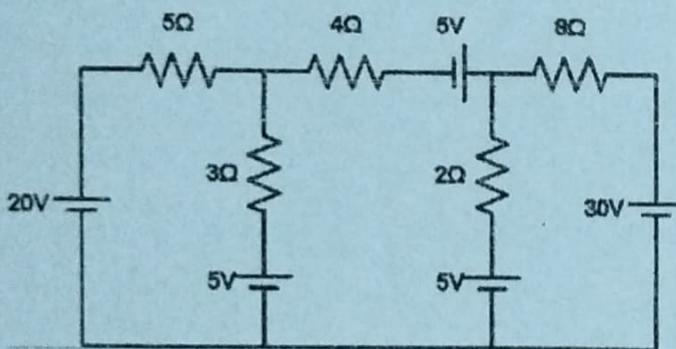
(b) Explain with phasor diagram the instantaneous current equation of series R-L circuit. Define power factor. [4]

6. (a) A circuit consists of a pure resistance and a coil in series. The power dissipated in the resistance is 500 W and the drop across it is 100 V. The power dissipated in the coil is 100 W and the drop across it is 50 V. Find the reactance and resistance of the coil and the supply voltage. [4]

(b) A resistance of $20\ \Omega$, an inductance of 0.2 H and capacitance of $100\ \mu F$ are connected in series across a single phase, 220 V, 50 Hz mains. Determine the following (i) Total Impedance (ii) current flowing (iii) voltage drop across R, L & C (iv) power consumed in watt. [4]

SECTION-D

7. (a) Find the current flowing through $8\ \Omega$ resistances using the Mesh Analysis. [4]



(b) An iron ring has a cross section of $3\ cm^2$ and a mean diameter of 25 cm. An air-gap of 0.4 mm has been cut across the section of the ring. The ring is wound with a coil of 200 turns through which a current of 2 A is passed. If the total magnetic flux is 0.24 mWb. Find the relative permeability of iron, assuming no magnetic leakage. [4]

8. (a) The resistor and a capacitor are connected in series with a variable inductor. When a circuit is connected to a 240 V, 50 Hz supply, the maximum current by varying the inductor is 0.5 A. At this current the voltage across the capacitor is 250 V. Calculate R, L and C. [4]
- (b) A 400 V, 3 Phase supply is connected to a balanced network of three impedances each consisting of a $20\ \Omega$ resistance and a $15\ \Omega$ inductive reactance. Determine (i) the line current (ii) power factor (iii) Total power in KW, when the three impedances are (a) star connected (b) delta connected. [4]

$\sqrt{3} = 1.73$



AUTUMN END SEMESTER EXAMINATION-2022

1st Semester B.Tech

DIFFERENTIAL EQUATION AND LINEAR ALGEBRA

MA11001

(For 2022 Admitted Batch)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions.

Question paper consists of four SECTIONS i.e. A, B, C and D.

Section A is compulsory.

Attempt minimum one question each from Sections B, C, D.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable
and all parts of a question should be answered at one place only.

SECTION-A

1. Answer the following questions. [1 × 10]

- (a) If the growth rate of the number of bacteria at any time t is proportional to the number present at t and becomes 1.5 times in 1 week. Write the mathematical modeling of this physical problem.
- (b) Find a general solution of $x^2y'' - 2y = 0$.
- (c) Find a 2nd order homogeneous ordinary differential equation for the given basis of solutions $\{e^{4x}, xe^{4x}\}$.
- (d) Is the given set of vectors linearly independent?
 $\{[0.4 \quad -0.2 \quad 0.2], [0.0 \quad 0.0 \quad 0.0], [3.0 \quad -0.6 \quad 1.5]\}$
- (e) Find the coefficient matrix from the system $y_1 = 2x_1 + 3x_2$, $y_2 = -x_1 + 4x_2$.
- (f) Find the value of $\int_0^\infty x^{-\frac{1}{2}} e^{-2x} dx$.

- (g) What is the radius of convergence for the power series
 $\sum_{m=0}^{\infty} \frac{(-1)^m}{3^m} (x - 2)^{2m}$.
- (h) Find the differential equation of the orthogonal trajectories to the family of curves $y^2 = \sqrt{x + c}$, $c = \text{constant}$.
- (i) What is the absolute value of the eigen value of a unitary matrix?
- (j) If $A = \begin{pmatrix} -2 & 1 \\ 0 & 3 \end{pmatrix}$, then find all eigen values of the matrix A^3 .

SECTION-B

2. (a) Find the second independent solution to the ordinary differential equation $x^2y'' - xy' + y = 0$ using a known solution $y_1 = x$ and hence solve the initial value problem for $y(1) = 2, y'(1) = 3$. [4]
- (b) Solve the initial value problem [4]
 $2xyy' + (x - 1)y^2 = x^2e^x, y(1) = 0.$

3. (a) Find the general solution to the ordinary differential equation $y'' + 5y' + 4y = \frac{1}{2}e^{-4x}$. [4]
- (b) Find an eigen basis and diagonalize the matrix [4]
 $A = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$.

SECTION-C

4. (a) Find the inverse of the matrix [4]
 $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 1 & 2 \\ 2 & 0 & 3 \end{bmatrix}$ using Gauss-Jordan method.

- (b) Test for exactness. If not exact, use an integrating factor and hence solve the ordinary differential equation [4]

$$(ye^x + 1)dx + (e^{x+y} + xe^x)dy = 0.$$

5. (a) Prove that the matrix $\begin{bmatrix} \frac{1}{2} & \frac{i\sqrt{3}}{2} \\ \frac{i\sqrt{3}}{2} & \frac{1}{2} \end{bmatrix}$ is unitary and hence find its eigen values. [4]

(b) Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x.$ [4]

6. (a) Find the transient current in the $RLC -$ circuit with $R = 4\Omega, L = 0.5 H, C = 0.1 F, E = 500\sin 2t \text{ Volts.}$ [4]
- (b) Find eigenvalues and eigenvectors of the following matrix. [4]

$$A = \begin{bmatrix} 3 & 0 & 0 \\ 5 & 4 & 0 \\ 3 & 6 & 1 \end{bmatrix}$$

SECTION-D

7. (a) Solve the ordinary differential equation [4]

$$(D^2 + 2D + 2I)y = e^{-x} \sec^3 x.$$

- (b) A tank contains 400 gal of brine in which 100 lb of salt are dissolved. Fresh water runs into the tank at a rate of 4 gal/min. The mixture, kept practically uniform by stirring, runs out at the same rate. How much salt will there be in the tank at the end of 1 hour? [4]

8. (a) If $P_m(x)$ is the Legendre polynomial of degree m , then [4]
show that $(m+1)P_{m+1}(x) = (2m+1)xP_m(x) - mP_{m-1}(x)$.

- (b) Test the consistency and hence solve the system [4]

$$3x + 2y = 5$$

$$2x - z = 2$$

$$4y + 5z = 8$$

$$\left[\begin{array}{ccc} 3 & 2 & 0 \\ 2 & 0 & -1 \end{array} \right]$$



AUTUMN END SEMESTER EXAMINATION-2022

1st Semester B.Tech

CHEMISTRY

CH10001

(For 2022 Admitted Batch)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions.

Question paper consists of four SECTIONS i.e. A, B, C and D.

Section A is compulsory.

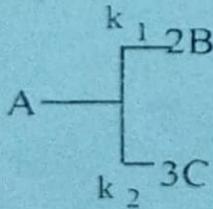
Attempt minimum one question each from Sections B, C, D.

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable
and all parts of a question should be answered at one place only.

SECTION-A

1. Answer the following questions. [1 × 10]
 - (a) In thermodynamics, two very similar terms Heat (Q) and Heat content (H) are used. Explain how the term H is different than Q.
 - (b) For a thermodynamic system at 25 °C, the increase in entropy is 4.6J/molK. Calculate the heat gain.
 - (c) In thermodynamic properties calculations, PV has two terms; (1) PdV and (2) VdP. How are they different and what is their significance?
 - (d) For the following reaction-



Calculate the concentration ratio of [B]/[C] at any time (t).

- (e) For a 1st order reaction $A \rightarrow P$: Activation energy (E_a) is 100kJ and the Arrhenius constant is $2 \times 10^{-3} \text{ s}^{-1}$. What is the rate constant at 700K?
- (f) What is bathochromic shift? Mention one factor which may be responsible for bathochromic shift of $\pi-\pi^*$ transition.
- (g) If light pass through a solution, intensity is reduced to half. Calculate Absorbance.
- (h) A Cu electrode immersed in a 0.1M CuSO₄ solution. What will be the half cell electrode potential? Given. Cu²⁺/Cu. E⁰=0.34V.
- (i) A hydrogen electrode in an unknown HCl solution was coupled with standard hydrogen electrode. E_{cell} was measured 0.177V at 25°C. What was pH of the unknown solution?
- (j) Give example of two smart materials. mention their stimuli and response.

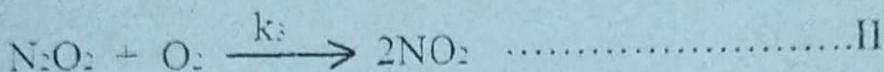
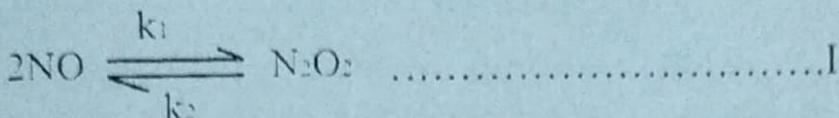
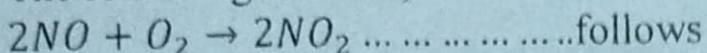
SECTION-B

2. (a) Prove that $\left[\frac{\partial}{\partial T} \left(\frac{\Delta G}{T} \right) \right]_P = - \frac{\Delta H}{T^2}$ [4]
- (b) Derive Clausius-Clapeyron equation. Based on it, explain cooking at higher altitude takes longer time. [4]
3. (a) For the consecutive reaction; $A \xrightarrow{k_1} B \xrightarrow{k_2} C$ [4]
- The concentration changes are expressed as;
- $$[A] = [A]_0 e^{-k_1 t}$$
- $$[B] = \frac{k_1 [A]_0}{k_2 - k_1} (e^{-k_1 t} - e^{-k_2 t})$$
- $$\text{and } [C] = [A]_0 \left(1 - \frac{k_2 e^{-k_1 t} - k_1 e^{-k_2 t}}{k_2 - k_1}\right)$$

Simplify these equation for $k_1 \gg k_2$. Based on that, plot the graph for concentration changes for A, B and C with time t.

2

- (b) The following reaction, [4]



Derive the rate expression.

SECTION-C

4. (a) Construct a galvanic cell of Zn electrode in $ZnCl_2$ solution and Cu electrode in $CuSO_4$ solution. Draw the cell diagram (IUPAC). Given, $E^\circ (Zn^{2+}/Zn) = 0.76$ V, $E^\circ (Cu^{2+}/Cu) = -0.34$ V. 2mol of Zn electrolyzed to Zn^{2+} . Calculate the free energy change. [4]

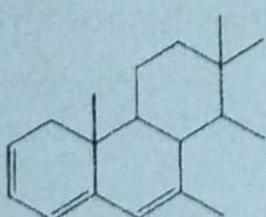
- ^{3 ✓} (b) Discuss mechanism of a lithium-ion battery. Write one possible application of it. [4]

5. (a) Calculate the wave number at which C=C bond will stretch. Given, force constant $k = 10^6$ gm/sec². [4]

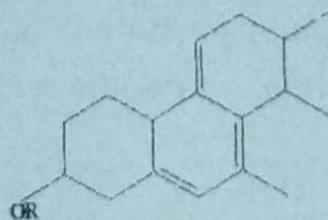
- (b) For CO_2 , calculate total number of possible vibrations. Apply selection rule of IR absorption and explain the IR active mode of vibration among them. [4] (3)

6. (a) Apply Woodward-Fieser rule to find λ_{max} for the following compounds: [4]

i



ii



- (b) Write detailed discussion on *any one* of the following smart materials : [4]

Piezoelectric material/ Solar cell/ Smart phone screen/ Shape memory alloys.

SECTION-D

7. (a) Describe the working principle of Hydrogen/Oxygen Fuel cell. (Describe in detail about the electrodes and electrolyte used). [4]

- (b) Using the given thermodynamic values (in standard condition, 25 °C), calculate the electrical work can be performed when 1mole of water is produced using the fuel cell. Reaction in a Fuel cell:- $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l); \Delta H = -286\text{ kJ/mol}$ [4]

Element/compound	Standard entropy change (ΔS°), J/mol
H_2	131
O_2	205
H_2O	70

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta H = \Delta U + PV$$

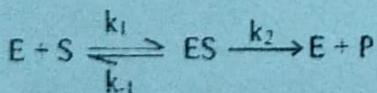
$$W = PV = \Delta n RT$$

8. (a) A glass electrode coupled with standard calomel electrode is used for pH measurement. Describe the construction of pH meter. [4]

The E_{cell} of the mentioned electrode pair was 0.115V when placed in an unknown solution at 25°C. What is the pH of the unknown solution?

Given, $E_g^0 = 0.199\text{ V}$ and $E_{cal}^0 = 0.242\text{ V}$.

- (b) For an enzyme catalyzed reaction, [4]



Derive rate expression. Given, Michaelis constant (K_M) is 0.5mM and substrate concentration is 1.0mM.

Calculate the rate to maximum rate ratio($\frac{R}{R_{max}}$).



22054397

Qn. Set Code-1

Semester: 1st
Programme: B.Tech
Branch: Scheme-B

AUTUMN END SEMESTER EXAMINATION-2022**1st Semester B.Tech****ENGLISH****HS10001****(For 2022 Admitted Batch)**

Time: 3 Hours

Full Marks: 50

*Answer any SIX questions.**Question paper consists of four SECTIONS i.e. A, B, C and D.**Section A is compulsory.**Attempt minimum one question each from Sections B, C, D.**The figures in the margin indicate full marks.**Candidates are required to give their answers in their own words as far as practicable and all parts of a question should be answered at one place only.***SECTION-A**

1. Answer the following questions. [1 × 10]
 - (a) When a candidate is being interviewed, what posture demonstrates confidence and attentiveness?
 - (b) Give two examples of semantic noise.
 - (c) Checking the date of the English examination from the schedule of the End-Semester examination is an example of _____.
 - a. skimming
 - b. scanning
 - c. analytical
 - d. none of the above
 - (d) Mention any two characteristics of mass communication.

(e) _____ listening can be compared with passive listening.

- a. critical
- b. appreciative
- c. superficial
- d. none of the above

(f) Define 'IPA'.

(g) What do you understand by the term 'professional communication'?

(h) "The tiny bit of paper fluttered away from Siddiqi Sahib's hand and fell on his lap like a half-dead moth".

What does the 'paper' refer to here?

(i) "Quietness and value: the description applied to both".
By 'both', what does Della mean?

(j) Who is the writer of the poem "We Have Not Long to Love"?

SECTION-B

2. (a) "Meanwhile a bomb exploded". [4]

What does 'bomb' refer to here? Explain it.

(b) What message did Chugtai try to convey to the society through the tale of Tushar and Samina? Discuss it. [4]

3. (a) Select the correct verbal form in the following sentences: [4]

i) Either my father or my brothers _____ (is/are) going to sell the car.

ii) The student, as well as his teacher, _____(was/were) going on the field trip.

- iii) Each of the students _____(is/are) responsible for doing his or her work.
- iv) Both of my roommates _____(has/have) decided to live in the dorms.
- (b) Demonstrate the usage of commas and semicolons with examples. ~~✓~~

SECTION-C

4. (a) Why is informal communication often referred to as 'grapevine communication'? Illustrate different types of informal networks. [4]
- (b) Why there should be compatibility between verbal and non-verbal behaviour? Explain it with examples. [4]
5. (a) Explain how the process of listening goes through different stages. [4]
- (b) How to overcome English problem sounds? Produce some measures. [4]
6. (a) Ankita is interacting with Alexa, a virtual assistant technology - Identify the level of communication and elaborate it with some other examples. [4]
- (b) What is the term used for study of space in non-verbal communication? Explain it. [4]

SECTION-D

7. (a) You are the purchase manager of Brainwonders, a Kolkata-based career counselling centre. Compose an order letter and send it to the sales manager, PC City, Patia, Mumbai. You want four Lenovo IdeaPads, model Ryzen5 5600H, for ₹56,000 each. For freight and

handling, you are willing to pay ₹5000. You are sending a bank draft in the amount of ₹2,29,000/- to PC City, Patia, Mumbai. You want your package to be delivered as soon as possible.

- (b) How is extensive reading technique different from intensive reading? Summarize the distinction with examples. [4]
8. (a) "The quality of mercy is not strain'd,
It droppeth as the gentle rain from heaven
Upon the place beneath: it is twice blest;
It blesseth him that gives and him that takes:"
Who is the speaker? Analyze the significance of the extract.
(b) Does Mercy triumph over justice in The Merchant of Venice? [4]



AUTUMN END SEMESTER EXAMINATION-2022

1st Semester B.Tech

SOCIO-POLITICAL ENVIRONMENT

SO10043

(For 2022 Admitted Batch)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions.

Question paper consists of four SECTIONS i.e. A, B, C and D.

Section A is compulsory.

Attempt minimum one question each from Sections B, C, D.

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SECTION-A

1. Answer the following questions. [1 × 10]
 - (a) Define theocracy.
 - (b) Under which constitutional amendment Right to Property was removed?
 - (c) What is malnutrition?
 - (d) Name the different types of social problems in India.
 - (e) Under which chapter of the constitution fundamental rights have been interpreted?
 - (f) Which article of the constitution says that DPSP shall not be enforceable by any court of law?
 - (g) Name the different political institutions.
 - (h) How many DPSPs (articles) are there in the constitution?

- (i) What do you mean by social harmony?
- (j) Write any two schemes by the government to uplift poverty from the country.

SECTION-B

- 2. (a) What do you mean by rational distribution of wealth? [4]
How it will help to push economic equality in the society?
- (b) Explain the objectives and importance of DPSP in detail. [4]
- 3. (a) Define unemployment. Discuss the different types of unemployment. [4]
- (b) Define judiciary. Explain, why it has been established as an independent body in India? [4]

SECTION-C

- 4. (a) Why fundamental rights are significant for the citizen? [4]
Discuss the different provisions of fundamental rights under different articles.
- (b) Explain in detail, how overpopulation becomes a problem in the development of a country? [4]
- 5. (a) What do you mean by social discrimination? Discuss the different bases for social discrimination in India. [4]
- (b) Why fundamental duties are significant to be performed by the citizens of India? What are the different fundamental duties discuss. [4]
- 6. (a) Discuss the problem of old age in India. Also discuss what are the practices through which the country can overcome this problem? [4]

Old age home
day care centre
proper pension
(2)

- (b) Why reservation is justified in India? How it insures social and economic development of the downtrodden class in India? [4]

SECTION-D

7. (a) How does the political environment affect economic and business environment of a country? [4]
- (b) How does the political environment influence social system in India? [4]
8. (a) What are the different provisions dictated under DPSPs which directs the government to ensure occupational policies (work policies) to ensure healthy and justified work environment in India? [4]
- (b) What are the different problems faced by women in India? Also discuss the provisions in the constitution which tries to remove gender discrimination in society and at work. [4]



AUTUMN END SEMESTER EXAMINATION-2022

1st Semester B.Tech

BASIC ELECTRONICS

EC10001

(For 2022 Admitted Batch)

Time: 3 Hours

Full Marks: 50

Answer any SIX questions.

Question paper consists of four SECTIONS i.e. A, B, C and D.

Section A is compulsory.

Attempt minimum one question each from Sections B, C, D.

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SECTION-A

1. Answer the following questions. [1 × 10]

- (a) Describe is the effect of temperature on the electrical conductivity of Semiconductor?
- (b) Define PIV rating in diode. Write the PIV for half wave rectifier. ✓m
- (c) State Snell's law.
- (d) Which gates are called Universal gate and why?
- (e) Compare the performance of FET over BJT?
- (f) Which transistor configuration amplifier is best to use and why?
- (g) Explain why collector region is made larger compared to emitter and base region?
- (h) Summarize the characteristics of an ideal op-amp.

- (i) A differential dc amplifier has a differential mode gain of 100 and a common mode gain of 0.01. What is its CMRR in dB?
- (j) Show the symbol and truth table of EXOR gate.

SECTION-B

2. (a) With proper diagram explain the operation of centre tap full wave rectifier. Also find its efficiency and ripple factor. [4]
- (b) Show the I-V characteristics of a Zener diode. Also explain the working of a Zener diode as a voltage regulator. [4]
3. (a) Construct a NPN transistor in CE configuration circuit and draw its Input & Output characteristics Showing different region of operation with proper labeling. [4]
- (b) What is the importance of Quiescent point in transistor biasing? Explain fixed biasing in detail. [4]

SECTION-C

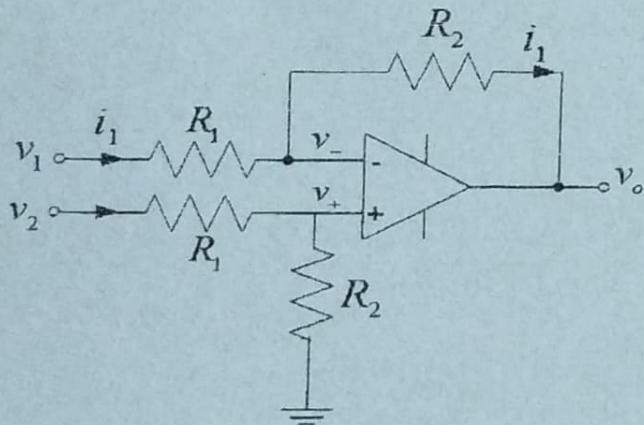
4. (a) Analyze and explain the op-amp circuit which invert the input signal with amplification and formulate its output voltage expression. Define CMRR and write its importance in design aspect. [4]
- (b) What is an adder circuit? Construct a half adder circuit and explain its operation with truth table? [4]
5. (a) With suitable diagram analyze the operation of N-channel Enhancement MOS with symbol. [4]
- ~~(b)~~ Explain the working principle of n-channel JFET. A JFET is operating at $I_D = 5 \text{ mA}$. The pinch-off voltage of the JFET is -8V and $V_{GS} = -4.7 \text{ V}$. Solve for the value of I_{DSS} . [4]

6. (a) Illustrate the operation of LED with suitable diagram and write its applications. [4]
- (b) What is the need for modulation? Distinguish between Amplitude Modulation and Frequency Modulation. [4]

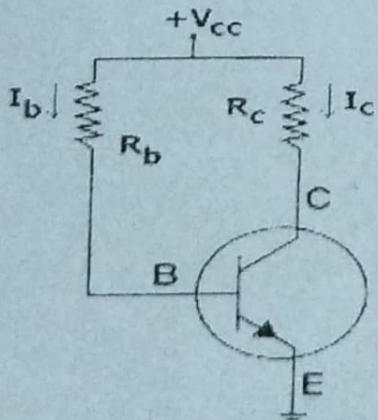
SECTION-D

7. (a) Draw and explain the circuit diagram of an non-inverting amplifier using OP-AMP and derive their output voltage expression [4]

Estimate the output voltage of the below circuit if $V_1=2V$ and $V_2=5V$, $R_1=5k\Omega$ and $R_2=10k\Omega$.



- (b) The silicon transistor circuit in the following figure has $V_{cc}=10V$, $R_c=2.2k\Omega$, and $I_B=10\mu A$. Calculate R_b , I_c , V_{CE} and V_E . Given $\beta=100$. [4]



- ✓ 8. (a) Draw the block diagram and truth table of SR flip flop. [4]
Describe how the disadvantage of SR flip-flop is overcome in JK flip-flop.
- (b) Solve the following conversions [4]
- $(30.625)_{10} = ()_2$
 - $(2FA.4FA)_{16} = ()_{10}$
 - $(575.26)_8 = ()_2$
 - $(100110.101)_2 = ()_8$
