

B. Tech-1st (All Br.)
Basic Electronics (BEL)

Full Marks : 50

Time : 2.30 hours

Answer all questions.

The figures in the right-hand margin indicate marks.

Symbols carry usual meaning.

Any supplementary materials to be provided.

1. Answer *all* questions : *2 × 5*

(a) Differentiate between analog, discrete and digital signals.

(b) Is JFET more advantageous than BJT ? Justify.

(c) Which topology of feedback amplifier is preferred for general amplifier and why ?

(d) Write Boolean expression for the statements :

(i) Ram is neither intelligent nor diligent

(2)

(ii) Of the two persons only one, and not both, can enter the room at a time.

(e) What are the need of modulation ?

2. (a) With neat diagram explain how passive components can be arranged to design a high pass filter circuit. Draw its frequency response curve. 4

(b) Consider sinewave input of 16 V peak-to-peak, $V_{B1} = 3$ V, $V_{B2} = 2$ V, $R = 1 \text{ K}\Omega$ and the diodes as ideal for the limiter shown in Figure 1. Analyze the circuit and draw its output waveform. 4

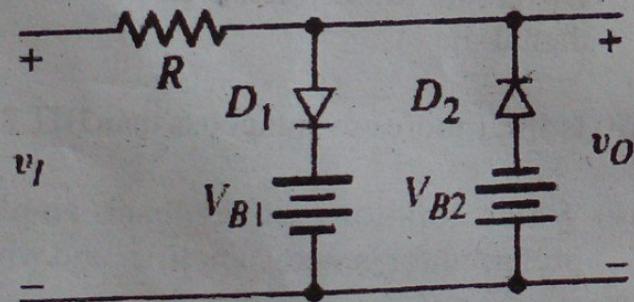


Figure 1

(3)

Or

(a) A 120 volt rms sinusoidal input is applied to a full-wave center-tap rectifier having $N_p : N_s = 50 : 100$ and load resistance $R_L = 1 \text{ K}\Omega$. Determine : 4

(i) The DC voltage available at the load, if silicon diodes are used in the rectifier circuit.

(ii) PIV of each diode

(iii) Ripple factor

(iv) Draw the output waveform.

(b) Draw the diagram of a p-n junction and explain how current flow through it in forward bias. Draw the V-I characteristic curve. Write diode current expression. Identify each term. 4

3. (a) Draw and discuss the different regions of a BJT output characteristics in common emitter configuration. Explain its shape. Explain its use in transistor operation. 4

(b) Explain the principle of transistor action as switch. 4

(4)

Or

- (a) With a neat sketch, describe the construction, principle of operation an n-channel JFET.. 4
- (b) What is the significance of the term field-effect in connection to JFET ? Define pinch-off voltage and pinch-off current. Why is the input impedance to a JFET so high ? Mention Shockley's current expression for JFET. Draw the transfer curve for a p-channel device with $I_{DSS} = 4 \text{ mA}$ and $V_p = 3 \text{ V}$. 4
4. (a) Draw an integrator circuit using operational amplifier and derive expression for its output voltage. What is the drawback of your circuit. 4
- (b) An amplifier has mid band frequency gain of 200. The upper and lower 3 dB frequency of the amplifier is 10 KHz and 100 Hz respectively. A negative feedback is incorporated in the amplifier circuit. Find out new gain and new bandwidth after feedback. 4

Or

(Continued)

(5)

- (a) What is the significance of slew rate of an Op-Amp ? In the difference amplifier circuit of Figure-2, $R_1 = R_2 = 500 \Omega$ and $R_f = R_g = 2 \text{ K}\Omega$. Calculate the voltage gain of the amplifier. If $V_1 = -0.3 \text{ V}$ and $V_2 = 0.5 \text{ V}$, what is the output voltage ? 4

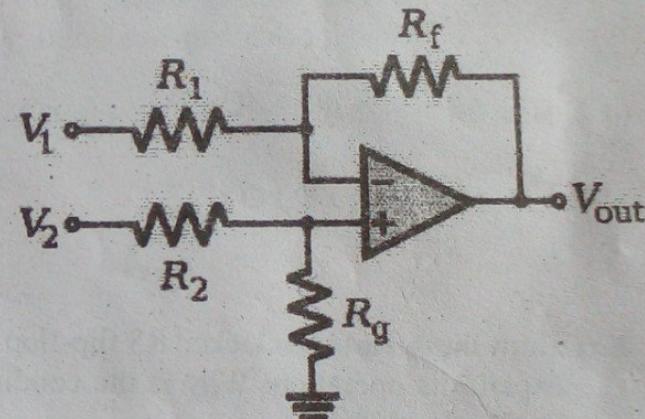


Figure-2

- (b) Distinguish between Regenerative and Degenerative feedback using suitable block diagram. Explain the effect of negative feedback on gain considering a voltage-shunt feedback network. 4

(6)

5. (a) Minimize the following Boolean function

$$F(A, B, C) = \overline{A}\overline{B}\overline{C} + ABC + A\overline{B}C + \overline{A}BC$$

Draw the original and simplified circuit
using gates. 4

- (b) Prove the following identities using Boolean postulates. 4

(i) $AB + AC + BC = AC + B\bar{C}$

(ii) $\overline{x \oplus y \oplus z} = x \oplus y \odot z$

Or

- (a) Draw the circuit of a clocked RS flip-flop and explain its operation. Why is the condition $S = R = 1$ avoided? 4

- (b) Write $(+45)_{10}$, $(-45)_{10}$, $(+23)_{10}$ and $(-23)_{10}$ in 2's complement form. Subtract 45 from 23 using 2's complement method of subtraction. 4

6. (a) With neat diagram explain the principle behind the display of waveform in CRO. 4

(7)

- (b) What is the input impedance of ideal CRO ?
Justify. Explain CRO as a voltmeter. 4

Or

- (a) What is meant by amplitude modulation (AM) ? With neat sketches and mathematical expressions, explain modulating signal, carrier signal and modulated signal for an AM system. 4

- (b) Describe a signal generator and its applications. 4

Set-14(1)

B. Tech-1st (All Br.)
Basic of Civil Engineering

Full Marks : 50

Time : 2.30 hours

Answer all questions.

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1. Answer *all* questions : *2 × 5*

(a) Discuss the differences between Plinth area and carpet area.

(b) Write down six important property of a good brick.

(c) List the functions of foundations.

(d) Compare lifts and escalators.

(e) What is the difference between a weir and a dam ?

(2)

2. (a) Draw a rough sketch of the section of a simple single storied building and mark the basic building components. Write down their functions. 4
- (b) List various disciplines of Civil Engineering and briefly discuss any three. 4
- Or.
- (a) Write six important factors to be considered in the selection of site for a building. 4
- (b) Explain the importance of civil engineering in infrastructural development of the country. 4
3. (a) Write a short note on EDM, Total station, GPS. 4

- (b) The following staff readings were taken successively with a level, the instrument being shifted after third, sixth and eighth readings : 2.228, 1.606, 0.988, 2.090, 2.864, 1.262, 0.602, 1.982, 1.044, 2.684. Enter the readings in level book and find the RL of points if the first reading was taken with a staff held on a bench mark of 432.384 m. 4

(3)

Or

- (a) What are the constituents of RCC ? List out grades of concrete with their usage. 4
- (b) Define grade of cement ? List available grades of cement. 4
4. (a) Explain step by step procedure for finishing of a wall using plastering. 4
- (b) Explain briefly the different types of pitched roof coverings. 4
- Or
- (a) List out the different types of bond in brick wall and explain any three in detail. 4
- (b) Explain the types of floor suitable for residential and commercial building. 4
5. (a) Discuss the significance and classifications of air conditioning systems ? 4
- (b) With a neat cross-section discuss different components of a railway track. 4

(4)

Or

(a) Explain the necessity and functional requirements of Ventilation. 4

6. (a) Write a short note on 'Transportation modes'. 4
(a) What are the aircraft characteristics affecting airport design. 4

(b) What are the classifications of urban roads ?
Briefly discuss each one of it. 4

Or

(a) Explain different types of dam along with purpose and functions. 4

- (b) What are the types of irrigation ? Explain the importance of irrigation. 4

Total Pages—5

Set-14(1)**B.Tech-1st- (All Br.)****Programming for Problem Solving***Full Marks : 50**Time : 2.30 hours***Answer all questions.***The figures in the right-hand margin indicate marks.***Symbols carry usual meaning.****1. Answer all questions : 2×5**

(a) Write the differences between primary memory and secondary memory.

(b) Draw a flowchart to determine whether a person is eligible for driving or not.

(c) With a neat diagram explain the basic structure of a computer.

(d) What is a token ? What are different types of tokens available in C language ? Explain.

(2)

(e) Explain formatted input and output statement with examples.

2. (a) Explain the different types of loops in C with syntax.

4

(b) Discuss various relational and logical operators with examples.

4

Or

(a) What is an array ? How a single dimension and two dimension arrays are declared and initialized ?

4

(b) Explain the row major and column major memory representation of array. Also mention how we can compute the address of an element in each case.

4

3. (a) What is recursion ? Explain. Write a C-program using recursive function for finding factorial of a positive number.

4

(b) Differentiate between Actual parameter and Formal parameter. Write a program in C to find out GCD of two numbers using function.

4

(3)

Or

(a) Write a program in C to find the sum and the mean of all elements in an array using pointers.

4

(b) Explain briefly how to use # define directive with suitable example.

4

4. (a) Explain the following string handling functions :

4

(i) strcmp()

(ii) strlen()

(iii) getchar()

(iv) strrev()

(v) strcut()

(vi) strcpy()

(b) Write a C program to compare two strings.

4

Or

(a) Write a program to find area of a circle using macros.

4

(4)

- (b) Write a C program to compute all possible roots of a Quadratic equation using switch statement. 4

5. (a) Write a c-program using structures to read, write, compute average- marks and display the students scoring above and below the average marks for a class of N students. 4

- (b) Write a program in C to print the following pattern: 4

```

1
1 2
1 2 3
1 2 3 4
.
```

Or

- (a) Write the functionality of `strlen()` and `strcpy()` using C program. Do not use library function. 4

- (b) What is a pointer? How does it help in dynamic memory allocation? Differentiate between `malloc()` and `calloc()` in C. 4

(5)

6. (a) What is FILE? Differentiate between text file and binary file? Explain the following file function with examples: 4

- (i) `fopen()`
- (ii) `fclose()`
- (iii) `feof()`
- (iv) `fseek()`

- (b) Write a program to read two integer X and Y and swap the contents of the variable X and Y using pointers. 4

Or

- (a) Write a program in C that reads the name of a file and displays the contents of the file on the user screen. 4

- (b) Describe the concept of 'Function returning pointers' and 'Pointers to functions' with examples. 4

Total Pages—6

Set-14(1)

B. Tech-1st (All Br.)
Chemistry

Full Marks : 50

Time : 2.30 hours

Answer all questions.

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1. Answer all questions : 2×5

(a) What do you mean by eigenvalue and eigenfunction ?

(b) What is the main criterion for a molecule to be microwave active ? Which of the following molecules will show a microwave rotational spectrum : HCl, CH₄, Br₂, CO₂.

(c) Show that $(\partial T / \partial P)_s = (\partial V / \partial S)_P$.

(2)

- (d) How stainless steel maintains luster for a long period ?
- (e) What are CNTs ? Write any two applications of CNT.
2. (a) Derive the expression for wave function and energy of a particle in one dimension box using the application of Schrödinger wave equation. 5
- (b) An electron is confined in a 1 D box of width 2 cm undergo a transition from the ground state ($n = 1$) to the first excited state ($n = 2$). Calculate the transition energy. 3

Or

- (a) Show that for a rigid diatomic rotor. The moment of inertia is given by $I = \mu r^2$. 4
- (b) The separation of lines in the microwave spectrum of $^{12}\text{C}^{16}\text{O}$ molecules was found to be 298 m^{-1} . Calculate the rotational constant, bond length of the molecule and the energy corresponding to first excited state energy level. 4

(3)

3. (a) Define the term chemical potential. Derive and write the significance of Gibb's Duhem equation. 4
- (b) At NTP 2.8 litres of Oxygen were mixed with 19.6 litres of Hydrogen. Calculate the increase in entropy (Assume ideal gas behavior). 4

Or

- (a) Draw a neat diagram and discuss the Water equilibrium system. Use Clausius-Clapeyron equation to explain the slope of different curves. 5
- (b) Discuss the application of Pb-Ag phase diagram in the Pattinson's process of desilverisation of Argentiferous lead. 3
4. (a) Discuss how pH of an unknown solution is measured by using Hydrogen electrode as indicator electrode and calomel electrode as reference electrode. 4
- (b) For the cell $\text{Al}/\text{Al}^{3+}(\text{a}) \parallel \text{Sn}^{4+}(\text{a})/\text{Sn}^{2+}(\text{a}), \text{Pt}$

(4)

The standard electrode potentials at 298 K are
 $E^\circ(\text{Al}^{3+}/\text{Al}) = -1.66 \text{ V}$, $E^\circ(\text{Sn}^{4+}/\text{Sn}^{2+}) = +0.15$. 4

- (i) Write the cell reaction
- (ii) Calculate the cell emf when the activities are 1M for all
- (iii) G° for the reaction
- (iv) K_{equ} for the reaction

Or

(a) What is corrosion ? Name different methods of corrosion prevention. How is corrosion prevented by cathodic protection ?

(b) What are fuel cell ? Discuss the construction and the reactions taking place at anode and cathode in Hydrogen-Oxygen fuel cell.

5. (a) What are complex reactions ? Discuss the kinetics of reversible reaction. 6

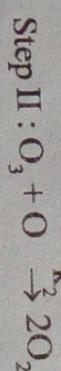
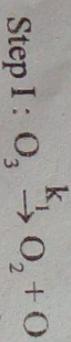
(b) What are chain reactions ? Write Rice-Herzfeld mechanism of reaction of hydrogen and bromine. 2

(5)

Or

(a) What is steady state approximation ? 2

(b) For the thermal decomposition of ozone to oxygen ($\text{O}_3 \rightarrow \text{O}_2$) the following mechanism has been suggested. 6



Show that the rate of decomposition of ozone is $k_1[\text{O}_3]$ using steady state approximation.

6. (a) Discuss briefly about the different classes of nanomaterials based on the macroscopic dimension with examples. 4

(b) Briefly describe the properties and application of nanomaterials. 4

Or

(a) What are organometallic compounds ? Write about the bonding/structure and properties of these compounds. 4

(6)

(b) Discuss any four important applications of organometallic compounds with example. 4