Question Bank for Basic Electronics and Communication Engineering (21ELN14/24)

Module – 1
Electronic Circuits

Power Supplies

1. With a neat block diagram, explain the working of a DC power supply. Also mention the principal components used in each block. ***(Aug '22 – 7M, MQP1 – 7M)***
2. What is a rectifier? What are the different types of rectifiers?
3. With a neat circuit diagram, explain the working of a half-wave rectifier along with relevant waveforms.
4. A mains transformer having a turns ratio of 44: 1 is connected to a 220 V r.m.s. mains supply. If the secondary output is applied to a half-wave rectifier, determine the peak voltage that will appear across a load.
5. What is the need for reservoir and smoothing circuits? Explain.
6. Explain the working of a half-wave rectifier with reservoir capacitor along with relevant waveforms.
7. The R-C smoothing filter in a 50 Hz mains operated half-wave rectifier circuit consists of $R_1 = 100\ \Omega$ and $C_1 = 1{,}000\ \mu F$. If 1 V of ripple appears at the input of the circuit, determine the amount of ripple appearing at the output.
8. A half-wave rectifier is fitted with an R-C smoothing filter comprising $R = 200\ \Omega$ and $C = 50\ \mu F$. If 2 V of 400 Hz ripple appear at the input of the circuit, determine the amount of ripple appearing at the output.
9. Explain the working of bi-phase full wave rectifier circuit with neat diagram and waveforms. ***(Aug '22 – 7M, MQP2 – 8M)***
10. With a neat circuit diagram, explain the working of a bi-phase rectifier along with relevant waveforms. Also explain how the output changes when a reservoir capacitor is used.
11. With neat circuit diagram and waveforms explain the working of bridge rectifier. ***(MQP1 – 8M)***
12. With a neat circuit diagram and waveforms, explain the working of bridge rectifier without filter. ***(Feb '22 – 8M)***
13. With a neat circuit diagram, explain the working of a bridge rectifier along with relevant waveforms. Also explain how the output changes when a reservoir capacitor is used.
14. What is a voltage regulator?
15. Explain the operation of a simple shunt Zener voltage regulator. ***(MQP2 – 7M)***

16. A 6 V zener diode has a maximum rated power dissipation of 500 mW. If the diode is to be used in a simple regulator circuit to supply a regulated 6 V to a load of 500 Ω, determine a suitable value of series resistor for a supply of 12 V. ***(Feb '22 – 6M)***
17. A 5 V zener diode has a maximum rated power dissipation of 500 mW. If the diode is to be used in a simple regulator circuit to supply a regulated 5 V to a load having a resistance of 400 Ω, determine a suitable value of series resistor for operation in conjunction with a supply of 9 V.
18. If a 9 V zener diode is to be used in a simple shunt regulator circuit to supply a load having a nominal resistance of 300 Ω, determine the maximum value of series resistor for operation in conjunction with a supply of 15 V.
19. Explain the terms output resistance and voltage regulation with respect to voltage regulator.
20. The following data were obtained during a test carried out on a d.c. power supply:

    (i) Load test

    Output voltage (no-load) = 12 V

    Output voltage (2 A load current) = 11.5 V

    (ii) Regulation test

    Output voltage (mains input, 220 V) = 12 V

    Output voltage (mains input, 200 V) = 11.9 V

    Determine (a) the equivalent output resistance of the power supply and (b) the regulation of the power supply.
21. The following data were obtained during a load test carried out on a d.c. power supply:

    Output voltage (no-load) = 8.5 V

    Output voltage (800 mA load) = 8.1 V

    Determine the output resistance of the power supply and estimate the output voltage at a load current of 400 mA.
22. The following data were obtained during a regulation test on a d.c. power supply:

    Output voltage (a.c. input: 230 V) = 15 V

    Output voltage (a.c. input: 190 V) = 14.6 V

    Determine the regulation of the power supply and estimate the output voltage when the input voltage is 245 V.
23. What is a voltage multiplier?
24. With circuit diagram explain the following: Voltage Doubler, Voltage Tripler ***(MQP2 – 5M)***

Amplifiers

1. What is an amplifier?
2. List and describe the main types of amplifiers. ***(MQP2 – 7M)***

3. Explain the following terms related to amplifier: (a) Gain (b) Input resistance (c) Output resistance
4. An amplifier produces an output voltage of 2 V for an input of 50 mV. If the input and output currents in this condition are, respectively, 4 mA and 200 mA, determine: (a) the voltage gain (b) the current gain (c) the power gain.
5. The following measurements were made during a test on an amplifier:

   $V_{in} = 250$ mV, $I_{in} = 2.5$ mA, $V_{out} = 10$ V, $I_{out} = 400$ mA

   Determine: (a) the voltage gain (b) the current gain (c) the power gain (d) the input resistance.
6. An amplifier has a power gain of 25 and identical input and output resistances of 600 Ω. Determine the input voltage required to produce an output of 10 V.
7. Explain the following terms related to amplifier: (a) Frequency response (b) Bandwidth (c) Phase shift
8. Write a note on frequency response characteristics of an amplifier circuit, clearly mentioning the half power frequencies. ***(MQP1 – 6M)***
9. Mention the advantages of negative feedback in amplifiers circuits. With relevant equations and diagram, explain the concept of negative feedback. ***(Aug '22 – 7M, MQP1 – 7M)***
10. With a neat block diagram, derive the expression for overall gain of a negative feedback amplifier. ***(Feb '22 – 6M)***
11. Explain the concept of negative feedback with a neat diagram. Show how negative feedback stabilizes the overall gain of an amplifier.
12. An amplifier with negative feedback applied has an open-loop voltage gain of 50, and one-tenth of its output is fed back to the input (i.e. $\beta = 0.1$). Determine the overall voltage gain with negative feedback applied. If the amplifier's open-loop voltage gain increases by 20%, determine the percentage increase in overall voltage gain.
13. An amplifier with negative feedback applied has an open-loop voltage gain of 250, and 5% of its output is fed back to the input. Determine the overall voltage gain with negative feedback applied. If the open-loop voltage gain increases by 20% determine the new value of overall voltage gain.
14. An integrated circuit that produces an open-loop gain of 100 is to be used as the basis of an amplifier stage having a precise voltage gain of 20. Determine the amount of feedback required.
15. An amplifier produces an open-loop gain of 180. Determine the amount of feedback required if it is to be operated with a precise voltage gain of 50.
16. What are multi-stage amplifiers? What are the different methods used for interstage coupling?

Operational Amplifiers

1. What is an operational amplifier? Sketch the circuit symbol for an operational amplifier. Label each of the connections.
2. Explain the following parameters of an op-amp: (a) Open-loop voltage gain (b) Closed-loop voltage gain (c) Input resistance (d) Output resistance
3. Define the following with respect to operational amplifiers and write their typical values:

   i) Open loop voltage gain ii) Input offset voltage iii) Full power bandwidth and

   iv) Slew rate ***(Feb '22 – 8M)***
4. During measurements on an operational amplifier under open-loop conditions, an output voltage of 12 V is produced by an input voltage of 1 mV. Determine the open-loop voltage gain expressed in dB.
5. An operational amplifier operating with negative feedback produces an output voltage of 2 V when supplied with an input of 400 μV. Determine the value of closed-loop voltage gain.
6. An operational amplifier with negative feedback applied produces an output of 1.5 V when an input of 7.5 mV is present. Determine the closed-loop voltage gain.
7. An operational amplifier has an input resistance of 2 MΩ. Determine the input current when an input voltage of 5 mV is present.
8. Explain the following parameters of an op-amp: (a) Input offset voltage (b) Full-power bandwidth (c) Slew rate
9. With the aid of a sketch, explain what is meant by the term 'slew rate'. Why is this important?
10. A perfect rectangular pulse is applied to the input of an operational amplifier. If it takes 4 μs for the output voltage to change from –5 V to +5 V, determine the slew rate of the device.
11. A wideband operational amplifier has a slew rate of 15 V/μs. If the amplifier is used in a circuit with a voltage gain of 20 and a perfect step input of 100 mV is applied to its input, determine the time taken for the output to change level.
12. List and explain the ideal and real characteristics of op-amp.
13. With neat circuit diagrams, explain the three basic configurations for operational amplifiers.
14. Explain how capacitors can be added to modify the frequency response of op-amps.
15. An inverting operational amplifier is to operate according to the following specification:

    Voltage gain = 100

    Input resistance (at mid-band) = 10 kΩ

    Lower cut-off frequency = 250 Hz

    Upper cut-off frequency = 15 kHz
16. Devise a circuit to satisfy the above specification using an operational amplifier. With a neat circuit diagram and waveforms, explain the following op-amp circuits: (a) Voltage follower (b) Differentiator (c) Integrator (d) Comparator (e) Summing amplifier

17. With a neat circuit diagram, explain the working of integrator using op-amp. ***(Feb '22 – 6M)***
18. With circuit diagram and waveform show how operational amplifier can work as a comparator. ***(MQP1 – 6M)***
19. Sketch the circuit of each of the following based on the use of operational amplifiers

    (a) comparator (b) a differentiator (c) an integrator (d) Inverting Amplifier.

    (Aug '22 – 6M, MQP2 – 8M)
20. An inverting amplifier is to be constructed having a mid-band voltage gain of 40, an input resistance of 5 kΩ and a frequency response extending from 20 Hz to 20 kHz. Devise a circuit and specify all component values required.
21. A summing amplifier with two inputs has $R_F = 10$ kΩ, and R_{IN} (for both inputs) of 2 kΩ. Determine the output voltage when one input is at -2 V and the other is $+0.5$ V.

Oscillators

1. What is an oscillator?
2. Explain the concept of positive feedback with a neat diagram. Show how positive feedback increases the overall gain of an amplifier.
3. An amplifier with a gain of 8 has 10% of its output fed back to the input. Determine the gain of the stage (a) with negative feedback (b) with positive feedback.
4. Explain the conditions for oscillation.
5. With a neat circuit diagram, explain ladder network oscillator.
6. List and explain the conditions for sustained oscillations. Determine the frequency of oscillation of a three-stage ladder network in which $C = 10$ nF and $R = 10$ kΩ.

   (Aug '22 – 6M, MQP1 – 6M)
7. A phase-shift oscillator is to operate with an output at 1 kHz. If the oscillator is based on a three-stage ladder network, determine the required values of resistance if three capacitors of 10 nF are to be used.
8. With a neat circuit diagram, explain the working of Wien bridge oscillator using op-amp. ***(Feb '22 – 6M)***
9. In a Wien bridge oscillator based on an operational amplifier, if $C_1 = C_2 = 100\ nF$, determine the output frequencies when (a) $R_1 = R_2 = 1\ k\Omega$ and (b) $R_1 = R_2 = 6\ k\Omega$.
10. In a Wien bridge oscillator based on an operational amplifier, $C_1 = C_2 = 22$ nF. Determine the values of R_1 and R_2 required to produce an output at exactly 400 Hz.
11. What is a multivibrator? What are the principal types of multivibrators? Distinguish between them.
12. With suitable circuit diagram, explain single stage astable multivibrator using operational amplifier. ***(Aug '22 – 7M)***
13. Describe the working of a single stage astable oscillator using an op-amp. ***(MQP2 – 5M)***
14. Write a note on crystal controlled oscillators.

Module – 2
Logic Circuits

1. Explain all the logic gates with the symbols and truth tables.
2. Implement exclusive-OR function using an arrangement of basic logic gates (AND, OR and NOT).
3. Construct a logic circuit that will produce a Logic 1 output whenever two or more of its inputs are at Logic 1. ***(MQP2 – 7M)***
4. With the help of truth table, explain half adder.
5. With the help of truth table, explain full adder using logic gates. ***(Aug '22 – 6M, Feb '22 – 8M, MQP2 – 5M)***
6. Design a full adder using two half adders and an OR-gate. ***(MQP1 – 8M)***
7. What is multiplexer? Mention its applications.
8. What is multiplexer? With truth table and logic circuit, explain 8:1 multiplexer. ***(Aug '22 – 7M)***
9. Realize 8-to-1 multiplexer using basic gates. ***(Feb '22 – 6M)***
10. What is a decoder? Mention its applications.
11. Design a 3:8 Decoder and show its implementation using basic gates. ***(Aug '22 – 8M, MQP2 – 8M)***
12. Define a bistable. Using truth table and logic circuit, explain R-S bistable. ***(Aug '22 – 7M)***
13. With the help of logic diagram, explain the working of R-S bistable circuit. ***(Feb '22 – 6M)***
14. Explain the operation of a J-K bistable.
15. Explain input and output states for a J-K bistable using clocked operation. ***(MQP2 – 8M)***
16. With the help of a timing diagram explain how D-type bistable circuit works. ***(MQP1 – 7M)***
17. With a neat block diagram, explain the 4-bit shift register using J-K flip-flop. ***(Feb '22 – 6M)***
18. Design a 4-stage shift register using J-K bistables. ***(MQP1 – 7M)***
19. With the help of a neat diagram explain the 4-bit shift register operation and types. ***(MQP2 – 7M)***
20. Discuss the design of a 3-bit asynchronous up-counter. ***(MQP1 – 6M)***
21. With a neat block diagram, waveforms and truth table, explain 3-bit asynchronous counter using J-K flip-flop. ***(Feb '22 – 6M)***
22. Convert hexadecimal A3 into binary.
23. Convert binary 11101000 binary to hexadecimal.
24. Write a note on different data types mentioning the bit size and range of values supported. ***(Aug '22 – 6M, MQP1 – 5M)***
25. Write a note on data storage.

26. With the help of neat block diagram, explain the working of microcontroller system. ***(Feb '22 – 8M)***
27. With a neat block diagram show how typical input and output blocks are connected to a microcontroller unit. ***(MQP1 – 7M)***
28. With a neat block diagram explain the arrangement of a microcontroller system with typical inputs and outputs. ***(Aug '22 – 6M, MQP2 – 5M)***

Module – 3
Embedded Systems

1. What is an embedded system? List any 7 comparisons between embedded system and general purpose computing system. ***(Feb '22 – 8M)***
2. Compare embedded systems and general computing systems. Also provide major application areas of Embedded Systems. ***(Aug '22 – 8M, MQP2 – 8M)***
3. Write a note on classification of embedded systems. ***(Aug '22 – 6M, MQP1 – 6M)***
4. Explain the classification of embedded system based on generation. ***(Feb '22 – 6M)***
5. With neat block diagram, explain the elements of embedded system.
6. Mention the different categories of the core of the embedded system.
7. List the comparison between microprocessor and microcontroller. ***(Feb '22 – 6M)***
8. Bring out the differences between RISC and CISC, Harvard & Von-Neumann. ***(Aug '22 – 6M, MQP1 – 6M)***
9. With a neat block diagram, explain an instrumentation system. ***(Feb '22 – 8M)***
10. With neat diagrams, explain instrumentation and control systems.
11. Give the classification of transducers with examples. ***(MQP1 – 6M)***
12. Define 'sensors' and give its classification with examples. ***(MQP2 – 6M)***
13. Explain the operation of an LED with neat diagram. Mention its applications.
14. With a neat circuit diagram, explain Common Cathode and Common Anode 7-segment LED display. ***(Feb '22 – 6M)***
15. Explain the different configurations of 7-segment LED Display. ***(Aug '22 – 6M, MQP2 – 6M)***
16. Explain the working, principle of operation and applications of stepper motor. ***(MQP1 – 8M)***
17. Define actuator. With relevant diagrams, explain the operation of Relay, Push button and Piezo buzzer. ***(Aug '22 – 8M, MQP1 – 8M, MQP2 – 8M)***
18. Describe the matrix keyboard interfacing and UART. ***(MQP2 – 6M)***
19. Explain the following external communication interfaces: USB, Wi-Fi ***(MQP2 – 6M)***
20. Bring out the main features of UART and USB. ***(Aug '22 – 6M, MQP1 – 6M)***
21. Explain the features of parallel interface.
22. Write a short note on GPRS.

Module – 4
Analog and Digital Communication

1. Describe the blocks of the basic communication system. ***(Feb '22 – 8M, MQP1 – 6M)***
2. Describe the basic block diagram of a communication system. ***(Aug '22 – 6M)***
3. Define the following terms: (i) Modulation (ii) Carrier communication system (iii) Baseband communication system with neat and suitable waveforms. ***(MQP1 – 6M)***
4. Explain the types of communication system. ***(Feb '22 – 6M)***
5. Describe the classification of RF (Radio Frequency) spectrum with applications in communications systems. ***(MQP2 – 8M)***
6. Define and explain SNR, Noise Figure, channel types, amplitude modulation. ***(MQP2 – 8M)***
7. Define Amplitude Modulation. With the help of waveforms, explain amplitude modulation. ***(Feb '22 – 6M)***
8. Write a note on: (i) Amplitude Modulation (ii) Frequency Modulation (iii) Phase Modulation
9. Explain the following with the help of waveforms. (i) PAM (ii)PWM (iii)PPM (iv) PCM ***(Aug '22 – 8M, MQP1 – 8M)***
10. Write a note on digital modulation techniques.
11. Define sampling theorem, Nyquist rate and explain when aliasing can happen. Also mention the different ways in which aliasing can be avoided. ***(Aug '22 – 8M, MQP1 – 6M)***
12. Explain different types of radio wave propagation with a neat diagram. ***(Aug '22 – 6M, MQP2 – 6M)***
13. Explain three different modes of propagation of electromagnetic waves, with a neat diagram. ***(Feb '22 – 8M)***
14. Present the architecture of a wireless communication transmitter and its modulation scheme QPSK with waveforms and constellation diagrams. ***(MQP2 – 6M)***
15. Discuss the various Multiple Access Techniques used in cellular network. ***(Aug '22 – 6M, MQP2 – 6M)***
16. Define the following terms: Multipath, Constructive and destructive interference, Coherence time, Coherence bandwidth, Delay spread ***(MQP1 – 10M)***
17. With a neat block diagram, explain transmitter and receiver using Automatic Repeat Request. ***(Feb '22 – 6M)***
18. Write short notes on: Forward Error Correction, Automatic Repeat Request ***(MQP2 – 6M)***
19. Define an antenna and discuss different types of antennas. ***(Aug '22 – 6M, MQP1 – 4M)***
20. Define an antenna. Explain Yagi antenna model. ***(Feb '22 – 6M)***

Module – 5
Wireless Cellular Networks, Satellite Communication, Optical Fiber Communication, Microwave Communication

1. With a neat block diagram, explain cellular telephone system. ***(Feb '22 – 8M)***
2. Draw the schematic diagram of a cellular telephone system and define its basic components. ***(Aug '22 – 6M, MQP1 – 6M)***
3. Define the terms cell & cluster in a cellular system and explain the cellular concept in wireless mobile networks. ***(MQP2 – 6M)***
4. Explain the cellular concept and the concept of frequency reuse in cellular networks.
5. Write the basic operations involved in transmitting and receiving in a cellular telephone network.
6. Write a note on mobility management in cellular networks.
7. With the help of diagrams, discuss the following types of network topologies: Ad-Hoc Network Topology, Infrastructure Network Topology ***(MQP1 – 8M)***
8. Briefly explain the features of first generation (1G) technology.
9. What are the features of second generation (2G) technology? Explain.
10. Draw the architecture of GSM system and explain the important features of it. ***(Aug '22 – 8M)***
11. With a neat block diagram, explain GSM system architecture. ***(Feb '22 – 6M)***
12. Define the following terms with respect to GSM system: Mobile Station (MS), Base Station Subsystem (BSS), Network & Switching System (NSS). ***(MQP2 – 6M)***
13. Discuss 3G technology with specific emphasis on CDMA. ***(MQP2 – 6M)***
14. With the help of architecture figures explain the evolution from GSM to LTE. ***(MQP1 – 8M)***
15. List the requirements identified for the 4G technology. ***(MQP1 – 4M)***
16. Write a short note on: (i) WLAN (ii) Bluetooth ***(Aug '22 – 6M)***
17. Write a short note on WLAN. ***(Feb '22 – 6M)***
18. With a neat block diagram, explain satellite communication. ***(Feb '22 – 8M)***
19. Draw the block diagram showing the basic elements of a satellite communication system and briefly explain them. ***(Aug '22 – 6M, MQP1 – 8M)***
20. Based on orbits, discuss the different types of satellites. ***(MQP2 – 6M)***
21. Explain the optical fiber communication system with a block diagram. ***(Aug '22 – 6M, MQP1 – 6M)***
22. With the help of a block diagram explain the generalized configuration of a fiber-optic communication system. ***(MQP2 – 8M)***

23. With a neat block diagram, explain analog link of an optical fiber communication system. ***(Feb '22 – 6M)***

24. With neat diagrams, explain the basic operation of frequency modulated microwave communication system.

25. Write a short note on frequency bands of microwave communication. ***(Feb '22 – 6M)***

26. Bring out the features of FM transmitter, FM receiver and repeaters in microwave communication system. ***(Aug '22 – 8M, MQP2 – 8M)***