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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **18EC2008** | **Duration** | **3hrs** |
| **Course Title** | **ANALOG CIRCUITS** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the process which converts ac into dc. | | CO1 | R | 1 |
| 2. | Indicate the other name of clamper circuit. | | CO1 | R | 1 |
| 3. | Recall the stability factor for a transistor biased with fixed biased method of biasing. | | CO2 | R | 1 |
| 4. | Indicate how many degree phases have been shifted from input to output in common emitter configuration. | | CO2 | R | 1 |
| 5. | Give the type of amplifier which has voltage gain approximately equal to 1. | | CO3 | U | 1 |
| 6. | Name the power amplifier in which crossover distortion occurs. | | CO4 | R | 1 |
| 7. | The voltage gaion of an amplifier without feedbak is 3000 and feedback factor is 0.01. Calculate the voltage gain with negative feedback. | | CO5 | A | 1 |
| 8. | List any two characteristics of differential amplifiers. | | CO5 | R | 1 |
| 9. | State barkhausen criterion. | | CO6 | R | 1 |
| 10. | Defend the need of tuned amplifiers. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discuss the induction filter with neat diagram. | | CO1 | U | 3 |
| 12. | For the circuit shown in the Figure, calculate IB and IC. Assume that  VBE = 0.7 and β = 50. | | CO2 | A | 3 |
| 13. | Justify why hybrid model is used for the analysis of BJT amplifier at low frequencies only. | | CO3 | E | 3 |
| 14. | List any 3 characteristics of power amplifier. | | CO4 | R | 3 |
| 15. | Define gain margin and Phase margin. | | CO5 | R | 3 |
| 16. | Generalize the need of current mirror circuit in differential amplifiers. | | CO5 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | A crystal diode having internal resistance rf = 20Ω is used for half-wave rectification. If the applied voltage v = 50 sin ω t and load resistance RL= 800 Ω, find : (i) Im, Idc, Irms (ii) a.c. power input and d.c. power output (iii) d.c. output voltage (iv) efficiency of rectification. | CO1 | A | 6 |
|  | b. | Explain the construction and working of centre tapped full wave rectifier. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Differentiate voltage amplifier from current amplifier. | CO2 | An | 4 |
|  | b. | Explain the operation of common base circuit arrangement with neat diagram and plot its input, output characteristics. | CO2 | U | 8 |
|  |  |  |  |  |  |
| 19. |  | Using low frequency h-parameter model, derive the expressions for voltage gain, current gain, input impedance and output admittance for a BJT Amplifier in CE configuration. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Mention the types of coupling used in multistage amplifier. | CO3 | R | 3 |
|  | b. | Draw the circuit diagram of a single stage RC coupled Amplifier and discuss the steps used for designing it. | CO3 | C | 9 |
|  |  |  |  |  |  |
| 21. | a. | Describe the operation of Series fed, Directly coupled Class A Power Amplifier and derive its maximum efficiency. | CO4 | U | 10 |
|  | b. | Illustrate the need of class AB is preferred over class B amplifier. | CO4 | A | 2 |
|  |  |  |  |  |  |
| 22. | a. | Define CMRR. | CO5 | R | 2 |
|  | b. | Discuss in detail about input and output resistances for Voltage Series feedback amplifier. | CO5 | U | 10 |
|  |  |  |  |  |  |
| 23. | a. | In a Hartley oscillator, if L1=0.2mH, L2=0.3mH and C=0.003μF. Calculate the frequency of oscillation. | CO6 | A | 3 |
|  | b. | With a neat diagram explain about Colpitt oscillator & derive the expression for frequency of oscillation and condition of oscillation. | CO6 | A | 9 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | In the wien bridge oscillator R1=R2-220 kΩ, C1=C2=250pF. Determine the frequency of oscillation. | CO6 | A | 3 |
|  | b. | Explain in detail about the construction and working of RC phase shift oscillator and derive the frequency of oscillation of it. | C06 | C | 9 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Design innovative circuit solutions by using the properties of diodes for specific real world  electronic applications. |
| **CO2** | Compare the characteristics of BJT and JFET amplifiers to evaluate their suitability for  specific applications. |
| **CO3** | Design Low frequency and high frequency transistor models for particular applications. |
| **CO4** | Examine the characteristics and efficiency of power amplifiers . |
| **CO5** | Evaluate the performance of a differential amplifier and feedback amplifier according to  specified requirements. |
| **CO6** | Illustrate the characteristics of sinusoidal and non-sinusoidal oscillators and identify  their key features and applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **18EC2012** | **Duration** | **3hrs** |
| **Course Title** | **LINEAR INTEGRATED CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Interpret the significance of the number ‘741’ in the operational amplifier IC. | | CO1 | U | 1 |
| 2. | Define offset current in an operational amplifier. | | CO1 | R | 1 |
| 3. | Write one advantage of a precision diode compared to a normal PN junction diode. | | CO2 | U | 1 |
| 4. | Name the operational amplifier circuit that uses a multiplier as a feedback element. | | CO2 | R | 1 |
| 5. | Indicate the function of a regulator in a power supply unit. | | CO3 | U | 1 |
| 6. | Deduce the process of generating a triangular wave using an astable multivibrator. | | CO3 | An | 1 |
| 7. | Identify the type of low-pass filter that provides ripples in the passband. | | CO4 | U | 1 |
| 8. | Give one advantage of an active filter compared to a passive filter. | | CO4 | U | 1 |
| 9. | Indicate the significance of the voltage-controlled oscillator in PLL. | | CO5 | U | 1 |
| 10. | Compare R-2R ladder type DAC with binary weighted resistor type DAC. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the internal block diagram of an operational amplifier. | | CO1 | A | 3 |
| 12. | A differential amplifier is designed using an op-amp with the following resistor values: R1=1kΩ, R2=10kΩ, R3=1kΩ, R4=10kΩ. Input voltages: V1=0.6V, V2 =0.2V. Compute the output voltage. | | CO2 | A | 3 |
| 13. | Justify why an amplifier with feedback can act as an oscillator under certain conditions. | | CO3 | E | 3 |
| 14. | Predict the type of bandpass filter if the filter passes the signal within the frequency range of fl = 30 Hz and fh = 4KHz. | | CO4 | E | 3 |
| 15. | Deduce the design of a wide bandpass filter from a low pass and high pass filter. | | CO4 | An | 3 |
| 16. | The reference voltage of a 3-bit DAC is 10.3V. If the digital input '000' represents 0V, determine the output voltage when the input is '101'. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | A sensor in an industrial application produces a low voltage output signal (0.2V to 0.5V), which needs to be amplified for further processing. Design a non-inverting amplifier using an operational amplifier to amplify the sensor output by a factor of 10. Determine the required resistor values and calculate the output voltage for an input of 0.3V. | CO1 | A | 8 |
|  | b. | An inverting summing amplifier using an op-amp takes three input voltages: V1=2V, V2 =3V, and V3 =−1V. The resistors used for all inputs and feedback are of equal value 𝑅=10𝑘Ω. Determine the output voltage. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. |  | Construct the Op-Amp-based circuit that operates according to the given input and output also provide necessary mathematical analysis. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain the working principle of an RC phase shift oscillator and discuss its applications in low-frequency signal generation. | CO3 | U | 8 |
|  | b. | A RC Phase shift Oscillator circuit uses R=100kΩ and C=0.001μF, compute the frequency of oscillation. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Design a second-order Sallen-Key high-pass filter and formulate a generalized transfer function. | CO4 | C | 8 |
|  | b. | A first-order low-pass filter is designed using a resistor 10 kΩ and a capacitor 1 µF. Determine the cut-off frequency (fc) of the filter. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | A 555 timer IC is configured in Astable mode to generate a continuous pulse train for an LED blinking circuit. The LED needs to blink at a frequency suitable for visibility. Select relevant resistors and capacitors to achieve a desired blinking frequency of 1 Hz and justify your choice of components. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the working of a monostable multivibrator using an operational amplifier and derive the expression for the time duration it remains in the quasi-stable state. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Discuss the key steps involved in the basic planar fabrication process used in semiconductor manufacturing. | CO6 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Deduce the working principle of a Successive Approximation ADC with an example, and outline the relevant diagram and waveforms. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the fundamentals of OP-AMP, its characteristics and fabrication techniques. |
| **CO2** | Design OP-AMP-based circuits such as Amplifiers, Differentiators, and Integrators. |
| **CO3** | Evaluate the significance of OP-AMPs in Multivibrators and Oscillators. |
| **CO4** | Construct filters using OP-AMPs. |
| **CO5** | Apply the functionality of IC555 timer and Phase Locked Loop (PLL) in practical scenarios. |
| **CO6** | Design real-time applications using ADC and DAC. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **18EC2015** | **Duration** | **3hrs** |
| **Course Title** | **DIGITAL SIGNAL PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Determine whether the discrete-time system y(n)=x(n-1)+5 is static or dynamic. | | CO1 | A | 1 |
| 2. | Define Interpolation. | | CO1 | R | 1 |
| 3. | Write the equation for calculating “twiddle factor” in FFT computation. | | CO2 | A | 1 |
| 4. | List the significance of multi rate DSP. | | CO2 | R | 1 |
| 5. | Write the equation of bilinear transformation technique for digital filter design. | | CO3 | A | 1 |
| 6. | Sketch the magnitude response of Chebyshev type-I low pass filter. | | CO3 | A | 1 |
| 7. | Define Gibbs Phenomenon for FIR filter design. | | CO4 | R | 1 |
| 8. | Define phase delay. | | CO4 | R | 1 |
| 9. | List the different quantization methods. | | CO5 | R | 1 |
| 10. | Write the special features of DSP processors. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Determine the circular convolution of two finite duration sequences x1[n]={1,2,1,1} x2[n]= {2,2,3} | | CO1 | A | 3 |
| 12. | Compare DIT-FFT with DIF-FFT. | | CO2 | An | 3 |
| 13. | Enumerate the characteristics of digital Butterworth filter. | | CO3 | R | 3 |
| 14. | List the characteristics of FIR filter. | | CO4 | R | 3 |
| 15. | Summarize the effects of finite word length in digital filter design. | | CO5 | U | 3 |
| 16. | Compare Harvard architecture with and Von Newman architecture. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Determine sectioned convolution using overlap save method  x[n]={2,-2,-3,2,4,5,2,7,8,1,4,2,1,2,3}, h[n]={1,2,-1} | CO1 | A | 8 |
|  | b. | Compare up sampling with down sampling. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. | a. | Compute 8 point DFT of a sequence x[n]= {0,1,2,3,4,5,6,7} using radix-2 DIT-FFT algorithm. | CO2 | A | 8 |
|  | b. | Sketch the flow graph for a 4-point DIF-FFT algorithm. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | Determine a Butterworth digital IIR filter using impulse invariant transformation technique for the following specifications: | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Determine the filter coefficients obtained by frequency sampling for N = 7. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the effect of quantization of filter coefficients with an example. | CO5 | U | 8 |
|  | b. | Explain Product quantization in detail. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the direct form-1 and direct form-II realization of the LTI system governed by the equation  𝑌(𝑛) = −0.7𝑦(𝑛 − 1)+ 0.45𝑦(𝑛 − 2)+ 5𝑥(𝑛) + 3 𝑥(𝑛 − 1)+ 0.6 𝑥(𝑛 −2) | CO3 | A | 8 |
|  | b. | Determine the transfer function of an IIR filter given  and Apply Bilinear Transformation | CO3 | A | 4 |
|  |  |  |  |  |  |
| 23. |  | Determine the 8 point DFT of a sequence x[n]=[2,3,3,4,4,4,5,6] using radix-2 DIF-FFT algorithm. Draw the signal flow graph and tabulate the intermediate stage results. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain how the adaptive filters are used as a noise canceller with suitable adaptive algorithm. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Examine signals and systems mathematically in the discrete-time domain. |
| **CO2** | Compute the Discrete Fourier Transform (DFT) using Fast Fourier Transform (FFT) algorithms |
| **CO3** | Design IIR filters using impulse invariance and bilinear transformation techniques |
| **CO4** | Design FIR filters using the windowing technique and frequency sampling method. |
| **CO5** | Evaluate quantization errors, truncation effects, and overflow in fixed-point and floating-point arithmetic operations. |
| **CO6** | Develop adaptive filtering algorithms for real-time applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **18EC2017** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER NETWORK** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the most suitable network topology for a small office where every device needs direct communication with every other device. | | CO1 | U | 1 |
| 2. | Interpret the performance of the star topology network, when the central device fails. | | CO1 | A | 1 |
| 3. | Write the difference between blocking and non-blocking switches. | | CO2 | A | 1 |
| 4. | List the phases involved in circuit switching. | | CO2 | R | 1 |
| 5. | Write the main difference between Pure ALOHA and Slotted ALOHA. | | CO3 | A | 1 |
| 6. | Illustrate bit stuffing in HDLC with example. | | CO3 | A | 1 |
| 7. | Identify the function of router in a network. | | CO4 | U | 1 |
| 8. | Name the routing algorithm which updates the information about its neighbors to all routers. | | CO4 | R | 1 |
| 9. | Identify the transport-layer protocol that offers reliable communication. | | CO5 | U | 1 |
| 10. | Name a queuing discipline which is used for network traffic management. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the key elements of protocol. | | CO1 | A | 3 |
| 12. | Write the purpose of a crossbar switch. | | CO2 | A | 3 |
| 13. | Write the dotted decimal notation for 10011101100011111111110011001111. | | CO3 | A | 3 |
| 14. | Compare broadcast routing with multicast routing. | | CO4 | U | 3 |
| 15. | Write the significance of open loop congestion control mechanism. | | CO5 | A | 3 |
| 16. | Describe the role of HTTP in web communication. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Analyze the functions of the network support layers in the ISO/OSI reference model with its architecture. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain packet switching approaches in detail. | CO2 | A | 6 |
|  | b. | Describe the working principle of a crossbar switch and analyze its advantages and disadvantages. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. | a. | Explain the frame formats and station types of HDLC in detail with necessary diagrams. | CO3 | A | 6 |
|  | b. | Explain the multiple access protocols which are used in wireless networks, highlighting their advantages and disadvantages. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Illustrate distance vector routing algorithm with one example network and indicate the table updating process. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Discuss the various queuing disciplines used in network traffic management and their impact on congestion. | CO5 | U | 6 |
|  | b. | Sketch the TCP header format and describe the fields in detail. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Sketch the frame format of IEEE 802.3 standard and explain its channel access mechanism. | CO3 | A | 8 |
|  | b. | Estimate the network address if the IP Address is 120.14.22.16 and mask is 255.255.128.0 | CO4 | E | 4 |
|  |  |  |  |  |  |
| 23. |  | Analyze how Quality of Service (QoS) techniques such as traffic shaping, prioritization, and bandwidth reservation enhance network performance. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the role of email protocols to facilitate email communication. | CO6 | A | 6 |
|  | b. | Describe the role of DNS caching and its impact on internet performance and security. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the performance of Local Area Networks (LANs) and Virtual LANs (VLANs)  using appropriate network topologies, transmission media, and protocols. |
| **CO2** | Evaluate the performance of switching techniques. |
| **CO3** | Design a LAN network using IEEE standards. |
| **CO4** | Develop virtual circuit and datagram networks and implement routing algorithms to  study the performance of broadcast and multicast routing. |
| **CO5** | Solve congestion control mechanisms and resource allocation strategies to ensure  Quality of Service (QoS) in network communication. |
| **CO6** | Formulate network applications using principles of layering, socket programming,  and protocols. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **18EC2019** | **Duration** | **3hrs** |
| **Course Title** | **DIGITAL IC DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify a structure that is formed by superimposing several layers of conducting, insulating and transistor forming materials. | | CO1 | R | 1 |
| 2. | Describe the region that separates the n-regions and is covered by a sandwich of silicon dioxide and a conducting polysilicon electrode | | CO1 | U | 1 |
| 3. | State the abbreviation for SPICE program in circuit simulator. | | CO2 | R | 1 |
| 4. | List the type of power dissipation that occurs when the gate is not switching. | | CO2 | R | 1 |
| 5. | Identify two metals used as interconnects in MOS devices. | | CO3 | R | 1 |
| 6. | Identify the fan-in for the following logic diagram given below (Fig.1)    Fig.1 Logic Diagram | | CO3 | U | 1 |
| 7. | Describe the type of switch that closes when the control input is 1. | | CO4 | U | 1 |
| 8. | State the value of the clock signal (Φ) required for the precharge phase in Domino CMOS logic. | | CO4 | R | 1 |
| 9. | Describe the circuit that takes m inputs and generates 2m bitline access signals in a memory module. | | CO5 | U | 1 |
| 10. | List the type of ASIC where logic cells are predesigned, and only some mask layers are customized. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Sketch the physical structure of a NMOS transistor and analyze the electrical role of each terminal in its operation | | CO1 | A | 3 |
| 12. | Summarize noise margin using suitable equations. | | CO1 | U | 3 |
| 13. | Construct a 3-input NAND gate using CMOS logic and analyze its transistor-level implementation. | | CO3 | A | 3 |
| 14. | Design using Domino CMOS logic. | | CO4 | C | 3 |
| 15. | Describe ROM and its different types. | | CO5 | U | 3 |
| 16. | Discuss the architecture and functionality of an FPGA, highlighting its blocks, with an appropriate diagram. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the IC fabrication process with a detailed diagram and examine each step involved in converting raw materials into a functional integrated circuit. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain in detail the operation of an enhancement-mode NMOS transistor in its three operating modes. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the various fabrication processes involved in making transistors in a deep submicron CMOS process and analyze their impact on device performance. | CO3 | An | 8 |
|  | b. | Determine the device sizes for 3-input NAND gates in conventional CMOS. Assume that the basic inverter is sized according to the figure given below and that the goal of the design is to have NAND3 gates with the same delay characteristics as the inverter. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate in detail the working of Dynamic CMOS logic and design a 3-input NAND gate using Dynamic CMOS logic. | CO4 | A | 8 |
|  | b. | Design a 2-input XOR gate using CMOS logic, detailing the transistor-level implementation and circuit operation. | CO4 | C | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain the read and write operations of 1T-SRAM and 6T-SRAM with appropriate diagrams. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Analyze the factors influencing the threshold voltage of a MOS transistor and derive its expression with relevant equations. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Design a 2×1 multiplexer using both CMOS logic and Transmission Gate logic. Construct a comparative analysis based on transistor count. | CO4 | C | 6 |
|  | b. | Design using CMOS and Dynamic CMOS Logic. | CO4 | C | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the various types of Gate Arrays with appropriate diagrams. | CO6 | U | 8 |
|  | b. | Sketch the ASIC design flow, including all steps from specification to fabrication. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply the basic concepts of MOS transistors in circuit design and analysis. |
| **CO2** | Assess the impact of different second-order effects in MOS transistors on circuit performance. |
| **CO3** | Examine the static and dynamic behavior of a CMOS inverter. |
| **CO4** | Design combinational logic circuits using CMOS technology. |
| **CO5** | Evaluate the interpretation of logic styles in the design of sequential logic circuits. |
| **CO6** | Develop the significance of optimizing logic circuit design. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **18EC2022** | **Duration** | **3hrs** |
| **Course Title** | **OBJECT ORIENTED CONCEPTS USING C++** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the concept of ‘Encapsulation’ in C++. | | CO2 | R | 1 |
| 2. | List two features of Object-Oriented Programming. | | CO2 | R | 1 |
| 3. | Compare ‘Structures’ with ‘Classes’ in C++ programming. | | CO1 | U | 1 |
| 4. | Explain ‘Encapsulation’. | | CO3 | U | 1 |
| 5. | List the operators that cannot be overloaded. | | CO4 | R | 1 |
| 6. | Illustrate the use of ‘Friend functions’. | | CO4 | A | 1 |
| 7. | Describe the purpose of ‘Templates’. | | CO4 | U | 1 |
| 8. | Explain ‘Stream Hierarchy’ in C++ programming. | | CO1 | A | 1 |
| 9. | List two Linear Data structures. | | CO5 | R | 1 |
| 10. | Name the sorting method that adopts ‘Divide and Conquer’ rule. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare while loop with do-while loop with an example. | | CO1 | An | 3 |
| 12. | Develop a program to display the address of a variable. | | CO2 | A | 3 |
| 13. | Explain ‘polymorphism’ with an example. | | CO3 | A | 3 |
| 14. | Explain the role of ‘File Pointers’ in C++ programming. | | CO4 | A | 3 |
| 15. | Compare Single and Double Linked list. | | CO5 | An | 3 |
| 16. | Describe the steps involved in ‘Bubble sort’. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Construct a program to implement an online shopping cart system with classes for customers, products, and orders. | CO1 | A | 8 |
|  | b. | Explain ‘Overloaded Constructors’ in detail. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Develop a program to overload ‘++’ operator. | CO2 | A | 4 |
|  | b. | Explain in detail about the different types of inheritance with necessary syntax. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 19. |  | Construct a program to demonstrate multiple Inheritance. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain ‘Exceptions’ in about 250 words. | CO3 | A | 4 |
|  | b. | Construct a program using ‘Static Function’. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. |  | Compare the Normal member functions accessed with pointers & Virtual member functions accessed with pointers and explain with an object-oriented program. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Develop a program to implement a basic hospital management system that includes patient registration and doctor assignment using ‘File handling’ operations. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Construct a program to display the data {10, 20, 30} using ‘Single Linked List’. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain ‘Heap sort’ in around 200 words. | CO5 | A | 8 |
|  | b. | Construct a program to search an item in the list. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Exhibit basic knowledge in object oriented programming for developing programming skills. |
| **CO2** | Recognize features of object-oriented design such as encapsulation, inheritance, and composition of systems based on object identity for appropriate applications. |
| **CO3** | Illustrate the concept of polymorphism and exceptions using object oriented approach |
| **CO4** | Specify simple data types and design implementations, using functions to document them |
| **CO5** | Identify the suitable data structure for the storage of data involved in the application and develop applications using various linear data structures |
| **CO6** | Choose the appropriate techniques in algorithmic design strategies for real time application  development |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **19EC2001** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRONICS FOR INTELLIGENT MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the challenges of industry 3.0. | | CO1 | R | 1 |
| 2. | Explain about the data mining. | | CO1 | U | 1 |
| 3. | Define cyber physical systems. | | CO2 | R | 1 |
| 4. | Give examples of IIoT devices. | | CO3 | U | 1 |
| 5. | List the play store application used for edutainment. | | CO2 | R | 1 |
| 6. | Write any two applications of intelligent machines. | | CO3 | A | 1 |
| 7. | Illustrte the characteristics of ultrasonic sensor. | | CO4 | U | 1 |
| 8. | List the types of sensors. | | CO4 | R | 1 |
| 9. | Define big data analytics. | | CO5 | R | 1 |
| 10. | Name any one generative AI applications. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the foundational disruptive technology in industry 4.0. | | CO1 | R | 3 |
| 12. | Explain artificial narrow intelligence with an example. | | CO2 | U | 3 |
| 13. | Define Internet of Everything. | | CO3 | R | 3 |
| 14. | Discuss the characteristics of IR sensors. | | CO4 | U | 3 |
| 15. | List the advantages of public cloud and give example. | | CO5 | A | 3 |
| 16. | State few applications of computational intelligence. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain briefly about the various industrial revolutions with an example. | CO1 | U | 8 |
|  | b. | Interpret the significance of artificial intelligence with suitable examples. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the IoT communication models with a neat sketch. | CO3 | A | 8 |
|  | b. | Describe the advantages and disadvantages of machine intelligence with suitable examples. | CO2 | R | 4 |
|  |  |  |  |  |  |
| 19. | a. | Discuss the digitalization process of industrial revolution and its step in detail. | CO1 | U | 8 |
|  | b. | List the key points of characterization of industry 4.0. | CO1 | R | 4 |
|  |  |  |  |  |  |
| 20. | a. | Describe the working principle of passive infrared sensor with a block diagram. | CO4 | R | 8 |
|  | b. | Write the characteristics of sensors and its different types with an example. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Describe the working principle of GPS and explain all the blocks with the block diagram. | CO4 | R | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the different types of cloud computing with an example. | CO5 | A | 8 |
|  | b. | Explain the cloud computing services. | CO5 | U | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the functional blocks of IoT with a neat sketch. | CO3 | U | 8 |
|  | b. | Write short notes on Big Data. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Describe the applications of design thinking process with a suitable case study example. | CO6 | R | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | To compare the different industry standards |
| **CO2** | To articulate the structure of an Intelligent machines |
| **CO3** | To illustrate the M2M interface needed in Intelligent machining |
| **CO4** | To be able to categorize the sensors for various Intelligent machines |
| **CO5** | To assess the data requirements for cloud storage |
| **CO6** | To be able to grade various types of Intelligent machines |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2012** | **Duration** | **3hrs** |
| **Course Title** | **WIRELESS SENSOR NETWORKS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List two examples of sensor nodes. | | CO1 | R | 1 |
| 2. | Name two key factors that influence the design of wireless sensor networks. | | CO1 | R | 1 |
| 3. | Identify the time synchronization protocol that uses a network of time servers. | | CO2 | U | 1 |
| 4. | Explain the significance of time synchronization in wireless sensor networks. | | CO2 | U | 1 |
| 5. | Describe the limitations of using GPS technology in wireless sensor networks. | | CO3 | U | 1 |
| 6. | Define Time of Arrival in wireless sensor networks. | | CO3 | R | 1 |
| 7. | Name an example of a wireless sensor network database management system. | | CO4 | R | 1 |
| 8. | Define throughput in the context of wireless sensor network databases. | | CO4 | R | 1 |
| 9. | List one power-saving mode of Bluetooth radios. | | CO5 | R | 1 |
| 10. | Name one application of wireless sensor networks in agriculture. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the main types of sensor network architectures. | | CO1 | U | 3 |
| 12. | Compare Zigbee and Bluetooth. | | CO2 | U | 3 |
| 13. | Illustrate trilateration in wireless sensor networks using a diagram. | | CO3 | U | 3 |
| 14. | Identify the goals of data aggregation in wireless sensor networks. | | CO4 | U | 3 |
| 15. | Explain the significance of Sleep State Transition Policy. | | CO5 | U | 3 |
| 16. | Describe one key feature of an EDGE network in wireless sensor networks. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the challenges faced by wireless sensor networks. | CO1 | An | 8 |
|  | b. | Compare wireless sensor networks and ad hoc networks. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. |  | Analyze the time synchronization protocols used in wireless sensor networks. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the four common methods used for distance estimation in wireless sensor networks. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the data aggregation techniques used in wireless sensor networks. | CO4 | A | 8 |
|  | b. | Analyze the challenges associated with sensor network databases. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the impact of state transition overhead and sleep time threshold derivation on energy savings. | CO5 | An | 6 |
|  | b. | Explain dynamic voltage scaling in sensor nodes and its impact on power consumption. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. |  | Analyze the functions of the core components of a sensor node. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the key power management strategies of IEEE 802.11 and Bluetooth. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the role and functionality of base stations in securing the network. | CO6 | A | 6 |
|  | b. | Explain the benefits and challenges of employing WSNs in health monitoring systems. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Develop the architecture of wireless sensor networks, including sensor node components and functional architecture. |
| **CO2** | Apply communication protocols like MAC, transport, and network layer protocols, focusing on IEEE 802.15.4 and Zigbee standards. |
| **CO3** | Plan tracking techniques using positioning algorithms like ToA, TDoA, AoA, and signal strength-based location tracking. |
| **CO4** | Develop sensor network databases using aggregation methods and selecting optimal aggregation points. |
| **CO5** | Design power management strategies to improve energy efficiency in wireless sensor networks. |
| **CO6** | Evaluate the applications of wireless sensor networks in domains such as health monitoring and agriculture, focusing on security and privacy considerations. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2015** | **Duration** | **3hrs** |
| **Course Title** | **PRINCIPLES OF DIGITAL IMAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the term 'hue' in an image. | | CO1 | R | 1 |
| 2. | Identify the principle on which a Vidicon camera tube operates. | | CO1 | U | 1 |
| 3. | Define the histogram of an image. | | CO2 | R | 1 |
| 4. | Explain the concept of low frequency in an image. | | CO2 | U | 1 |
| 5. | An image has a pixel located at (30, 50). Apply a translation transformation that shifts the image by 20 pixels to the right and 30 pixels downward. Determine the new coordinates of the pixel after translation. | | CO3 | A | 1 |
| 6. | List the methods for estimating image degradation. | | CO3 | R | 1 |
| 7. | State the key properties of dilation in morphological image processing. | | CO4 | R | 1 |
| 8. | Justify the need for segmentation in image processing. | | CO5 | E | 1 |
| 9. | Identify the morphological operator that enlarges the foreground and shrinks the background in image processing. | | CO4 | U | 1 |
| 10. | Name any two image coding methods used in image processing applications. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Find the Euclidean distance, city block distance and chessboard distance between the two pixel coordinates p(3,6) and s(4,8). | | CO1 | A | 3 |
| 12. | Explain the homomorphic filter based on the illumination and reflection model in image processing. | | CO2 | A | 3 |
| 13. | Compare Wiener filtering and inverse filtering based on effectiveness, noise handling, and practical applications. | | CO3 | An | 3 |
| 14. | Determine the output image after performing erosion on the given input image.  Input Image:   |  |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |   Structuring element:   |  |  |  | | --- | --- | --- | | 1 | 0 | 1 | | | CO4 | A | 3 |
| 15. | Examine the sequential steps involved in edge detection in image processing. | | CO5 | A | 3 |
| 16. | Interpret the features of Principal Component Analysis (PCA) in image description. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the structure and functions of the human eye with the help of a labeled diagram. | CO1 | U | 8 |
|  | b. | Interpret the role of visual perception in digital image processing. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. |  | Evaluate the impact of gray level transformations on image enhancement in digital image processing. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the impact of smoothing filters in the frequency domain on image quality and detail preservation. | CO2 | E | 8 |
|  | b. | Describe the process of frequency filtering with a block diagram. | CO2 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the sources of noise in digital images and the probability density functions (PDFs) used to model noise. | CO3 | A | 8 |
|  | b. | Interpret the degradation and restoration process in image processing with a block diagram. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the performance of opening and closing morphological operations in image preprocessing and noise removal. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Evaluate the role of thresholding in image processing and its effectiveness in segmentation. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 23. |  | Summarize the applications of digital image processing and explain a case study with a neat block diagram. | CO1 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the procedure for boundary representation in an image and its potential improvements for enhancing accuracy and efficiency in image processing applications. | CO6 | A | 8 |
|  | b. | Interpret the significance of boundary length and circularity in image processing, and provide the mathematical formulas used to compute them. | CO6 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply the principles of digital image processing to solve engineering challenges. |
| **CO2** | Evaluate the image enhancement methods to meet specific requirements. |
| **CO3** | Assess degraded images using appropriate restoration techniques. |
| **CO4** | Develop morphological operations to accurately detect and characterize object shapes. |
| **CO5** | Implement segmentation techniques to interpret digital images effectively. |
| **CO6** | Apply representation techniques for effective image classification and description. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **19EC2018** | **Duration** | **3hrs** |
| **Course Title** | **SYSTEM VERILOG AND FUNCTIONAL VERIFICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Explain the purpose of always comb in Verilog. | | CO1 | U | 1 |
| 2. | Enumerate the primary use of logic in System Verilog. | | CO1 | R | 1 |
| 3. | Differentiate between initial and always blocks in System Verilog. | | CO2 | U | 1 |
| 4. | Interpret the function of the logic data type in System Verilog, and how does it differ from reg and wire. | | CO2 | A | 1 |
| 5. | List the keywords used to declare a constructor in a System Verilog class. | | CO3 | R | 1 |
| 6. | Analyze the outcome when randomize() is used without constraints in System Verilog. | | CO3 | An | 1 |
| 7. | Differentiate between static and dynamic arrays in System Verilog. | | CO4 | U | 1 |
| 8. | Justify the need of System Verilog Events. | | CO3 | E | 1 |
| 9. | Illustrate the need of the System Verilog Mod port. | | CO5 | U | 1 |
| 10. | Infer the need of semaphore variable in System Verilog. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Devise a code snippet to declare a 2-dimensional array and initialize it with values in Verilog. | | CO1 | An | 3 |
| 12. | Infer a parameterized adder module using System Verilog. | | CO2 | U | 3 |
| 13. | Explain a System Verilog program that generates 'Hello World' during simulation. | | CO3 | A | 3 |
| 14. | Describe System Verilog's string data type used to concatenate several strings. What are the essential syntax and operators used in this process? | | CO4 | U | 3 |
| 15. | Examine randomization is implemented in System Verilog classes. Describe the function of the rand and randc keywords, as well as how constraints may be used to control random values. | | CO5 | A | 3 |
| 16. | Estimate the use assertions in System Verilog for verification. Describe any specific form of assertion statement and its purpose. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Design a simple 4-bit synchronous counter with enable and asynchronous reset using Verilog. Include a brief explanation of the logic and functionality of your code. Ensure that your design includes:   * A clock signal. * Enable input. * Asynchronous reset. * A 4-bit output to hold the current count. | CO1 | C | 8 |
|  | b. | Justify testbench in sequential circuit D flip flop and give all the test cases of D flip flop model | CO1 | E | 4 |
|  |  |  |  |  |  |
| 18. | a. | Design a 4-bit binary counter in Verilog that counts from 0 to 15 in increments of 1. The counter should have an active-low asynchronous reset and an enable signal. Provide the Verilog code for the counter and explain its functioning with block diagram. | CO1 | C | 6 |
|  | b. | Evaluate the impact of utilizing a blocking versus non-blocking assignment in Verilog. When modelling and synthesizing, consider their behaviour, benefits, and possible concerns. Provide a Verilog example using both sorts of assignments and explain the differences. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 19. |  | Examine how to design a System Verilog class that models a 32 bit basic Arithmetic Logic Unit (ALU) with methods for addition, subtraction, and bitwise AND operations. Include a constructor for initializing the operands, and demonstrate how to instantiate and utilize the class within a testbench. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Design a Bank\_System class that can manage multiple accounts (at least 1 accounts), and perform the following: Create one bank accounts with different account numbers and holder names using system Verilog code. | CO4 | C | 8 |
|  | b. | Explain the different System Verilog data types and their use in hardware modelling and verification. Explain the distinctions between logic, register, and wire types, and provide an example with System Verilog code. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain the concept of System Verilog classes and attributes. Describe their significance in verifying a digital design, emphasizing classes that are used to describe components and the properties that aid in formal verification. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Justify in detail about various types of constrained randomization of the System Verilog with an illustration program. | CO4 | E | 6 |
|  | b. | Analyze the concept of functional coverage in System Verilog. Discuss the different types of coverage in System Verilog and coverage metrics may be missing or incomplete during simulation. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Create a System Verilog solution that utilizes the Mailbox class to allow communication between a packet generator (Process-1) and a driver (Process-2). In such a scenario, the generator class will generate and randomize packets before placing them in the mailbox (mb\_box).  Process-1 (Generator class) will generate (created and randomize) the packet and store it in the mailbox mb\_box.  Process-2 (Driver class) gets the generated packet from the mailbox and displays the fields. | CO5 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Analyze the System Verilog testbench code for an adder model that does not use the Monitor, Agent, or Scoreboard. In your analysis, consider the following:  a. The function and structure of the topmost file that connects the Design Under Test (DUT) to the testbench.  b. How the testbench top is built, containing instances of the DUT, test, and interface.  c. Explain the purpose and structure of the interface that connects the DUT to the test bench. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand concept of Verilog programming in Functional Verification |
| **CO2** | Illustrate the concept of System Verilog |
| **CO3** | Analyze different classes in System Verilog |
| **CO4** | Code in System Verilog using constraint and randomization |
| **CO5** | Interpret coverage methods and inter process synchronization |
| **CO6** | Comprehend test bench concept in System Verilog |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2019** | **Duration** | **3hrs** |
| **Course Title** | **ASIC DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Interpret the function of a synthesis tool in ASIC design. | | CO1 | A | 1 |
| 2. | List the two hardware description languages used in ASIC design. | | CO1 | R | 1 |
| 3. | Name the primary method used to erase the data stored in an EPROM chip. | | CO2 | R | 1 |
| 4. | Relate the feature of programmable ASICs allows for modifications and updates after the initial deployment? | | CO2 | A | 1 |
| 5. | Infer the need for process node size in ASIC fabrication that usually results in lower power consumption. | | CO3 | U | 1 |
| 6. | Show the use of EDIF format to transfer a design between several CAD programs. | | CO3 | U | 1 |
| 7. | Recognize the significance of the Common Fabric Interface (CFI) in the design of programmable ASICs. | | CO3 | R | 1 |
| 8. | Determine the optimal routing paths in a complex circuit with multiple layers, ensuring minimal congestion using global routing techniques. | | CO5 | A | 1 |
| 9. | Apply a detailed routing technique to ensure that all the nets are routed correctly with respect to the given design rules. | | CO5 | A | 1 |
| 10. | Estimate the need of memory synthesis considered crucial in modern digital systems? | | CO6 | E | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discuss the factors that should be considered when choosing an ASIC fabrication process node? | | CO1 | U | 3 |
| 12. | Distinguish between FPGA and ASIC. | | CO1 | An | 3 |
| 13. | Deduce the given Boolean function F=A′⋅B+A⋅B⋅C′+A′⋅B′⋅C use Shannon's expansion theorem to decompose and then implement this function in an ACT1 logic module. Evaluate the efficiency of this approach in terms of the number of gates and levels of logic used, and compare it with a direct implementation using standard logic gates. | | CO3 | An | 3 |
| 14. | Summarize in what ways does Altera’s Flexible Logic Element Matrix improve the performance and adaptability of FPGA designs? | | CO3 | U | 3 |
| 15. | Convert the representation of the routing region to channel connectivity graph. | | CO4 | U | 3 |
| 16. | Evaluate the methods for optimizing a multiplier's performance in terms of speed and area when designed using logic gates in the synthesis process. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Evaluate the different types of ASICs (Application-Specific Integrated Circuits), including Full-Custom, Standard Cell, Gate Array, and Structured ASIC. Discuss the design processes, applications, advantages, and disadvantages of each type, and determine which type of ASIC would be best suited for various scenarios such as consumer electronics, high-performance computing, and rapid prototyping. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Design and explain the CMOS implementation of a 3-input NOR gate the explanation should include:   1. The logic equation for a 3-input NOR gate. 2. A step-by-step application of CMOS design rules with the stick diagram to ensure correct functionality and minimal power consumption. 3. An explanation of how the pull-up and pull-down networks work for all possible input combination and draw the layout. | CO1 | C | 6 |
|  | b. | Assess the various types of programmable technologies that can be integrated into ASIC designs, explaining their functionalities, applications, and how they contribute to the flexibility and performance of the overall system. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyse developing a certain programmable ASIC in the real world, how would you decide between Altera FLEX and Xilinx EPLD? Give reasons for your decision based on design complexity, cost, and performance. | CO3 | An | 6 |
|  | b. | Develop a basic signal processing system with the Altera MAX 7000 series. Describe the process to incorporate it for improved performance with Altera MAX 9000. | CO3 | C | 6 |
|  |  |  |  |  |  |
| 20. | a. | Design a floorplan for a VLSI circuit with the following blocks: logic gates, memory units, and I/O pads. Explain the steps involved in partitioning and placing the blocks on the chip. Discuss how the placement algorithms can help achieve an optimized design. | CO4 | C | 8 |
|  | b. | Explain the principle of VLSI design placement algorithms. Examine the benefits and drawbacks of the quadratic placement and simulated annealing techniques for wire length reduction and placement optimization. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain the various types of routing and the method to channel routing in the floor planning. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Design a VLSI chip, tasked with applying hierarchical partitioning for global routing to reduce congestion in a complex design shown below. | CO5 | C | 12 |
|  |  |  |  |  |  |
| 23. |  | Determine in minimize the number of gates in logic synthesis, apply Boolean algebra techniques to simplify a given logic function | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Evaluate the role of comparator synthesis in logic synthesis, Determine the efficient comparator design for 2-bit binary number contribute to the overall performance of a system. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Define the types of ASICs, Combinational and Sequential logic cells, concepts of design rules and logical efforts. |
| **CO2** | Describe the programmable ASIC and programmable logic cell. |
| **CO3** | Demonstrate programmable ASIC interconnect and programmable ASIC design software |
| **CO4** | Illustrate the goal and objectives of portioning, floorplan and placement |
| **CO5** | Develop algorithms for various types of routing and explain the concepts of circuit extraction and DRC |
| **CO6** | Develop the HDL logic synthesis skills |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **19EC2021** | **Duration** | **3hrs** |
| **Course Title** | **LOW POWER TECHNIQUES IN VLSI DESIGN** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the formula for calculating the subthreshold current in a MOS transistor. | | CO1 | A | 1 |
| 2. | Illustrate the main cause of static power dissipation in CMOS circuits. | | CO1 | A | 1 |
| 3. | Calculate the total number of bit transitions in a 3-bit binary code. | | CO2 | A | 1 |
| 4. | Illustrate a simple logic gate-based signal gating technique. | | CO2 | A | 1 |
| 5. | State the effect of a floating node on power consumption. | | CO3 | R | 1 |
| 6. | Calculate the total number of transistors required to implement the given logic circuit using CMOS logic. | | CO3 | A | 1 |
| 7. | Analyze the given circuit and derive its logic function. | | CO4 | An | 1 |
| 8. | State Hold time of the flipflop. | | CO4 | R | 1 |
| 9. | Name the two modes of operation in SRAM. | | CO5 | R | 1 |
| 10. | State the meaning of 'adiabatic' in adiabatic circuits. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write the equation for the stage ratio and the total delay calculation of an inverter chain. | | CO2 | A | 3 |
| 12. | Apply transistor Network Restructuring and obtain different circuit implementations that are logically equivalent, but different in circuit characteristics for the following circuit. | | CO2 | A | 3 |
| 13. | Sketch the flow graph for the given equation,  Y=A.B+A.C | | CO3 | A | 3 |
| 14. | Illustrate the negative edge-triggered flip-flop using transmission gate logic and analyze its impact on power dissipation. | | CO4 | A | 3 |
| 15. | Explain the basic types of semiconductor memories. | | CO5 | A | 3 |
| 16. | Sketch the output waveform of a pulsed power supply and label its four operational phases. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain dynamic power dissipation in CMOS circuits in terms of the charging and discharging of capacitance, and derive the equation for power dissipation. | CO1 | A | 8 |
|  | b. | Illustrate the trade-off between computing resources and analysis accuracy at different levels of design abstraction in CMOS Circuits. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. |  | Apply transistor sizing and determine the stage ratio K for an inverter chain. Analyze the impact of K on delay and total power dissipation. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain Precomputation Logic in Low-Power VLSI Design. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Explain Clocked SR Latch and RAM based style SR latch used in optimization theme in Evolution of flipflops and latch with necessary diagrams. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Design a dynamic word line decoder using the following to minimize power dissipation and to enhance performance.   1. Domino NAND logic 2. NOR decoder | CO5 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Construct the Control Data Flow Graph (CDFG) and design the hardware implementation for the given equation:  Explain how operator reduction can be applied to achieve low-power optimization. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Illustrate specialized techniques used for power reduction in clock networks, focusing on their role in efficient clock distribution. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Apply the transformation steps from static CMOS to adiabatic design and analyze its impact on power efficiency. Construct the adiabatic realization of a basic logic gate using adiabatic logic principles. | CO6 | A | 10 |
|  | b. | llustrate the adiabatic charging of a capacitor with a diagram. | CO6 | A | 2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Develop skills to simulate gate-level logic and perform power analysis. |
| **CO2** | Develop optimized circuits through techniques such as transistor and gate sizing, network reconstruction, and reorganization. |
| **CO3** | Evaluate the impact of switching activity reduction and parallel architectures on power consumption and performance management. |
| **CO4** | Examine the development of latches and flip-flops and their influence on power consumption and performance. |
| **CO5** | Develop strategies for reducing power in the write driver and sense amplifier circuits of SRAM architectures. |
| **CO6** | Design adiabatic logic gates to achieve low-power operation in digital circuits. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2029** | **Duration** | **3hrs** |
| **Course Title** | **DATA SCIENCE AND DATA ANALYTICS** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define data science. | | CO1 | R | 1 |
| 2. | Write an Excel formula to extract unique values from a column whose range is C1 to C10. | | CO1 | A | 1 |
| 3. | Identify a service provider API that is used by the popular game “Pokemon go” to find the location information. | | CO2 | U | 1 |
| 4. | Define Data Fatigue. | | CO2 | R | 1 |
| 5. | Calculate the 50th percentile of 2, 4, 6, 8, 10. | | CO3 | A | 1 |
| 6. | Calculate the standard deviation of the following data:  4, 8, 6, 5, 10, 12, 14, 7, 9. | | CO3 | A | 1 |
| 7. | Define Data Encoding. | | CO4 | R | 1 |
| 8. | Name a data visualization tool. | | CO4 | R | 1 |
| 9. | Name a Python library that is used for data visualization. | | CO5 | R | 1 |
| 10. | Identify the methodology that automates the entire machine learning lifecycle, including model versioning and deployment. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare Data Analytics with Data Analysis. | | CO1 | U | 3 |
| 12. | Name any three relational database management systems. | | CO2 | R | 3 |
| 13. | Calculate the accuracy of the machine learning model whose confusion matrix parameters are as follows: TN=525, FP=150, FN=86, TP=420. | | CO3 | A | 3 |
| 14. | Compare quantitative data with qualitative data. | | CO4 | U | 3 |
| 15. | Write a Python program to generate a box plot for the given dataset. The dataset represents the test scores of students in three different subjects.  **Dataset:**  Maths: 78, 85, 92, 88, 76  Science: 81, 79, 94, 90, 87  English: 74, 80, 85, 89, 82 | | CO5 | A | 3 |
| 16. | Explain the importance of Apache Spark in data processing. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Apply the steps of the data science lifecycle to illustrate how a school district can improve student performance and reduce dropout rates by analyzing student performance data. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the data collection strategies to be carried out by the data analyst and write the practical advantages and disadvantages of the data collection strategies. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Calculate Pearson’s Correlation Coefficient (r) of the following table. The table shows the marks obtained by six students in Mathematics (X) and Physics (Y):   |  |  |  | | --- | --- | --- | | **Student** | **X (Maths Marks)** | **Y (Physics Marks)** | | A | 10 | 20 | | B | 12 | 22 | | C | 20 | 30 | | D | 25 | 32 | | E | 30 | 35 | | F | 35 | 40 | | CO3 | A | 8 |
|  | b. | Determine the outlier in the given data: 12, 15, 14, 10, 18, 22, 29, 13, 15, 14 using the Inter Quartile Range (IQR) method. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | A data analyst is designing a dashboard for an e-commerce platform to visualize key performance metrics such as sales revenue, customer satisfaction ratings, and product demand trends. Illustrate suitable visual encodings for effectively representing these three types of data in a graphical report using Bertin’s visual variables. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | A food delivery startup maintains an orders table that stores details of food orders.   |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | | **Order ID** | **Customer Name** | **Place** | **Order Date** | **Total Amount** | **Delivery Time (minutes)** | | 1 | Reethu | RSpuram | 2024-01-05 | 2000 | 30 | | 2 | Aleena | Race Course | 2024-01-06 | 1500 | 25 | | 3 | Ben | Vadavalli | 2024-01-07 | 2500 | 35 | | 4 | Sophia | Gandhipuram | 2024-01-08 | 3250 | 20 | | 5 | David | Ganapathy | 2024-01-09 | 600 | 45 | | 6 | John | Ukkadam | 2024-01-10 | 980 | 28 |   1. Write an SQL query to calculate the total amount spent by each customer and sketch the output table.  2. Write an SQL query to calculate the average delivery time for each place and sketch the output table. | CO5 | A | 8 |
|  | b. | Write a Python program for the given dataset to create a bar chart showing the names of employees on the x-axis and their salaries on the y-axis.   |  |  | | --- | --- | | **Employee Name** | **Salary** | | Anand | 50000 | | Benny | 60000 | | Charlie | 70000 | | Danis | 55000 | | Raja | 65000 | | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | The following dataset contains the performance of the employees in a company. Perform an Exploratory Data Analysis (EDA) to uncover key insights.    **Dataset: Employee Performance**   |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | | **Employee ID** | **Department** | **Experience (years)** | **Monthly Salary** | **Project Rating** | **Training Hours** | **Job Satisfaction** | | 101 | HR | 3 | 3500 | 4.2 | 10 | 3 | | 102 | Marketing | 5 | 4200 | 4.5 | 12 | 4 | | 103 | IT | 7 | 5200 | 4.7 | 15 | 5 | | 104 | Finance | 2 | 3800 | 3.8 | 8 | 2 | | 105 | HR | 10 | 5500 | 4.9 | 18 | 4 | | 106 | IT | 6 | 4900 | 4.3 | 14 | 3 | | 107 | Marketing | 4 | 4600 | 4.6 | 11 | 4 |   Answer the following questions based on the EDA.  1) Evaluate the relationship between Experience and Monthly Salary.  2) Evaluate the distribution of Project Rating across different Departments.  3) Evaluate the impact of Training Hours on Job Satisfaction.  4) Select outlier data from the dataset. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | A company wants to use a linear regression algorithm to predict the future demand for its products based on past sales data. Explain the process of using linear regression for making predictions in a dataset. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Write the latest methods used for collecting and analyzing data. Explain the impact of AI, IoT, big data, and cloud computing technologies in improving these methods with practical examples. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Apply data science toolkits to perform exploratory data analysis and solve analytics problems. |
| **CO2** | Evaluate data management solutions utilizing appropriate tools and techniques such as SQL, Big Data frameworks, to manage, process, and extract insights from datasets. |
| **CO3** | Apply statistical concepts and basic machine learning algorithms to interpret data and make predictions. |
| **CO4** | Apply data visualization techniques and tools to create insightful visual representations of diverse data types. |
| **CO5** | Develop data science solutions in real-world applications using Python, R, SQL, and Microsoft Power BI. |
| **CO6** | Assess recent trends in data collection, analysis, and visualization techniques to develop data science applications using tools like Apache Spark. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
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| **Course Code** | **19EC2030** | **Duration** | **3hrs** |
| **Course Title** | **CLOUD COMPUTING** | **Max. Marks** | **100** |

|  |  |  |  |  |  |
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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the software component that manages multiple virtual machines. | | CO1 | R | 1 |
| 2. | Interpret the significance of para virtualization technique. | | CO1 | U | 1 |
| 3. | **Describe the primary purpose of Infrastructure as a Service (IaaS).** | | CO2 | U | 1 |
| 4. | List the types of cloud computing based on deployment. | | CO2 | R | 1 |
| 5. | Define Identity Security. | | CO3 | R | 1 |
| 6. | List the levels of infrastructure security. | | CO3 | R | 1 |
| 7. | Describe Authorization and Authentication. | | CO4 | U | 1 |
| 8. | List the process of AAA framework. | | CO4 | R | 1 |
| 9. | Identify the principal stakeholder for the cloud computing service. | | CO5 | R | 1 |
| 10. | Define cloud provisioning. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare bare-metal hypervisor with hosted hypervisor. | | CO1 | An | 3 |
| 12. | Differentiate between on-premise and cloud-based storage solutions. | | CO2 | An | 3 |
| 13. | Compare identity security with information security. | | CO3 | An | 3 |
| 14. | Describe the components of CIA triad. | | CO4 | U | 3 |
| 15. | Discuss the services available to a cloud consumer. | | CO5 | U | 3 |
| 16. | Examine the impact of cloud computing in IoT. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the types of virtualization techniques with suitable real time examples. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain cloud instances and its life cycle process with practical examples. | CO2 | A | 6 |
|  | b. | Infer the features of cloud deployment models. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Examine the security issues in cloud computing at different levels and the approaches to mitigate those issues. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the AAA framework of IAM with a suitable example. | CO4 | An | 8 |
|  | b. | Infer the metrics used to measure the success of availability management. | CO4 | An | 4 |
|  |  |  |  |  |  |
| 21. |  | Explain the NIST cloud computing service architecture with suitable examples. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the architecture of Open Stack with a neat diagram. | CO1 | A | 8 |
|  | b. | Compare cloud computing with edge and fog computing. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 23. |  | Infer the standards of IAM and its functions with necessary diagrams. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Appraise the significance of cloud deployment models in IoT with a case study example. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the concepts and techniques of virtualization in the context of cloud computing. |
| **CO2** | Develop cloud computing solutions using different service and deployment models. |
| **CO3** | Examine the security challenges at various levels of cloud infrastructure and data security. |
| **CO4** | Establish security and identity access management strategies for cloud environments. |
| **CO5** | Apply cloud computing concepts to the Internet of Things (IoT) and mobile cloud computing. |
| **CO6** | Evaluate deployment models of cloud computing in IoT, addressing security, reliability, and integration concerns with cloud services. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2041** | **Duration** | **3hrs** |
| **Course Title** | **CELLULAR MOBILE COMPUTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define co-channel cells. | | CO1 | R | 1 |
| 2. | Name the technique that bring better coverage, utility of frequency spectrum and reduced transmitter power. | | CO1 | R | 1 |
| 3. | Infer the correct problem from the following measurement: Both C/I and C/N are < 18 dB and C/I < C/N in the given area. | | CO2 | U | 1 |
| 4. | Define Directivity. | | CO2 | R | 1 |
| 5. | State the Uplink and Downlink frequency bands of GSM 900. | | CO3 | R | 1 |
| 6. | Name the popular 2G mobile standard in India. | | CO3 | R | 1 |
| 7. | Give an example of session oriented transaction. | | CO4 | U | 1 |
| 8. | Cite the down link access scheme of 4G LTE release 8. | | CO4 | U | 1 |
| 9. | Identify the propagation mechanism that makes waves bend around the obstacle. | | CO5 | U | 1 |
| 10. | Indicate the GSM subsystems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | If a total of 33MHz of bandwidth is allocated to a particular FDD/FDMA cellular system which uses 50 KHz duplex channels. Determine the number of duplex voice channels available per cell if the system uses 7 cell reuse. | | CO1 | A | 3 |
| 12. | Determine the channels allocated to the 6th cell and depict the first 63 channels allocated to cells in the N=7 reuse AMPS system. | | CO2 | A | 3 |
| 13. | Explain the process of spreading by channelization and scrambling. | | CO3 | A | 3 |
| 14. | Compare TDMA with FDMA. | | CO4 | U | 3 |
| 15. | Evaluate the performance of flat fading. | | CO5 | An | 3 |
| 16. | Explain the GSM network interfaces. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the cellular system. Infer the reasons of using small cells. | CO1 | U | 6 |
|  | b. | Explain the power reduction in a cell achieved through Cell splitting technique. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Distinguish the down tilting of antenna beam electrically from down tilting mechanically. Discuss the effects of antenna tilt. | CO2 | An | 6 |
|  | b. | Employ a channel allocation scheme for adjacent channel interference minimization. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Determine the steps involved in Mobile originated call in a Cellular system. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Compare the performance of TDMA with FDMA. | CO4 | An | 6 |
|  | b. | Deduce the development process of SMS applications. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. |  | Describe Doppler spread and its types with suitable figures. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | In the WCDMA system, apply the spreading code on the given data and show the successful recovery of the data by despreading.  Data: 010010  Spreading code: 1 -1 -1 1 -1 1 1 -1 | CO3 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Distinguish Long session-oriented transactions from Short transaction-oriented dialogue. | CO4 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate call routing of outgoing call from GSM. | CO6 | U | 6 |
|  | b. | With suitable figure, describe the network aspects in GSM. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply techniques to improve capacity and reduce co-channel interference in cellular systems. |
| **CO2** | Choose appropriate antennas, diversity techniques and power to overcome co-channel and non-co-channel interferences in cellular communication. |
| **CO3** | Compare 5G with previous generations’ cellular wireless systems. |
| **CO4** | Apply security and multiple access techniques in mobile computing applications. |
| **CO5** | Estimate fading and time dispersion parameters of mobile radio environment. |
| **CO6** | Evaluate the architecture, services and limitations of GSM, GPRS and IS-95. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **19EC2045** | **Duration** | **3hrs** |
| **Course Title** | **SoC DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the correct order of instruction execution sequence in a processor. | | CO1 | A | 1 |
| 2. | Compare the advantages and limitations of hardware and software implementations in SoC processor design. | | CO1 | U | 1 |
| 3. | Describe the processor design trade-offs using makimoto wave. | | CO2 | R | 1 |
| 4. | Determine cycle time with its possible sequence of action. | | CO2 | A | 1 |
| 5. | Explain the reason for implementing soft core processors despite challenges such as large area, power consumption, execution time, and cost. | | CO3 | U | 1 |
| 6. | Analyze the impact of vector instructions on improving the efficiency of vector processors. | | CO3 | An | 1 |
| 7. | Analyze the limitations of the memory module's cycle time. | | CO4 | An | 1 |
| 8. | Distinguish DRAM and SRAM memory. | | CO4 | An | 1 |
| 9. | Explain the advantages of physical layer in NoC architecture. | | CO5 | U | 1 |
| 10. | Describe the advantages of flexible throughput mechanism in NoC architecture. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the key requirements and the step-by-step design process of SoC design. | | CO1 | A | 3 |
| 12. | Describe the power calculation equation involved in processor design. | | CO2 | R | 3 |
| 13. | Predict the major cause of pipeline delays or breaks in processor microarchitecture. | | CO3 | E | 3 |
| 14. | Illustrate the function of write-back cache policy with its neat schematic. | | CO4 | A | 3 |
| 15. | Interpret the communication bandwidth and communication latency issue in interconnect architectures with an example. | | CO5 | U | 3 |
| 16. | Explain different video compression techniques used in SoC digital still camera controllers. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Classify the components of a SoC system model and examine the functions with its architecture. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Assess the key design trade-offs in processor architecture and analyze the factors affecting processors reliability. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 19. | a. | Summarize the flow of processor core selection in a SoC processor. | CO3 | E | 6 |
|  | b. | Explain the impact of Super-scalar processor technology in SoC architecture. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Analyze the primary data path of a Vector processor with its schematic and demonstrate its operations using a matrix representation. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Develop direct mapping and set-associative mapping techniques in cache organization and evaluate their effects on cache performance. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Develop a DRAM-based memory chip and summarize its functionality using necessary timing diagram. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 23. |  | Design an efficient on-chip and off-chip interconnect architectures for SoC applications | CO5 | C | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design and optimize a SoC controller architecture for a digital still camera to improve performance and efficiency. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basic concepts of SoC System Architecture. |
| **CO2** | Understand the concepts of choosing the processor for the SoC Design. |
| **CO3** | Design processors keeping area, power and speed as constraints. |
| **CO4** | Analyze memories using reconfigurable architectures. |
| **CO5** | Develop interconnect architectures for SoC and NoC. |
| **CO6** | Analyze reconfigurable architectures for real time applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **19EC2059** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF SATELLITE COMMUNICATION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State Kepler’s second law used in satellite communication. | | CO1 | R | 1 |
| 2. | List the applications of satellite launched in medium earth orbit. | | CO1 | R | 1 |
| 3. | **Explain** the role of thrusters in satellite subsystems. | | CO2 | U | 1 |
| 4. | Indicate the modulation techniques used in satellite communication. | | CO2 | U | 1 |
| 5. | **Explain** the importance of redundancy in satellite communication systems. | | CO3 | U | 1 |
| 6. | **Identify** the need for thermal control and propulsion in satellites. | | CO2 | U | 1 |
| 7. | **Describe** the relationship between EIRP and antenna gain. | | CO4 | U | 1 |
| 8. | **Define** guard time in satellite communication. | | CO4 | R | 1 |
| 9. | **Explain** the concept of single access in satellite communication | | CO5 | U | 1 |
| 10. | **List** the major applications of VSAT satellites | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | **Apply** the concept of Hohmann transfer orbit to demonstrate its use in satellite orbit adjustments. | | CO1 | A | 3 |
| 12. | Analyze the role of geostationary satellites in modern communication systems. | | CO2 | An | 3 |
| 13. | **Justify** the necessity of thermal control mechanisms for the survival and performance of satellites. | | CO2 | E | 3 |
| 14. | **Illustrate** the process and advantages of spin stabilization in satellite attitude control. | | CO4 | A | 3 |
| 15. | **Classify** the types of FDMA with suitable applications. | | CO4 | An | 3 |
| 16. | **Interpret** why uplink frequencies are allocated higher than downlink frequencies in satellite systems. | | CO5 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | **Analyze** the orbital parameters and evaluate their impact on satellite positioning and coverage. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate the concepts of azimuth, and elevation angles in satellite communication, and analyze their significance using relevant diagrams and equations. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Construct a block diagram of a C-band satellite transponder and evaluate its role in signal amplification and frequency translation | CO3 | A | 12 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 20. |  | Calculate the **received power** at the ground station using the **free-space path loss (FSPL) formula** and express the result in **dBW;** if the **transmit power** is **20 dBW, transmit antenna gain** is **30 dB, Frequency of 14 GHz,** distance of **36,000 km, receive antenna gain** at the ground station is **40 dB, atmospheric loss of 2 dB** and **miscellaneous losses of 3 dB.** | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | **Classify** different types of antennas used in satellite communication and **evaluate** their suitability for various satellite systems. | CO5 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | **Interpret** the working principle of CDMA and its advantages in satellite communication. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | **Sketch** the block diagram of an Earth Station transmitter and **explain** each component. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Analyze the architecture of a VSAT satellite network and evaluate its effectiveness using a real-world application scenario. | CO6 | An | 8 |
|  | b. | **Justify** the importance of multiple access techniques in handling multiple users efficiently. | CO4 | E | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate satellite orbits, satellite elements, and operational aspects of satellite communication systems to optimize performance and functionality |
| **CO2** | Assess the concepts of space segment, propulsion, payload, and TT&C to enhance the efficiency of satellite operations. |
| **CO3** | Evaluate the performance and requirements of earth station systems for optimal operation |
| **CO4** | Develop advanced multiplexing, modulation, and multiple access techniques for efficient satellite communication. |
| **CO5** | Evaluate link design, assess rain fading and link availability, and perform interference analysis |
| **CO6** | Evaluate the structure, capabilities, and performance of satellite systems, analysing their roles in communication, broadcasting, and disaster management. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **20EC1002** | **Duration** | **3hrs** |
| **Course Title** | **R PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name the IDE used to integrate R Programming. | | CO1 | R | 1 |
| 2. | Indicate the R operator that specify the range of cells. | | CO1 | U | 1 |
| 3. | Write the keyword used in R programming to get the number of rows in a matrix. | | CO2 | A | 1 |
| 4. | Indicate the R function to create a data frame. | | CO2 | U | 1 |
| 5. | Identify the control structure that repeats a block of code multiple times based on a condition. | | CO3 | R | 1 |
| 6. | Name the loop statement that checks the condition after each iteration. | | CO3 | R | 1 |
| 7. | Write the R-function to read text file. | | CO4 | A | 1 |
| 8. | Indicate the purpose of read file(). | | CO4 | U | 1 |
| 9. | Write the base R function that display the distibution of a dataset and identify the outliers. | | CO5 | A | 1 |
| 10. | Name the parameter used in plot() function that is used to set the aspect ratio of plots. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Indicate the valid and Invalid variable name.   1. 2var\_name 2. var.name 3. var\_name% | | CO1 | U | 3 |
| 12. | Compare atomic vectors with Lists. | | CO2 | An | 3 |
| 13. | Analyze the given R code to find the output.  mat <- matrix(1:9, nrow = 3, ncol = 3)  row<- apply(mat, 1, sum)  col<-apply(mat, 2, sum)  print(row)  print(col) | | CO3 | An | 3 |
| 14. | Write any three R-functions for pattern matching and string manipulation using regular expressions. | | CO4 | A | 3 |
| 15. | List the visualization packages in R. | | CO5 | R | 3 |
| 16. | Interpret the following functions of lattice graphics.  xyplot()  bwplot()  levelplot() | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Classify the data types of R and explain any five data types of R with suitable examples. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Illustrate the arithmetic, logical and comparison operators of R with examples. | CO1 | A | 10 |
|  | b. | Differentiate between readline() method and scan() method. | CO1 | An | 2 |
|  |  |  |  |  |  |
| 19. | a. | Explain in detail the vectors and list data structures of R with suitable example. | CO2 | A | 10 |
|  | b. | Write a code to create a vector and find the vector length. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 20. | a. | Explain in detail the various control structures and loops with R code examples. | CO3 | U | 10 |
|  | b. | Write a code to create 3x2 matrix with values 1 to 6 and find the dimension of a matrix using R programming. | CO2 | A | 2 |
|  |  |  |  |  |  |
| 21. |  | Explain the given R functions with example codes.   1. apply() 2. lapply() 3. sapply() 4. tapply() | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Explain the methods and basic functions to handle and diagnose the error in R programming with examples. | CO4 | A | 10 |
|  | b. | Indicate the function of grepl() and predict the output for the given code.  text<- “Hello, world!”  grepl(“Hello”, text) | CO4 | U | 2 |
|  |  |  |  |  |  |
| 23. |  | Explain in detail the base R functions to visualize the relationship between variables with suitable examples. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Write the various plot types in R and explain its allied functions to visualize and analyze the business data points in a graph with suitable examples. | CO6 | A | 10 |
|  | b. | Infer the importance of color function in graphics. | CO6 | An | 2 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basics of programming using R. |
| **CO2** | Create and execute R programs. |
| **CO3** | Understand the concepts of file processing. |
| **CO4** | Adopt different techniques for using functions in the program. |
| **CO5** | Formulate algorithms and programs using basic objects and methods. |
| **CO6** | Analyze existing data of real world problems in business, medical fields etc. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **20EC2005** | **Duration** | **3hrs** |
| **Course Title** | **IOT FOR COMMUNICATION ENGINEERING** | **Max. Marks** | **100** |

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| **Q.**  **No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)**  **(Answer all the questions)** | | | | | |
| 1. | Define M2M. | | CO1 | R | 1 |
| 2. | Define energy harvesting. | | CO2 | R | 1 |
| 3. | Identify the given communication pattern | | CO1 | R | 1 |
| 4. | Define network security. | | CO4 | R | 1 |
| 5. | Interpret the functions of UMB core in an IoT system. | | CO3 | U | 1 |
| 6. | Describe Mirai chain reaction. | | CO4 | R | 1 |
| 7. | List the topologies of Fog Computing. | | CO5 | R | 1 |
| 8. | Define SAAS. | | CO5 | R | 1 |
| 9. | Describe cryptography. | | CO4 | R | 1 |
| 10. | List two methods to prevent attacks. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)**  **(Answer all the questions)** | | | | | |
| 11. | Explain multi-casting communication pattern. | | CO1 | U | 3 |
| 12. | Distinguish between IoT and WoT. | | CO1 | U | 3 |
| 13. | Explain Fragmentation and Reassembly. | | CO2 | U | 3 |
| 14. | Describe intruder detection. | | CO3 | R | 3 |
| 15. | Differentiate between NaaS and SaaS. | | CO5 | U | 3 |
| 16. | Differentiate between Data Lost and Data Leakage IoT attacks. | | CO4 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain IPv4 classes and their respective addressing ranges. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the following in detail:   1. ZigBee 2. Bluetooth 3. LoRaWAN | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the types and issues of interoperability in IoT. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Analyze the security attacks in different phases of an IoT System with necessary diagrams. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Compare Platform as a Service (PaaS) with Infrastructure as a Service (IaaS). | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Describe open stack cloud architecture with neat sketch. | CO5 | U | 6 |
|  | b. | Explain how Intrusion Detection Systems (IDS) can be implemented to detect unauthorized access on a critical server. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Discuss public cloud and private cloud with examples. | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the concept of home automation with neat sketch. | CO6 | A | 6 |
|  | b. | Explain the working of smart irrigation system with real-time examples. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the fundamental concepts of IoT, architecture and communication pattern. |
| **CO2** | Analyse the various sensors/actuators and the various IoT protocols. |
| **CO3** | Analyse WSN architecture, node behaviour and interoperability issues. |
| **CO4** | Analyse the various network security issues and its prevention. |
| **CO5** | Apply their understanding and to apply the IoT principles in real time applications. |
| **CO6** | Examine various real time applications and case studies. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **20EC3002** | **Duration** | **3hrs** |
| **Course Title** | **LOW POWER VLSI DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Interpret the importance of low power consumption in the context of portable and battery-operated gadgets. | CO1 | U | 9 |
|  | b. | Analyze the trade-offs between leakage power and dynamic power in Low Power VLSI designs. | CO1 | An | 7 |
|  |  |  |  |  |  |
| 2. | a. | Discriminate a real-world scenario where Probabilistic Power Analysis could be more advantageous than traditional power analysis methods. | CO2 | E | 8 |
|  | b. | Calculate the power dissipation in a circuit where a capacitor with capacitance C is being charged from a voltage source through a resistor R, and then discharged through the same resistor. Assume the voltage source maintains a constant voltage V. How does the power dissipation change over time during the charging and discharging process? | CO2 | An | 8 |
|  |  |  |  |  |  |
| 3. |  | Estimate transistor sizing as the process of determining the physical dimensions (width and length) of transistors in a CMOS circuit. | CO3 | An | 16 |
|  |  |  |  |  |  |
| 4. |  | Propose low-power modifications to a given gate-level design, considering the various techniques for the VLSI circuits. | CO3 | C | 16 |
|  |  |  |  |  |  |
| 5. | a. | Compare and contrast the advantages and disadvantages of various power and performance management techniques in the context of VLSI circuits. | CO4 | A | 8 |
|  | b. | Illustrate Flow Graph Transformation as a process used in control systems to simplify complex system models represented by flow graphs. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 6. |  | Discriminate an overview of SRAM as a type of semiconductor memory that utilizes bistable latching circuitry to store data without the need for refreshing. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 7. |  | Justify the principle of clock gating, where the clock signal is selectively enabled or disabled based on circuit activity. | CO5 | E | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. |  | Analyze the power consumption characteristics of conventional CMOS circuits and compare them with adiabatic logic techniques, highlighting the reduction in energy dissipation. | CO6 | An | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Understand the various sources of power dissipation. |
| CO2 | Acquire the knowledge on simulation power analysis and Probabilistic power analysis Techniques. |
| CO3 | Learn the various low power reduction techniques at circuit and logic level. |
| CO4 | Analyze the various low power techniques at Architecture and system level. |
| CO5 | Design low power clock Networks, bus and low power SRAM circuits. |
| CO6 | Design various adiabatic logic circuits. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC1004** | **Duration** | **3hrs** |
| **Course Title** | **PYTHON PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the output of the following code:  s = "Welcomes"  print("W"+ s[3:]) | | CO1 | R | 1 |
| 2. | Determine the output of the following code:  numbers = [10, 25, 8, 32, 19]  print(min(numbers)): | | CO1 | A | 1 |
| 3. | Interpret the purpose of the ‘count()’ function in Python. | | CO1 | U | 1 |
| 4. | List any two built-in string methods in Python. | | CO5 | R | 1 |
| 5. | Construct a python program to check whether the user entered number is odd or even. | | CO2 | A | 1 |
| 6. | Identify the output of: print("Python"[::-2]). | | CO2 | U | 1 |
| 7. | Define a lambda function in Python with an example. | | CO4 | R | 1 |
| 8. | Identify and debug the error in the following code.  x = [‘12’, ’hello’, 456]  x[0] \*= 3  x[1][1]=’bye’ | | CO2 | U | 1 |
| 9. | List any two properties of dictionaries in Python. | | CO5 | R | 1 |
| 10. | Define inheritance concept in Object Oriented Programming. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write a Python program to compute the Greatest Common Divisor (GCD) of two numbers. | | CO3 | A | 3 |
| 12. | Interpret the output of the following python code:  def modify\_string(s):  for word in s.split():  s = "-".join(word)  return s    print(modify\_string("Hello World")) | | CO2 | U | 3 |
| 13. | Write a Python code using math module to find the factorial of the given number. | | CO3 | A | 3 |
| 14. | Analyze the use of list slicing with an example. | | CO5 | An | 3 |
| 15. | Write a Python function to check whether given string is a palindrome or not. | | CO4 | A | 3 |
| 16. | Differentiate between procedural and object-oriented programming approaches with examples. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Write a Python program to implement ticket booking application. Get the name and age of the passenger to book the ticket. Check the age, if it is less than 6 years or greater than or equal to 60 years then apply 30% concession to the original ticket price (Rs.1000/-). Otherwise simply print tickets booked with the original ticket price. | CO2 | A | 9 |
|  | b. | Predict the output of the following code snippet:  count = 0  while(True):  if count % 2 == 0:  print(count, end = " ")  if(count > 15):  break;  count += 1 | CO2 | E | 3 |
|  |  |  |  |  |  |
| 18. | a. | Develop a python program to print ‘n’ natural numbers using while loop statement. | CO1 | A | 6 |
|  | b. | Write a Python program to implement the binary search algorithm. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Develop a python code to create a class called STRING and implement the following operations.   1. STRING s1=”VTU”; 2. STRING s2=”BELGAUM”; 3. STRING s3=S1+S2; | CO5 | A | 8 |
|  | b. | Write a Python program to count the number of vowels in a string. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the concept of fruitful functions in Python with an example program. | CO4 | An | 6 |
|  | b. | Construct a user-defined function **‘reverse\_digits’** that takes an integer as input, reverses its digits, and displays the reversed number. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the below operations using Python programs:  a) Convert a tuple into a string.  b) Merge two tuples and eliminate duplicate elements.  c) Verify whether a tuple is a subset of another tuple.  d) Identify the difference between two dictionaries based on keys.  e) Divide a dictionary into two smaller dictionaries.  f) Compute the sum of all values in a dictionary. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Construct the following dictionary and perform operations on it:  inventory = {'gold' : 500, 'pouch' : ['flint', 'twine', 'gemstone'], 'backpack' : ['xylophone', 'dagger', 'bedroll', 'bread loaf'] }  Implement suitable methods to:   1. Add a key to inventory called 'pocket'. 2. Set the value of 'pocket' to be a list consisting of the strings 'seashell', 'strange berry', and 'lint'. 3. sort () the items in the list stored under the 'backpack' key. 4. remove('dagger') from the list of items stored under the 'backpack' key. 5. Add 50 to the number stored under the 'gold' key. | CO3 | A | 6 |
|  | b. | Develop a Python program to perform the following operations on the below dictionary:    people = {1: {'name': 'John', 'age': '27', 'sex': 'Male'},2: {'name': 'Marie', 'age': '22', 'sex': 'Female'}}  a) Extend the existing people dictionary by adding two more individuals.  b) Update the name of person 1 from "John" to "Jonathan".  c) Remove person 2 from the dictionary.  d) Iterate through the dictionary and display all key-value pairs. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Develop a Python application implementing Inheritance for an ATM System as follows:   1. Create a superclass CashTree to represent an ATM machine with attributes like name, codeno, and location. 2. Define core functionalities in the superclass, including ViewBalance, Withdraw, and Deposit. 3. Derive two subclasses: SBI\_Bank and HDFC\_Bank, incorporating additional attributes such as customer\_name and balance. 4. Redefine functionalities in the subclasses to reflect bank-specific policies, differentiating them using factors like service charges, interest rates, and maximum withdrawal limits.   Implement a menu-driven approach to interact with the ATM system. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a Python program to process a text file by accepting it as input and determining the total number of words in the file while also extracting characters from multiple text files and storing them in a list for further processing.  Perform the following operations on the text file:  a) Read and display the first n lines.  b) Read the file line by line and store each line in a list.  c) Count and display the total number of lines in the file.  d) Remove newline characters from the file content. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basics of programming using python. |
| **CO2** | Write and execute python programs |
| **CO3** | Understand the concepts of using math library |
| **CO4** | Adopt different techniques using functions in the program. |
| **CO5** | Formulate algorithms and write programs using modules, packages and strings |
| **CO6** | Apply python for real time application using object oriented approach |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC1006** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO COMPUTER ENGINEERING** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the main virtue for using single Bus structure. | | CO1 | U | 1 |
| 2. | \_\_\_\_\_\_ are used to overcome the difference in data transfer speeds of various devices. | | CO1 | R | 1 |
| 3. | Define Control System. | | CO2 | R | 1 |
| 4. | List the different types of generating control signals. | | CO2 | R | 1 |
| 5. | Operation code field is present in--- | | CO2 | U | 1 |
| 6. | In the case of, Zero-address instruction method the operands are stored in \_\_\_\_\_ | | CO2 | R | 1 |
| 7. | \_\_\_\_\_\_ have been developed specifically for pipelined systems. | | CO4 | U | 1 |
| 8. | The interrupt-request line is a part of the \_\_\_\_\_ | | CO4 | R | 1 |
| 9. | Name the two pipelines (in proper sequence) that are used to calculate an inner product in vector processor. | | CO5 | U | 1 |
| 10. | Mention the other name of the I/O Devices. | | CO4 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Write about hierarchy of buses, bus signals and its functionalities. | | CO1 | R | 3 |
| 12. | Justify how parallel processing improves the performance of multiprocessing environment. | | CO5 | A | 3 |
| 13. | Tabulate the Input-Output Instructions using register transfer notations. | | CO2 | U | 3 |
| 14. | Recall the use of Hardware multithreading. | | CO4 | R | 3 |
| 15. | State the use of polling in computer architecture. | | CO4 | U | 3 |
| 16. | Label different types of addressing modes. | | CO5 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q.No. 17 to 23, Q.No. 24 is Compulsory)** | | | | | |
| 17. | a. | Sketch the internal organization of CPU with its functionalities and block diagram. | CO1 | R | 6 |
|  | b. | Explain different type of buses with its architecture diagram. | CO1 | R | 6 |
|  |  |  |  |  |  |
| 18. | a. | Paraphrase about microinstruction sequencing and execution techniques in detail. | CO2 | A | 6 |
|  | b. | Outline how microprogrammed control is used in computer architecture. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. | a. | Describe program control instructions and its use. | CO3 | U | 6 |
|  | b. | Explain in detail about status bit conditions with example. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | With a neat schematic, explain DMA controller and its mode of data transfer. | CO4 | R | 6 |
|  | b. | Summarize how Pipelined data path and control is used to improve the performance during instruction execution. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate serial and parallel arbitration processes in a shared multiprocessor environment. | CO5 | U | 6 |
|  | b. | Enumerate Synchronous versus Asynchronous I/O in computer architecture. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the mapping process involved in transformation of data from main to Cache memory. | CO6 | U | 6 |
|  | b. | Define virtual memory. Explain the relation between address space and memory space in a virtual memory system along with its memory table for mapping. | CO6 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Sketch the operation of TLB used in operating systems | CO4 | R | 6 |
|  | b. | Interpret different types of Internal registers. | CO4 | R | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Distinguish SISD, MIMD, SIMD, SPMD and Vector Architectures in detail | CO5 | U | 6 |
|  | b. | Explain inter processor communication and synchronization in a shared multiprocessor environment. | CO5 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Examine the organizational structure of a basic CPU subsystems |
| **CO2** | Evaluate the micro-operation sequencing and control mechanisms on instruction fetch and  execution cycle. |
| **CO3** | Apply instruction set principles to program optimized assembly-level programs. |
| **CO4** | Inspect pipeline principles and I/O techniques like interrupts, polling and DMA for efficient data transfers. |
| **CO5** | Compare parallel processing architectures for addressing computational challenges. |
| **CO6** | Apply memory hierarchy concepts to improve system performance. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2005** | **Duration** | **3hrs** |
| **Course Title** | **OPERATING SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define context switching in process management. | | CO1 | R | 1 |
| 2. | Define interrupt in OS. | | CO1 | R | 1 |
| 3. | List the functions of the dispatcher module. | | CO2 | R | 1 |
| 4. | Enumerate the various scheduling criteria for CPU | | CO2 | R | 1 |
| 5. | Define swapping. | | CO3 | R | 1 |
| 6. | Define Address binding. | | CO3 | R | 1 |
| 7. | Identify the drawbacks of contiguous allocation of disk space. | | CO4 | U | 1 |
| 8. | Define seek time and latency time. | | CO4 | R | 1 |
| 9. | Define the file directory. | | CO5 | R | 1 |
| 10. | Give two examples of open-source operating systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Illustrate the use of fork() and exec() system calls. | | CO1 | U | 3 |
| 12. | Compare the characteristics of single-threaded and multi-threaded processes. | | CO2 | U | 3 |
| 13. | Distinguish between scheduling and dispatching in operating systems. | | CO3 | U | 3 |
| 14. | Identify the conditions necessary to avoid deadlock in the system. | | CO4 | U | 3 |
| 15. | Distinguish between segmentation and fragmentation. | | CO5 | U | 3 |
| 16. | Illustrate the layers in android operating system. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | **Explain the implementation of various types of operating system structures. Discuss the following types:**  a. **Simple Structure** b. **Non-Simple Structure** c. **Complex Structure** d. **Layered OSes** | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Consider the following set of processes, with the length of the CPU burst given in milliseconds:   |  |  |  | | --- | --- | --- | | Process | Burst Time | Priority | | P1 | 2 | 2 | | P2 | 1 | 1 | | P3 | 8 | 4 | | P4 | 4 | 2 | | P5 | 5 | 3 |   The processes are assumed to have arrived in the order P1, P2, P3, P4, and P5 all at time 0.   1. Sketch the Gantt charts that illustrate the execution of these processes using the priority scheduling algorithm. 2. Determine the average waiting time of each process. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the implementation of Hashed paging structure and Inverted paging table in a memory management system. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Consider the following set of Read/Write  Read/Write sequence = {76, 25, 34, 60, 92, 111, 41, 14}  Initial head position = 50  Utilizing a clear graphic, apply the SCAN and LOOK disk scheduling technique, determine the overall seek time. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain about kernel I/O subsystem and transforming I/O to hardware operations. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 22. |  | Consider the following set of processes, with the length of the CPU burst given in milliseconds:   |  |  | | --- | --- | | Process | Burst Time | | P1 | 8 | | P2 | 1 | | P3 | 7 | | P4 | 4 | | P5 | 3 |   The processes are assumed to have arrived in the order P1, P2, P3, P4, and P5, all at time 0.   1. Sketch the Gantt charts that illustrate the execution of these processes using the shortest job first scheduling algorithm. 2. Determine the average waiting time of each process. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Consider the following set of Read/Write  Read/Write sequence = {176, 79, 34, 60, 92, 11, 41, 114}  Initial head position = 50  Utilizing a clear graphic, apply FCFS and shortest seek time first disk scheduling technique, and determine the overall seek time. | CO4 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain in detail the design principles, kernel modules, process management, and scheduling in LINUX system. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Assess the evolution and objectives of operating systems. |
| **CO2** | Apply process management techniques. |
| **CO3** | Design a memory management scheme for embedded systems. |
| **CO4** | Evaluate the mass storage systems and their impact on performance. |
| **CO5** | Assess the role of the Kernel and application I/O interface. |
| **CO6** | Examine the case studies of kernel modules, file systems, and memory management strategies across Linux, iOS, and Android. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **DATA STRUCTURES AND ALGORITHMS** | **Duration** | **3hrs** |
| **Course Title** | **21EC2007** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the time complexity of the following algorithm in Big-Theta notation.  *for(i = 0; i < n; i++) {*  *for(j = 0; j < n; j++) {*  *c[i][j] = a[i][j] + b[i][j];*  *}*  *}* | | CO1 | R | 1 |
| 2. | List any two examples of linear data structures. | | CO1 | R | 1 |
| 3. | State the best and worst-case time complexities of Linear Search. | | CO2 | R | 1 |
| 4. | Define Bubble sort. | | CO2 | R | 1 |
| 5. | Show the diagrammatic representation of a queue. | | CO3 | U | 1 |
| 6. | Apply the following operations on a stack and display the result.  push(10), push(20), push(30), pop(), push(40). | | CO3 | A | 1 |
| 7. | List the two common methods of graph representation. | | CO4 | R | 1 |
| 8. | Identify the leaf nodes and the height of the following tree structure.  Tree in Data Structure using C# - deBUG.to | | CO4 | U | 1 |
| 9. | Define NP-Completeness. | | CO5 | R | 1 |
| 10. | Give at least two examples of a greedy algorithm. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Define algorithm, time complexity, and space complexity. | | CO1 | R | 3 |
| 12. | Analyze the time complexity and the number of iterations performed by Insertion Sort to sort the following array elements: 38, 12, 27, 7, 19. | | CO2 | An | 3 |
| 13. | Compute the result of the following postfix expressions by illustrating each step of the stack operation.   * 5 3 2 \* + * 3 4 7 - + | | CO3 | A | 3 |
| 14. | Explain any three types of graphs with suitable examples. | | CO4 | U | 3 |
| 15. | Describe the key properties of a Spanning Tree with examples. | | CO5 | U | 3 |
| 16. | Write a recursive pseudocode to compute the factorial of a number. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the following functions in the Single Linked List with suitable Pseudocode:   1. Insert at the end 2. Delete at the beginning 3. Insert at Nth position | CO1 | A | 8 |
|  | b. | Analyze the differences in the deletion process of the last node between Circular Linked List and Singly Linked List with suitable examples. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 18. |  | Illustrate Linear Search and Binary Search algorithms with pseudocode and examples. Also, discuss their time complexities. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Apply the stack algorithm to convert the following infix expressions to their postfix form, and demonstrate the steps involved in the process.   1. A + B \* (C – D / E) - F 2. (A + B) \* (C + D) 3. A \* B + C / D – E 4. A – B / D \* E | CO3 | A | 8 |
|  | b. | Illustrate the insertion and deletion operations in a Linear Queue using array implementation with an example. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | Construct a Binary Search Tree (BST) using the following data elements in the given order: 50, 35, 60, 25, 45, 20, 65, 70, 30, 55, 40, 58, 62. Show the step-by-step insertion process and draw the final structure of the tree. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Analyze the application of Kahn’s algorithm to perform topological sorting on the given DAG by explaining the step-by-step process, focus on in-degree calculation and derive the final sorted order. | CO5 | An | 8 |
|  | b. | Define the following terms with examples.   1. Cyclic graph 2. Degree of a node 3. Forest 4. Loop | CO5 | R | 4 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the Depth-First Search (DFS) algorithm with the given graph by explaining the step-by-step traversal process. | CO4 | U | 6 |
|  | b. | Apply Heap Sort to the given array [1, 3, 5, 4, 6, 13, 10, 9, 8, 15, 17] and demonstrate the step-by-step implementation. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Explain different types of trees in data structures with their characteristics, properties, and examples. Also, illustrate the tree traversal techniques with appropriate examples. | CO4 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the working principle of the Bellman-Ford algorithm with an example graph. | CO6 | U | 6 |
|  | b. | Describe the characteristics of an algorithm with suitable examples. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Analyze the time and space efficiency of data structures and algorithms and apply this analysis to select the best tools for solving particular problems. |
| **CO2** | Implement a variety of algorithms for searching and sorting, including linear search, binary search, insertion sort, selection sort, merge sort, quicksort, and heap sort. |
| **CO3** | Describe, explain, and use abstract data types including stacks, queues, lists, sets, maps and graphs. |
| **CO4** | Implement those data types using both contiguous and linked representations. |
| **CO5** | Read and write recursive algorithms. Understand when recursion is, and is not, appropriate. |
| **CO6** | Implement an advanced algorithm using Elementary and Greedy Method with Single Source Shortlist Paths. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2009** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF JAVA PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the significance of the public keyword in Java. | | CO1 | R | 1 |
| 2. | Describe the purpose of a constructor in Java. | | CO2 | R | 1 |
| 3. | Identify the Java method to convert the string "hello" into uppercase. | | CO2 | U | 1 |
| 4. | Name any one built-in Java package. | | CO3 | R | 1 |
| 5. | Define the role of access specifiers in inheritance. | | CO3 | R | 1 |
| 6. | Differentiate ArrayList and Vector. | | CO5 | U | 1 |
| 7. | Identify the purpose of the try-catch block. | | CO3 | U | 1 |
| 8. | List any two classes in the Collection Framework. | | CO5 | R | 1 |
| 9. | Define the term “random access file” in Java. | | CO5 | R | 1 |
| 10. | Differentiate between text and binary file operations. | | CO5 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Differentiate between JDK and JRE. | | CO1 | U | 3 |
| 12. | Write a Java program to calculate the area of a circle for a given radius and print the calculated area as the output. | | CO1 | A | 3 |
| 13. | Summarize the use of collections in Java. | | CO2 | U | 3 |
| 14. | Describe about User defined exception. | | CO3 | R | 3 |
| 15. | Discuss the role of the final keyword in Java. | | CO3 | U | 3 |
| 16. | List the methods available in the Thread class. | | CO4 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Describe the core Object-Oriented Programming (OOP) concepts in Java, including Encapsulation, Inheritance, Polymorphism, and Abstraction. Discuss with Java code examples that demonstrates these principles. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Analyze a scenario where a Java application determines a student's grade based on marks using if, if-else, and switch statements. Explain how each statement can be used for decision-making and write a Java program to implement the logic. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Differentiate the exceptions in Java, highlighting the distinctions between checked and unchecked exceptions. | CO3 | U | 6 |
|  | b. | Write a Java program that demonstrates exception handling using try, catch, and finally blocks. The program should take two numbers as input from the user and perform division. Handle the case when the denominator is zero by catching the ArithmeticException. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain the working of the Java Stack class with a program demonstrating operations like push, pop, isEmpty, search, size, and clear. Demonstrate the expected output to show how elements are added, removed, and retrieved from the stack. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Explain the different types of inheritance in object-oriented programming. Describe each type with an example and discuss its advantages and limitations. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the concept of method overloading in Java by explaining how it allows multiple methods with the same name to coexist in a class with different parameter lists and how the compiler differentiates between them during method calls. | CO2 | U | 6 |
|  | b. | Define a Java interface named Calculator with methods for basic operations (add, subtract, multiply, divide). Write a class BasicCalculator that implements this interface with actual methods. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the concept of Java Database Connectivity (JDBC) by explaining the steps involved in establishing a database connection, executing queries, and handling the results in a Java application. | CO6 | U | 6 |
|  | b. | Write a Java program to copy the contents of one file to another using FileInputStream and FileOutputStream. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Create a Java Swing-based Hotel Booking System where users can enter booking details (customer name, room type, number of days, etc.), and the data should be stored in a database. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the basics of object-oriented design. |
| **CO2** | Identify classes, abstract classes, objects and members needed for specific application. |
| **CO3** | Create java application programs using sound oop practices. |
| **CO4** | Develop programs using multitasking applications. |
| **CO5** | Analyse real time applications. |
| **CO6** | Apply the skills for designing gui based applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2010** | **Duration** | **3hrs** |
| **Course Title** | **LINEAR INTEGRATED CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Write the open loop gain of an operational amplifier. | | CO1 | A | 1 |
| 2. | Name the first block of an operational amplifier. | | CO1 | R | 1 |
| 3. | Determine the output of multiplier if the input voltages are 4v and 3 v. | | CO2 | A | 1 |
| 4. | Name the behavior of inverting amplifier if Rf = R~~i~~​. | | CO2 | R | 1 |
| 5. | Define line regulation in the context of voltage regulators. | | CO3 | R | 1 |
| 6. | Predict the output voltage of 7902 fixed voltage regulator. | | CO3 | U | 1 |
| 7. | Estimate the gain of first order HPF, when the input frequency is less than the cutoff frequency. | | CO4 | An | 1 |
| 8. | Determine the band width of Band Pass Filter (BPF) , if fl = 3KHz and fh = 6KHz . | | CO4 | A | 1 |
| 9. | Write any one application of Phased Locked Loop(PLL). | | CO5 | A | 1 |
| 10. | Name the fastest Analog to Digital Convertor (ADC) | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | **List the ideal characteristics of an operational amplifier.** | | CO1 | R | 3 |
| 12. | **Sketch the circuit diagram of an inverting comparator with positive and negative reference and show its waveform.** | | CO2 | A | 3 |
| 13. | **Explain the Barkhausen criteria for sustained oscillation.** | | CO3 | U | 3 |
| 14. | **Illustrate the circuit diagram of a second-order high-pass filter.** | | CO4 | A | 3 |
| 15. | **Define lock-in range and capture range in the context of Phase-Locked Loop (PLL).** | | CO5 | R | 3 |
| 16. | **Determine the output voltage of a 3-bit DAC when the input data is 111 and the reference voltage** VR=8 V**.** | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | **Sketch the equivalent circuit of an operational amplifier.** | CO1 | A | 3 |
|  | b. | **Explain any three DC characteristics of an operational amplifier and discuss the compensation techniques used to improve them.** | CO1 | U | 9 |
|  |  |  |  |  |  |
| 18. | a. | **Discuss the working of a non-inverting amplifier and derive the voltage gain, along with the necessary waveforms.** | CO2 | U | 6 |
|  | b. | **Describe the working principle of a full-wave precision rectifier.** | CO2 | R | 6 |
|  |  |  |  |  |  |
| 19. |  | Illustrate the working principle of an Op-Amp Monostable Multivibrator with the circuit diagram and waveforms. Also, derive the expression for the time period. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. | a. | Design a second-order Butterworth low-pass filter (LPF) with a cutoff frequency of 2 kHz. (Assume C=0.1 μF and R1=10 kΩ). | CO4 | C | 8 |
|  | b. | Sketch the circuit diagram of Narrow band pass filter. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Illustrate the working principle of an astable multivibrator using a 555 timer with the necessary circuit diagram, equations, and waveforms. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Examine the output voltage of a subtractor. | CO2 | A | 6 |
|  | b. | Describe the working principle of an Integrator. | CO2 | R | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the principle of an Op-Amp Schmitt trigger. | CO3 | A | 6 |
|  | b. | Sketch the circuit diagram of RC phase shift oscillator. | CO3 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | **Illustrate the working principle of a Successive Approximation ADC with an example.** | CO6 | A | 8 |
|  | b. | Explain the features of a switched capacitor. | CO6 | U | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the fundamentals of OP-AMP and its characteristics. |
| **CO2** | Design OP-AMP-based circuits such as Amplifiers, Differentiators, and Integrators. |
| **CO3** | Evaluate the significance of OP-AMPs in Multivibrators and Oscillators |
| **CO4** | Construct filters using OP-AMPs. |
| **CO5** | Apply the functionality of IC555 timer and Phase Locked Loop (PLL) in practical scenarios. |
| **CO6** | Design real-time applications using ADC and DAC. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2011** | **Duration** | **3hrs** |
| **Course Title** | **ANALOG ELECTRONICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the material used as a Gate in a MOSFET. | | CO1 | U | 1 |
| 2. | Name the process for producing single crystal silicon ingots. | | CO1 | R | 1 |
| 3. | State the operating regions of MOSFET. | | CO2 | R | 1 |
| 4. | Write the drain current (ID) equation of MOSFET in linear region. | | CO2 | A | 1 |
| 5. | Classify the types of MOSFETs. | | CO3 | U | 1 |
| 6. | Sketch the circuit symbol of an n-channel E-MOSFET. | | CO2 | A | 1 |
| 7. | Identify the small-signal model parameters of a MOSFET. | | CO4 | U | 1 |
| 8. | Predict the parameter in characterizing amplifier performance. | | CO4 | A | 1 |
| 9. | Sketch the basic circuit of a current mirror. | | CO5 | A | 1 |
| 10. | Define drain conductance (gd) in a MOSFET. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Interpret the process of Lithography. | | CO1 | A | 3 |
| 12. | Explain the significance of the Voltage-Transfer Characteristic (VTC) in amplifier operation. | | CO2 | A | 3 |
| 13. | Sketch the small-signal equivalent circuit of a MOSFET with necessary equations. | | CO3 | A | 3 |
| 14. | Visualize the structure of a cascode current mirror. | | CO4 | R | 3 |
| 15. | Predict the input and output impedance values of the Common-Gate configuration of a MOSFET. | | CO5 | A | 3 |
| 16. | Identify the important characteristics of CMOS technology. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the various steps involved in the IC fabrication process with suitable examples. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Sketch the CMOS p-well process and label each step clearly. | CO1 | A | 8 |
|  | b. | Construct the circuit symbol and truth table of a two input NAND gate using CMOS technology. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 19. |  | Illustrate device structure and physical operation for an enhancement type NMOS transistor with diagram. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Determine the drain current equation for a MOSFET in the linear region using the MOSFET current-voltage relationship. | CO2 | A | 8 |
|  | b. | Apply the concept of channel length modulation to determine the drain current of a MOSFET when VDS increases from 0.5V to 1V, given that the MOSFET carries a drain current of 1mA in saturation at VDS =0.5V and the channel length modulation parameter λ =0.2V-1. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Interpret the process of obtaining a voltage amplifier and its significance in electronic circuits. | CO3 | A | 4 |
|  | b. | Explain the operation of MOS differential amplifier with common mode input voltage with neat circuit diagram. | CO5 | An | 8 |
|  |  |  |  |  |  |
| 22. |  | Determine the voltage gain, input impedance and output impedance of Common source amplifier with necessary equivalent circuit. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Discuss the following MOS current mirrors with necessary equations.  i)Basic current mirror ii)Wilson current mirror | CO5 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the working principles and performance parameters of the given CMOS amplifier topologies:  i) Common-source with resistive load  ii) Common-source with diode-connected load | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the principles of IC and MOSFET fabrication processes, including lithography and oxidation to assess their impact on device performance. |
| **CO2** | Design the structure of MOSFETs to determine design parameters that influence their operation and performance in amplifier applications. |
| **CO3** | Apply knowledge of MOSFET configurations to design circuits that optimize performance for specific applications, such as amplifiers or digital logic circuits. |
| **CO4** | Design cascode amplifiers to enhance performance factors such as gain, bandwidth, and linearity. |
| **CO5** | Evaluate the performance of current mirrors and differential amplifiers in practical applications. |
| **CO6** | Apply the concepts of biasing, feedback, and stability to design efficient and high-performance CMOS amplifiers. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2015** | **Duration** | **3hrs** |
| **Course Title** | **WEB TECHNOLOGY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Give an example for web client. | | CO1 | U | 1 |
| 2. | State the HTML code used for creating a hyper link in a web page. | | CO1 | R | 1 |
| 3. | Identify the CSS property to change the text size in a HTML page. | | CO2 | R | 1 |
| 4. | Describe the CSS code used to set the image as background for the DIV element. | | CO2 | R | 1 |
| 5. | Give an example Java Script code to change the text color of HTML paragraph. | | CO3 | U | 1 |
| 6. | Define cookie in a website. | | CO3 | R | 1 |
| 7. | Identify the Java Servlet function to read HTML form input parameters. | | CO4 | R | 1 |
| 8. | Identify the version of XML document. | | CO4 | R | 1 |
| 9. | State the method used as a call back function in AJAX. | | CO6 | R | 1 |
| 10. | Define a web service. | | CO5 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the three types of List formats in HTML with suitable examples. | | CO1 | R | 3 |
| 12. | Describe the following CSS selectors with appropriate examples.  a) element selector b) class selector c) id selector | | CO2 | R | 3 |
| 13. | Give example JavaScript code for the following control statements   1. for loop b) if else c) switch | | CO3 | U | 3 |
| 14. | Illustrate Java Servlet program to store and read data in a session variable. | | CO4 | U | 3 |
| 15. | Give an example for XSLT for the XML document. | | CO6 | U | 3 |
| 16. | Describe the use of SOAP protocol in web service. | | CO5 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe the following HTML form elements with appropriate HTML code.   * Text Field * Password Field * Radio Buttons * Checkboxes * Number Field * Email Field | CO1 | U | 6 |
|  | b. | Develop the following layout using appropriate HTML tags with proper alignments.   |  |  |  |  | | --- | --- | --- | --- | | **Quick** | **brown fox** | | **jumps** | | Over the | lazy | dog | and | | then | it | will | | prey to a lion | | | | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. |  | Develop a HTML program using JavaScript to perform Simple Interest Calculation as given below. [Formula: A = P \*(1+r\*t), where A – Final Amount, P – Principle Amount, r- interest rate, t – tenure ] | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Develop a Java Servlet program to perform Bank account creation in database as follows.   * Design a registration form using HTML to collect Account Name, Account Number, Initial Amount. * Save the Account details to the database table when the form is submitted using appropriate Java Servlet program implementation. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the types of JSP Tags with suitable example programs. | CO4 | U | 6 |
|  | b. | Write a JSP program to demonstrate storing and retrieving data in a session and cookies. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Describe the HTML elements used to perform the following in a HTML web page with suitable example programs.   * Play a music file * Play a video file * Display your photo * Link an external website * Play a youtube video * Display Google Map | CO1 | U | 6 |
|  | b. | Explain the CSS Box Properties with suitable example programs. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Develop an XML document named employees.xml that contains information about five employees, including their ID, name, position, salary, and department. Then, using JavaScript and an HTML page   * Load and parse the employees.xml file using the XML DOM Parser. * Display each employee’s details (ID, Name, Position, Salary, Department) in an HTML table. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Explain Xpath and XSLT with respect to XML using suitable example. | CO5 | U | 6 |
|  | b. | Give example programs to demonstrate the following three ways of including CSS in a HTML web page.   * Inline CSS * Internal CSS * External CSS | CO6 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop an **AJAX-based program with** JSP, where users type in a search box, and suggestions appear dynamically based on a predefined list of words stored in a JSP file. Your solution should include:   * An **HTML page** with a text input field where users type a letter or word. * A **JavaScript function** that sends the typed data to a JSP file using AJAX. * A **JSP program** that processes the request, matches the input with a predefined list of words, and returns matching suggestions. * Display the suggestions dynamically in the web page. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Design simple web pages using markup languages like HTML and XHTML |
| **CO2** | Create dynamic web pages using DHTML and java script that is easy to navigate and use. |
| **CO3** | Program server-side web pages that have to process request from client side web pages. |
| **CO4** | Represent web data using XML and develop web pages using JSP. |
| **CO5** | Understand various web services |
| **CO6** | Comprehend how these web services interact. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2018** | **Duration** | **3hrs** |
| **Course Title** | **MACHINE LEARNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the different parts of biological neuron. | | CO1 | R | 1 |
| 2. | Distinguish between supervised and unsupervised training methodologies. | | CO1 | An | 1 |
| 3. | Compare 2D and 3D hyperplane. | | CO2 | An | 1 |
| 4. | List the performance measures used to evaluate the machine learning algorithms. | | CO2 | R | 1 |
| 5. | Distinguish between linear regression and logistic regression. | | CO3 | An | 1 |
| 6. | “Entropy is inversely proportional to information gain”. Justify this statement. | | CO3 | E | 1 |
| 7. | Distinguish between linear SVM and non-linear SVM. | | CO4 | An | 1 |
| 8. | List the different types of kernels used in Support Vector Machines. | | CO4 | R | 1 |
| 9. | “Hopfield neural networks are the stable neural networks”. Justify this statement. | | CO5 | E | 1 |
| 10. | Illustrate the process of medical image classification using a block diagram. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the output value for the given input x= [0.5 0.5] and weights w= [0.6 0.7] using sigmoidal activation function. | | CO1 | A | 3 |
| 12. | Compute the accuracy of a brain image classification system with 100 correctly classified images and 50 misclassified images. | | CO2 | A | 3 |
| 13. | “Decision Tree is used for both classification and regression applications”. Justify this statement. | | CO3 | E | 3 |
| 14. | Explain the maximum margin method used in SVM for classification applications. | | CO4 | U | 3 |
| 15. | Distinguish between Perceptron and Kohonen neural network. | | CO5 | An | 3 |
| 16. | “Feature Extraction is also used for dimensionality reduction”. Justify this statement. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the classification, regression, clustering and association applications with examples. Include relevant illustrations. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Distinguish between underfitting and overfitting in machine learning algorithms. | CO2 | An | 6 |
|  | b. | Distinguish between single and multilayer artificial neural networks. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Evaluate the given two architectures in terms of information gain and determine the best feature for the root node. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 20. |  | Distinguish between the different scenarios of SVM with hyperplanes for data classification. Use relevant diagrams to validate your answer. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Calculate the new weight values of a perceptron neural network with the following specifications: x=[0.4 0.3]; old weights (w) = [0.5 0.5]; learning rate 0.6; Threshold 0.5. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Differentiate feature extraction and feature selection in pattern recognition. | CO6 | An | 6 |
|  | b. | “Pre-processing is essential for brain image classification to increase the accuracy”. Justify this statement | CO6 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | “Kohonen neural networks are more suitable for clustering applications”. Justify this statement. | CO5 | E | 6 |
|  | b. | Distinguish between Hopfield neural network and feed forward neural network. | CO5 | An | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the training algorithm of Back propagation neural network with illustrations. Include relevant mathematical equations. | CO5 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the performance of supervised and unsupervised machine learning algorithms. |
| **CO2** | Compute the accuracy measures for regression and classification applications. |
| **CO3** | Evaluate the performance of decision tree models using LMS algorithms. |
| **CO4** | Evaluate the performance of Support Vector Machines using maximum margin methods. |
| **CO5** | Determine the weight matrices of supervised and unsupervised artificial neural networks |
| **CO6** | Apply supervised machine learning algorithms for pattern recognition applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2019** | **Duration** | **3hrs** |
| **Course Title** | **SYSTEM SOFTWARE AND COMPILER DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Analyze the volume of sphere using code generation operations. | | CO1 | An | 1 |
| 2. | Evaluate the significance of program analysis techniques in compiler designs. | | CO1 | E | 1 |
| 3. | List two practical applications of compiler algorithms. | | CO2 | R | 1 |
| 4. | Analyze the working of a two-pass assembler with examples. | | CO2 | An | 1 |
| 5. | Define automatic library search with its significance. | | CO3 | R | 1 |
| 6. | Interpret the role of a simple bootstrap loader in system programming. | | CO3 | An | 1 |
| 7. | State the different language representations along with necessary notations. | | CO4 | R | 1 |
| 8. | Illustrate the working of a lexical analyzer with an example. | | CO4 | A | 1 |
| 9. | Infer the concept of syntax anlyzer. | | CO4 | An | 1 |
| 10. | List the functions used in push down automata in parsing. | | CO4 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Justify the separation of lexical analysis from parsing. | | CO1 | E | 3 |
| 12. | Describe the P-code compiler with an example. | | CO2 | U | 3 |
| 13. | Classify the various applications of finite state automata in computational theory. | | CO3 | An | 3 |
| 14. | Infer the difficulties encountered in lexical analysis with suitable examples. | | CO3 | An | 3 |
| 15. | Interpret the roles of parsers in system programming. | | CO4 | A | 3 |
| 16. | Appraise the fundamental functions of a loader by analyzing its working steps. | | CO4 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the workflow of a language processing system with a neat block diagram. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Examine the role of an assembler and analyze the functions of a basic assembler along with its directives using a simple pseudocode. | CO2 | A | 8 |
|  | b. | Sketch the quadruples and syntax tree of three address code for a + b \* c – d/ (b\*c). | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Explain the basic loader function and justify the following:  a)Absolute loader b)Simple Bootstrap loader | CO2 | A | 8 |
|  | b. | Explain the pseudo code instructions and assembler directives with an example. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 20. | a. | Describe the instruction in three address code with examples for if\_then\_else and while\_do statements and list out the SATG attributes in the compiler. | CO2 | R | 8 |
|  | b. | Illustrate the concept of automated compiler construction using compiler- complier with a neat sketch. | CO3 | A | 4 |
|  |  |  |  |  |  |
| 21. | a. | Explain in brief the specification and recognition of token and feature of languages with an example. | CO3 | An | 6 |
|  | b. | Examine non liner finite state automata of the different conditions with a neat sketch. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the basic loader design in system software with necessary pseudo code for different conditions. | CO3 | An | 6 |
|  | b. | Justify the necessity of machine dependent loader features with appropriate algorithms and pseudo-code for an example. | CO3 | E | 6 |
|  |  |  |  |  |  |
| 23. | a. | Determine the transition function ẟ of automata using the tabulation method. Justify the finite state automata for the natural language processing applications. | CO3 | A | 8 |
|  | b. | Explain, why should lexical analysis be separated from syntax analysis? | CO4 | An | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss on syntax analysis of a programming language with examples and explain brief about context – free grammar. | CO4 | U | 8 |
|  | b. | Sketch the derivation trees in syntax analysis with a necessary condition. | CO4 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Compare various system software and compiler related to the given system. |
| **CO2** | Understand the concepts required to develop the system software and tools. |
| **CO3** | Understand algorithms by tracing its computational states. |
| **CO4** | Identify bugs in algorithms and bug correction using related tools. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2020** | **Duration** | **3hrs** |
| **Course Title** | **DATA COMMUNICATION NETWORKS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Indicate the number of links needed in mesh topology to access 500 nodes. | | CO1 | U | 1 |
| 2. | Name the layer which supports dialog control | | CO1 | R | 1 |
| 3. | Determine the redundant bits for the following data using VRC method  101010 | | CO2 | A | 1 |
| 4. | Write the data rate and segment length of 10 BASE 2 thin Ethernet. | | CO2 | A | 1 |
| 5. | Choose the maximum number of slaves in Piconet of Bluetooth technology. | | CO3 | A | 1 |
| 6. | Identify the channel accessing method used in Ethernet. | | CO3 | R | 1 |
| 7. | Name the network layer protocol used in unicast routing. | | CO4 | R | 1 |
| 8. | Write the header size of IpV6 protocol. | | CO4 | U | 1 |
| 9. | Name the connectionless protocol used in transport layer. | | CO5 | R | 1 |
| 10. | Give an example of protocol used in Electronic Mail. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the components of data communication. | | CO1 | R | 3 |
| 12. | Determine the check sum for the following data bits.  0010 0100 0001 1000 | | CO2 | A | 3 |
| 13. | Explain any one congestion avoidance method. | | CO3 | U | 3 |
| 14. | Deduce the class, NET ID and network address of the given IP address  126.23.45.63 | | CO4 | An | 3 |
| 15. | Explain the types of traffic profile used in computer networks. | | CO5 | A | 3 |
| 16. | List the types of Generic domain Systems. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Discuss the categories of networks. | CO1 | U | 4 |
|  | b. | Sketch the structure of OSI model and explain the responsibility of network support layers. | CO1 | U | 8 |
|  |  |  |  |  |  |
| 18. | a. | Explain stop and wait protocol. | CO2 | A | 4 |
|  | b. | Examine the principle of Cyclic Redundant check (CRC) for the following data bits  Dividend (Data bits ) = 100100  Divisor =1101 | CO2 | An | 8 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the types of packet switching in detail. | CO3 | A | 8 |
|  | b. | Discuss the features of Bluetooth technology. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 20. | a. | Estimate the initial routing table for all the routers, Router updating process and final routing table of the router B using Distance Vector algorithm. | CO4 | E | 8 |
|  | b. | Discuss the functions of Mobile IP with relevant diagram. | CO4 | U | 4 |
|  |  |  |  |  |  |
| 21. | a. | Categorize the types of closed loop congestion control mechanisms in detail. | CO5 | An | 8 |
|  | b. | Explain the features of User Datagram Protocol (UDP). | CO5 | U | 4 |
|  |  |  |  |  |  |
| 22. | a. | Discuss the principle of Go back N ARQ error control method. | CO2 | U | 6 |
|  | b. | Illustrate the state transition diagram of TCP. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Categorize the types of transmission medium in detail. | CO1 | An | 7 |
|  | b. | Explain the features of Ethernet. | CO3 | U | 5 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Discuss the types of cryptography. | CO6 | U | 6 |
|  | b. | Describe the protocols used in electronic mail. | CO6 | R | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Examine the Fundamentals of Data Communications, Network Types, and OSI Model. |
| **CO2** | Assess Data Transmission, Error Control, and Flow Management in Data Communications. |
| **CO3** | Evaluate the performance of Media Access Control and Network Layer Services in Communication Systems. |
| **CO4** | Develop networking skills related to Network Layer Protocols, Routing Mechanisms, and IPv6 Transition. |
| **CO5** | Interpret the Mechanisms of Transport Layer Protocols for Reliable Communication. |
| **CO6** | Apply Network Security Concepts in Application Layer Protocols. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2025** | **Duration** | **3hrs** |
| **Course Title** | **NEURAL NETWORKS AND DEEP LEARNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify the most suitable loss function for multiclass classification. | | CO1 | U | 1 |
| 2. | Write the activation function at the output layer of a neural network for classifying images into 10 categories. | | CO1 | A | 1 |
| 3. | List two advantages of the Radial Basis Function (RBF) Neural Network. | | CO2 | R | 1 |
| 4. | Identify the learning method that is commonly used to train the weights of an RBF network. | | CO2 | U | 1 |
| 5. | List two drawbacks of the Hopfield Neural Network. | | CO3 | R | 1 |
| 6. | Identify the learning algorithm that is commonly used to train Restricted Boltzmann Machines (RBM). | | CO3 | U | 1 |
| 7. | Indicate the primary purpose of a Gated Recurrent Unit (GRU). | | CO4 | U | 1 |
| 8. | Name one practical application of Recurrent Neural networks (RNN). | | CO4 | R | 1 |
| 9. | A max-pooling layer with a 2×2 filter and a stride of 2 is applied to a 16×16 feature map. Calculate the output size. | | CO5 | A | 1 |
| 10. | Indicate the selection strategy that is commonly used in Monte Carlo Tree Search (MCTS). | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the total number of parameters in a fully connected network with 3 input neurons, 4 hidden neurons, and 2 output neurons. | | CO1 | A | 3 |
| 12. | Write the applications of multi-quadric RBF Neural Network | | CO2 | A | 3 |
| 13. | A discrete Hopfield Neural Network is trained with the pattern X = [-1,1,1]. Compute the weight matrix W of the network. | | CO3 | A | 3 |
| 14. | Compare Gated Recurrent units (GRU) and Long short-term memory (LSTM) in terms of architecture and computational efficiency. | | CO4 | U | 3 |
| 15. | Calculate the output size of a 64×64 image when passed through a convolutional layer with a 5×5 filter, stride 1, and padding 2. | | CO5 | A | 3 |
| 16. | Compare policy-based and value-based reinforcement learning approaches. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain a Multi-Layer Perceptron (MLP) with Backpropagation to predict house prices based on features such as square footage and the number of bedrooms. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Illustrate an RBF Neural Network architecture for a binary classification problem that predicts whether an email is spam or not based on extracted features. | CO2 | An | 12 |
|  |  |  |  |  |  |
| 19. |  | Evaluate a Hopfield Neural Network that stores the following pattern [1,-1,1]. Test whether the network can retrieve the stored pattern when a noisy input [0 0 1] is given. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Apply the Long short-term memory (LSTM) model to develop a predictive system for sequential data analysis and explain the role of each gate in handling long-term dependencies effectively. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Apply the Convolutional Neural Network (CNN) model for the image classification system and explain the role of convolution, pooling, and fully connected layers in feature extraction and classification. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Illustrate the autoencoder model for data dimensionality reduction and reconstruction and explain the role of the encoder and decoder in capturing essential features and reconstructing the input data. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Use Restricted Boltzmann Machines (RBM) for pattern recognition and explain the role of visible and hidden layers in learning meaningful representations of data. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine deep reinforcement learning to optimize decision-making in a dynamic environment and justify the role of policy networks, value functions, and reward mechanisms in learning optimal strategies. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Design neural network architectures and gradient-descent strategies to implement and optimize binary and multiclass models. |
| **CO2** | Evaluate Radial Basis Function Networks for solving nonlinear problems. |
| **CO3** | Apply Restricted Boltzmann Machines and their stacking techniques to solve complex problems in pattern recognition. |
| **CO4** | Design Recurrent Neural Network architecture to implement effective solutions for sequential data processing applications. |
| **CO5** | Evaluate convolutional neural network architectures to implement innovative solutions for real-world applications involving image data. |
| **CO6** | Develop deep reinforcement learning models to implement intelligent systems |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

|  |  |  |  |
| --- | --- | --- | --- |
| **Course Code** | **21EC2029** | **Duration** | **3hrs** |
| **Course Title** | **HIGH PERFORMANCE COMPUTING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Describe the deadlock problem in supercomputing. | | CO1 | R | 1 |
| 2. | Write the four key components of the anatomy of a supercomputer. | | CO1 | A | 1 |
| 3. | Discuss the key features of SIMD architecture. | | CO2 | U | 1 |
| 4. | List the limitations of parallel computer. | | CO2 | R | 1 |
| 5. | List the advantages of distributed memory computers. | | CO3 | U | 1 |
| 6. | Define bisection bandwidth. | | CO3 | R | 1 |
| 7. | Give two examples of functional parallelism. | | CO4 | R | 1 |
| 8. | Write two methods for designing algorithms in parallel computers. | | CO4 | A | 1 |
| 9. | Interpret the work stealing mechanism in parallel aglorithms. | | CO5 | A | 1 |
| 10. | Infer the challenges associated with big data. | | CO6 | An | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Infer the parallel shutdown problem in supercomputing. | | CO1 | An | 3 |
| 12. | Differentiate between coarse-grained and fine-grained parallelism. | | CO2 | An | 3 |
| 13. | Sketch the different hypercube networks in parallel computing. | | CO3 | A | 3 |
| 14. | Differentiate between processes and threads. | | CO4 | An | 3 |
| 15. | Interpret the advantages and disadvantages of micro-kernel structure. | | CO5 | A | 3 |
| 16. | Write a short note on data munging. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the concept of Von-Neumann Computing with its key components and challenges. | CO1 | A | 6 |
|  | b. | Infer some supercomputing problems and relate them to the performance of the supercomputer. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the broad classification of parallel architecture with a neat sketch. | CO2 | A | 6 |
|  | b. | Differentiate between symmetric and asymmetric multiprocessing. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Analyze the architecture of various topologies in parallel computing with an example. | CO3 | An | 6 |
|  | b. | Write the applications of parallel computing algorithms. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Illustrate the load imbalance in a parallel computer with a neat sketch. | CO4 | A | 6 |
|  | b. | Analyze the RAM model along with its significant features. | CO4 | An | 6 |
|  |  |  |  |  |  |
| 21. |  | Examine the impact of the data parallelism in medium grained and coarse-grained parallelism with an example. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate the Fork – Join algorithm for parallel computer with a relevant case study. | CO5 | An | 6 |
|  | b. | Explain operating system services in parallel computing technologies with an example. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Examine the big data analytics on health care applications with an example. | CO5 | A | 6 |
|  | b. | Explain the Texas Advanced Computing Centre based high performance computing. | CO6 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Summarize the process of the big data life cycle in high performance computing with relevant use cases. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Examine the architecture of computing technology and illustrate its key components and functionality. |
| **CO2** | Distinguish between various parallel HPC architecture families and compare their design principles and use cases. |
| **CO3** | Demonstrate the architectural features of parallel computers and apply them to solve computational challenges. |
| **CO4** | Evaluate the performance of HPC applications and justify their suitability for specific use cases. |
| **CO5** | Organize insights on emerging trends in computing technology and estimate their potential impacts on future developments. |
| **CO6** | Interpret the role of HPC in big data processing and relate it to advancements in high-performance computing. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2031** | **Duration** | **3hrs** |
| **Course Title** | **SEMANTIC MODELING AND ITS APPLICATIONS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Indicate the web component that create and structure the content on the web page. | | CO1 | U | 1 |
| 2. | Estimate the in-degree of node E in the given sociogram. | | CO1 | E | 1 |
| 3. | Write the ontology language that is domain independent and can be used to model real world objects and information resources. | | CO2 | A | 1 |
| 4. | Indicate the primitive of Resource Description Framework (RDF) that are strings with optional language and datatype identifiers. | | CO2 | U | 1 |
| 5. | Identify the ontology that defines concepts and their relationships without complex logic or constraints. | | CO3 | R | 1 |
| 6. | Write an example of centralized social networks. | | CO3 | A | 1 |
| 7. | Identify the supervised learning algorithm used for spam email detection. | | CO4 | U | 1 |
| 8. | Indicate the unsupervised learning algorithm commonly used for market basket analysis. | | CO4 | U | 1 |
| 9. | Name the term in semantic modeling that refers to the problem of determining whether two elements have the same meaning. | | CO5 | R | 1 |
| 10. | Indicate the type of feedback from model users that is noise free and trustworthy. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the current web and infer any three limitations. | | CO1 | An | 3 |
| 12. | List the three variants of Web Ontology Language (OWL). | | CO2 | R | 3 |
| 13. | Justify the need for ontology language for semantic web and write its characteristics. | | CO3 | E | 3 |
| 14. | Differentiate between Supervised Learning and Unsupervised Learning. | | CO4 | An | 3 |
| 15. | State the reasons for a bad model specification in semantic modelling. | | CO5 | R | 3 |
| 16. | Indicate the use of lexicalizations terms and state the reasons for its necessity in semantic model. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Sketch the Graph G for the given nodes and edges of a social network.  E= {(A,E), (A,B), (B,A), (B,D), (C,F), (D,C), (F,B), (F,C), (F,D)}. Determine the outdegree of A, order of the graph, and size of the graph. | CO1 | A | 9 |
|  | b. | Differentiate between Web 1.0, Web 2.0 and Web 3.0. | CO1 | An | 3 |
| 18. |  | Determine the betweenness centrality and closeness centrality for the given facebook sociogram. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. | a. | Explain in detail the ontology language that employs “triple” data to model both real world objects and information resources with suitable examples. | CO2 | A | 8 |
|  | b. | Write any four data aggregation techniques for social network data. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 20. |  | Sketch the Descriptions and Situations ontology design pattern for modelling non-physical objects and explain with a model of social relationship. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Explain the steps involved in the generation of association rule using Eclat algorithm with a suitable example. | CO4 | An | 10 |
|  | b. | Compare Apriori algorithm with Eclat Algorithm. | CO4 | An | 2 |
|  |  |  |  |  |  |
| 22. | a. | Estimate the frequency itemsets using Apriori Algorithm for the given facebook user engagement data with minimum support of 30%.   |  |  | | --- | --- | | **TID** | **Engagement Actions** | | 1 | Like, Comment, Share | | 2 | Like, Comment | | 3 | Comment, Share | | 4 | Like, Share, Save Post | | 5 | Like, Comment, Save Post | | 6 | Comment, Tag Friend | | 7 | Like, Share | | CO4 | An | 10 |
|  | b. | Infer the significance of the Markov model in stock price prediction. | CO4 | U | 2 |
|  |  |  |  |  |  |
| 23. |  | Explain the metrics used for measuring the quality of a semantic model and discuss their impact with suitable example. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Illustrate the expressiveness and content dilemmas in semantic model with suitable example. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate the need for semantic Web and analyze properties of social networks using key measures in network analysis. |
| **CO2** | Develop a model to aggregate the social network data using ontology languages. |
| **CO3** | Apply ontology-based Knowledge Representation for modelling social individuals and social relationships. |
| **CO4** | Implement machine learning models for social network analysis. |
| **CO5** | Examine the pitfalls in social network analysis. |
| **CO6** | Illustrate the dilemmas and their influence in designing semantic models. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2032** | **Duration** | **3hrs** |
| **Course Title** | **COMPUTER VISION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List any two non-linear smoothing filters. | | CO1 | R | 1 |
| 2. | **Identify** the basic morphological operations in binary image processing. | | CO1 | R | 1 |
| 3. | Recall the formula to find the D8 distance between pixels | | CO2 | R | 1 |
| 4. | **Define** the skeletonization process in image morphology | | CO2 | R | 1 |
| 5. | **Summarize** the significance of shape numbers in object recognition | | CO3 | U | 1 |
| 6. | **Define** the area of a region in digital image analysis. | | CO3 | R | 1 |
| 7. | State the advantages of RANSAC for straight line detection. | | CO4 | U | 1 |
| 8. | **Describe** the applications of the Hough Transform in shape detection. | | CO4 | U | 1 |
| 9. | **Recall** the formula used to calculate **focal length** in camera geometry. | | CO5 | R | 1 |
| 10. | **Define** Stereopsis in the context of 3D vision. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Enumerate the importance of image segmentation. | | CO1 | An | 3 |
| 12. | **Distinguish** between regional and boundary descriptors. | | CO2 | U | 3 |
| 13. | Illustrate the skeletonizing operation in image processing. | | CO3 | An | 3 |
| 14. | Compare global and local thresholding. | | CO4 | U | 3 |
| 15. | Explain 3D translation process. | | CO5 | An | 3 |
| 16. | Discuss the pedestrian location process in In-vehicle vision system. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Apply the fundamental steps of image processing to a sample image and describe the result at each stage. | CO1 | A | 6 |
|  | b. | Apply Dilation operation morphological operation on the given binary image using the specified structuring element and interpret the resulting output.  .  And the structuring element is as follows. | CO2 | A | 6 |
| 18. | a. | Analyze the directional transitions along the object’s boundary starting from the upper left pixel, and construct the corresponding chain code in a clockwise direction. | CO3 | An | 6 |
|  | b. | Apply the Sobel edge detection algorithm to a sample image and interpret the resulting edge map. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Apply D4, D8, and Dm distance formulas to compute the spatial distance between pixels P and Q for the given image, and analyze the effect of connectivity set V = {1, 2} on the result. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Apply Hough Transform and examine whether the points (1,2), (2,3) and  C (3, 4) are collinear. Also find the equation of the line on which these points lie. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Analyze and compare different projection schemes in 3D vision, highlighting their impact on image formation. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Apply the RANSAC algorithm to detect a straight line in a given noisy 2D point set. Illustrate the key steps with intermediate outputs. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Analyze the boundary, region-based, and Fourier descriptors and evaluate their suitability for shape representation. | CO5 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Evaluate various pedestrian detection methods in lane detection systems and justify the most effective approach. | CO6 | E | 6 |
|  | b. | Apply background subtraction techniques for surveillance footage and analyze challenges in foreground extraction. | CO6 | A | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| CO1 | Implement fundamental image processing techniques required for computer vision. |
| CO2 | Perform shape analysis and to Implement boundary tracking techniques. |
| CO3 | Apply chain codes and other region descriptors. |
| CO4 | Apply Hough Transform for line, circle, and ellipse detections. |
| CO5 | Apply 3D vision techniques and Implement motion related techniques. |
| CO6 | Develop applications using computer vision techniques. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2033** | **Duration** | **3hrs** |
| **Course Title** | **EMBEDDED SYSTEM DESIGN** | **Max. Marks** | **100** |

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| --- | --- | --- | --- | --- | --- |
| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the characteristics of an embedded system. | | CO1 | R | 1 |
| 2. | Compare embedded systems with general computing systems. | | CO1 | An | 1 |
| 3. | Sketch the organization of memory in an embedded system. | | CO2 | A | 1 |
| 4. | Define cache memory. | | CO2 | R | 1 |
| 5. | List the advantages of PCI-X bus. | | CO3 | R | 1 |
| 6. | Define system software. | | CO3 | R | 1 |
| 7. | List the applications of watchdog timer. | | CO4 | R | 1 |
| 8. | Define multi-threading. | | CO5 | R | 1 |
| 9. | Describe deadlock condition in task scheduling. | | CO5 | R | 1 |
| 10. | Infer the importance of stepper motor in real time applications. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare an embedded processor with a microcontroller. | | CO1 | An | 3 |
| 12. | Discover the function of chip select signal in a memory. | | CO2 | A | 3 |
| 13. | Compare Assembly language with High level language based program development for embedded systems. | | CO3 | An | 3 |
| 14. | Explain the function of device drivers. | | CO4 | A | 3 |
| 15. | Indicate the advantages of using an RTOS in real time embedded systems. | | CO5 | U | 3 |
| 16. | Summarize the importance of product development in MVP. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate an embedded application with the design steps involved in the embedded system design process in top–down approach with an example. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Infer the importance of cache memory in embedded systems and explain cache coherency. | CO2 | An | 6 |
|  | b. | Classify the different types of memory based on their size, access time, speed and usage. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Interpret the different “C” program elements used in embedded software design with examples. | CO3 | A | 6 |
|  | b. | Explain the software/firmware development tool kit used in host and target machines. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. | a. | Interpret the significance of device drivers and explain parallel port device driver with necessary diagrams. | CO4 | A | 8 |
|  | b. | Explain the function of ISR. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Interpret the significance of Zephyr –RTOS in automobiles (ADAS systems) and its key features. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. | a. | Infer the significance of co-processors in embedded design. | CO2 | An | 6 |
|  | b. | Interpret the operation and application of the CAN bus in embedded systems. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. | a. | Explain the importance of linker & locator in a software development process. | CO3 | U | 8 |
|  | b. | Explain the concept of process & threads in RTOS. | CO5 | A | 4 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop an automatic cruise control system in a car, which maintains the speed of the car set by the driver. Illustrate the design with necessary diagrams and algorithm. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply the principles of embedded system architecture to design efficient solutions for embedded and SoC applications. |
| **CO2** | Evaluate different types of memory systems to optimize the selection for embedded applications. |
| **CO3** | Develop embedded software using advanced programming techniques to meet out the system specifications. |
| **CO4** | Design device drivers tailored for specific system requirements. |
| **CO5** | Demonstrate the integration and customization of Real-Time Operating Systems (RTOS) for embedded firmware. |
| **CO6** | Design a closed-loop embedded system for specific real time engineering applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **21EC2034** | **Duration** | **3hrs** |
| **Course Title** | **CYBER PHYSICAL SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Give examples of CPS in everyday life. | | CO1 | U | 1 |
| 2. | List two differences between CPS and IoT. | | CO1 | R | 1 |
| 3. | Describe the meaning of reactivity in CPS modeling. | | CO2 | U | 1 |
| 4. | Trace an actor model of continuous dynamics in CPS. | | CO2 | U | 1 |
| 5. | List two types of multitasking. | | CO3 | R | 1 |
| 6. | State the end-to-end system design refers to in CPS. | | CO3 | R | 1 |
| 7. | List the key types of scheduling based on decisions. | | CO4 | R | 1 |
| 8. | Name the scheduling algorithm that prioritizes shorter periods in tasks. | | CO4 | R | 1 |
| 9. | Illustrate the types of coupling mechanisms. | | CO5 | U | 1 |
| 10. | AES stands for \_\_\_\_\_\_\_in cryptography. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the role of an actuator in a cyber-physical system with an example. | | CO1 | U | 3 |
| 12. | Differentiate between asymptotic stable and unstable in Lyapunov analysis using a diagram. | | CO2 | U | 3 |
| 13. | Classify the different levels of the memory hierarchy. | | CO3 | U | 3 |
| 14. | Sketch the task execution times in scheduling. | | CO4 | A | 3 |
| 15. | Explain the mitigation techniques used for reducing electromagnetic susceptibility. | | CO5 | A | 3 |
| 16. | Describe the role of DES in securing CPS communications. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain a smart home CPS architecture specifying its sensing, actuation, data flow, and connectivity with illustration. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Compare continuous dynamics with discrete dynamics using an example with a neat illustration of the actor model. | CO2 | An | 6 |
|  | b. | Explain the various types of properties used in continuous dynamics to ensure stability. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Analyze a multitasking system for a smart traffic control application using scheduled and managed tasks. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Compare the different types of Lyapunov stability in CPS with the neat diagram to evaluate the importance of the Lyapunov function in ensuring stability. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. | a. | Compare the major regulatory standards FCC, and CISPR landscape for EMI/ EMC in CPS. | CO5 | An | 6 |
|  | b. | Explain the implications and challenges of meeting military EMI standards in military systems. | CO5 | A | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the role of CPS in healthcare for Medical CPS applications. | CO1 | A | 6 |
|  | b. | Explain the significance of data analysis and security within a Medical CPS with an example. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 23. |  | Illustrate a hybrid model for a CPS in agriculture, detailing how continuous and discrete dynamics interact in irrigation and pest control processes. | CO2 | An | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Create a security framework for industrial applications that incorporates Kerckhoff’s Principle, public key cryptography, and digital signatures to ensure system performance. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Demonstrate a comprehensive understanding of the principles, architecture, and interactions between cyber and physical components in CPS environments. |
| **CO2** | Develop models of cyber-physical systems using mathematical techniques, software tools, and simulate their dynamic behavior for analysis and optimization. |
| **CO3** | Design real-time embedded systems to control physical processes by applying control theory and signal processing concepts. |
| **CO4** | Evaluate communication protocols between computational systems and physical processes in CPS. |
| **CO5** | Assess vulnerabilities, and security risks and apply relevant security strategies to protect cyber-physical systems from cyber-attacks and physical tampering. |
| **CO6** | Integrate CPS solutions into real-world applications such as smart grids, autonomous vehicles, healthcare, and industrial automation, considering constraints like energy efficiency, real-time operation, and scalability. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22EC1004** | **Duration** | **3hrs** |
| **Course Title** | **FUNDAMENTALS OF ELECTRICAL AND ELECTRONICS ENGINEERING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Compute the charge passing through the circuit if a current of 5A flows for 2 minutes. | | CO1 | A | 1 |
| 2. | Interpret the energy conversion in a wind turbine. | | CO1 | U | 1 |
| 3. | Identify the type of motor used in washing machines. | | CO2 | R | 1 |
| 4. | State the advantage of AC motors over DC motors. | | CO2 | R | 1 |
| 5. | Name the semiconductor material used in infrared LEDs. | | CO3 | R | 1 |
| 6. | Identify the working principle behind capacitors. | | CO3 | U | 1 |
| 7. | Interpret a logic device that can store multiple bits of information. | | CO4 | U | 1 |
| 8. | Identify a secondary memory device. | | CO4 | R | 1 |
| 9. | Define active sensors. | | CO5 | R | 1 |
| 10. | Show the structure of a cell in 5G mobile communication. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the power consumed by a 100W refrigerator running for 24 hours in 30 days. | | CO1 | A | 3 |
| 12. | Discuss the working of a transformer with illustration. | | CO2 | U | 3 |
| 13. | Determine the resistance value of the following resistors:  i) Red, Red, Brown, Gold  ii) Green, Blue, Orange, Silver | | CO3 | A | 3 |
| 14. | Sketch the block diagram of a microcontroller. | | CO4 | A | 3 |
| 15. | Compare analog sensors with digital sensors. | | CO5 | An | 3 |
| 16. | Sketch the general block diagram of a communication system. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the working principle of an analog energy meter with a neat diagram and list any two disadvantages of single-phase supply. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the construction and working principle of a DC motor with illustrations and list a few applications. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. |  | Explain the different characteristics of bipolar junction transistors with relevant diagrams and list the different biasing modes of a transistor. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 20. |  | Differentiate the functioning of XOR, XNOR, AND, and OR gates using their truth tables and boolean expressions. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 21. |  | Sketch the block diagram of an industrial automation system. List the advantages of automation in industries. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the construction and working of a Zener diode with a suitable diagram. Sketch the IV characteristics of a Zener diode. | CO3 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Describe in detail with an illustration the working of a nuclear power plant. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Compare the various features of 4G and 5G technologies. Discuss the phenomenon of handoff. | CO6 | U | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Recognize the importance and judicious use of energy systems in everyday life. |
| **CO2** | Identify the types of electrical machines used for various applications. |
| **CO3** | Understand and apply the concept of electronics to design simple circuits. |
| **CO4** | Understand and relate various digital circuits. |
| **CO5** | Understand the various sensing and instrumentation applications. |
| **CO6** | Identify the various generations of wireless communication. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2002** | **Duration** | **3hrs** |
| **Course Title** | **SOCIAL MEDIA ANALYTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Explain Velocity of Data. | | CO1 | U | 1 |
| 2. | Name the four Dimensions of Analysis Taxonomy. | | CO1 | R | 1 |
| 3. | Indicate any one primary measure used to determine a node’s importance in a network. | | CO2 | U | 1 |
| 4. | List the nodes which has the degree 4 and 3 for the given undirected graph.    Fig.1 Undirected graph | | CO2 | R | 1 |
| 5. | Give an example of web spamming. | | CO3 | U | 1 |
| 6. | Name the web crawler types. | | CO3 | R | 1 |
| 7. | Define sentiment classification. | | CO4 | U | 1 |
| 8. | Identify the types of opinion spam. | | CO4 | R | 1 |
| 9. | Mention one application of social web mining. | | CO5 | U | 1 |
| 10. | State the challenges in recommendation systems. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Distinguish between Data in Motion and Data at Rest in terms of their characteristics, use cases, and challenges in social media analytics. | | CO1 | An | 3 |
| 12. | Categorize the following networks based on social balance theory.   |  |  | | --- | --- | |  |  | | Fig.2 Network A | Fig.3 Network B | | | CO2 | An | 3 |
| 13. | Analyze vector space model used in information retrieval. | | CO3 | An | 3 |
| 14. | Explain conditional sentence handling in sentiment analysis. | | CO4 | U | 3 |
| 15. | Analyze the concept of visualizing interest graphs in GitHub mining. | | CO5 | An | 3 |
| 16. | Summarize collective behaviour analytics in social media. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the role of Domain of Analysis in structuring social media data for better insights. | CO1 | An | 08 |
|  | b. | Assess a social media analytics framework for analyzing information-sharing sites and microblogging platforms. | CO1 | E | 04 |
|  |  |  |  |  |  |
| 18. | a. | Analyze the evolution of random graphs and discuss their implications on social network analysis. | CO2 | An | 08 |
|  | b. | Explain influence and homophily in social networks with practical examples. | CO2 | A | 04 |
|  |  |  |  |  |  |
| 19. |  | Illustrate how content spamming, link spamming, and hiding techniques are employed in web analytics. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Apply the concept of aspect-based sentiment analysis to a practical scenario, highlighting its applications and limitations. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the methods to compute document similarity and discuss their relevance in social web mining. | CO5 | A | 08 |
|  | b. | Analyze the methods used for clustering LinkedIn data. | CO5 | An | 04 |
|  |  |  |  |  |  |
| 22. |  | Examine the challenges and benefits of using External social media versus Internal social media for data analysis. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 23. | a. | Evaluate classical recommendation algorithms used in social media and discuss their strengths and weaknesses. | CO6 | E | 08 |
|  | b. | Compare random graph models and small world models. | CO2 | An | 04 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Develop a novel solution for sentiment classification in social media, clearly explaining your proposed method and anticipated outcomes. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Understand the concept of social media analytics and its significance |
| **CO2** | Apply web analytics to the realistic data sets |
| **CO3** | Analyze social network data to identify important social actors, subgroups and network properties in social media sites. |
| **CO4** | Illustrate solutions to the emerging problems with social media |
| **CO5** | Design new solutions to opinion extraction, sentiment classification problems |
| **CO6** | Summarize the issues in social recommendation systems |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2005** | **Duration** | **3hrs** |
| **Course Title** | **PATTERN RECOGNITION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name a dimensionality reduction technique. | | CO1 | R | 1 |
| 2. | List two qualitative features. | | CO1 | R | 1 |
| 3. | Write the assumptions in Gaussian class dependence. | | CO2 | A | 1 |
| 4. | List the evaluation metrics used to assess the performance of a Pattern Recognition (PR) system. | | CO2 | R | 1 |
| 5. | List the Discriminant functions. | | CO3 | R | 1 |
| 6. | Describe the challenges associated with unsupervised learning. | | CO3 | U | 1 |
| 7. | Write the grammar rules for constructing a parse tree in syntactic pattern recognition. | | CO4 | A | 1 |
| 8. | Define Parsing. | | CO4 | R | 1 |
| 9. | List a Content Addressable Memory(CAM) approach in Neural PR. | | CO5 | R | 1 |
| 10. | Name a machine learning algorithm used for character classification. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Construct the feature vector for the face recognition task, considering features such as eyes, ears, nose, and other facial components as part of the face. | | CO1 | A | 3 |
| 12. | Enumerate the algorithmic steps of k-Nearest Neighbors classifier. | | CO2 | R | 3 |
| 13. | Compare binary classifiers with multi class classifiers. | | CO3 | An | 3 |
| 14. | Explain the string matching in syntactic pattern recognition. | | CO4 | A | 3 |
| 15. | Sketch the structure of feed forward neural network. | | CO5 | A | 3 |
| 16. | List the applications of pattern recognition techniques. | | CO6 | R | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the structure of pattern recognition system with an example. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | A dataset contains 60% spam emails and 40% non-spam emails. The probability of the word "offer" appearing in spam is 0.8, and in non-spam is 0.2. Using Bayesian Decision Theory, calculate the posterior probability that an email is spam given that it contains the word "offer." | CO2 | A | 8 |
|  | b. | Calculate the precision, recall of the pattern recognition system given that True Positives (TP) = 45, False Positives (FP) = 4 and False Negative (FN) =15. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 19. | a. | Apply Linear Discriminant Function (LDF) to find the best linear boundary that separates the two classes and classify new data points (140,60) as either "Male" or "Female  Class 1 (Male): (175, 70), (180, 75), (170, 65)  Class 2 (Female): (160, 55), (155, 50), (165, 60) | CO3 | A | 8 |
|  | b. | Correlate K-Means clustering with the unsupervised learning paradigm. | CO3 | An | 4 |
|  |  |  |  |  |  |
| 20. | a. | Explain the graphical approaches in Syntactic pattern recognition. | CO4 | A | 6 |
|  | b. | Construct parse tree for the following sentence using bottom up and top-down parsing techniques.  “The cat eats food” | CO4 | A | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain feed forward networks and the back propagation training algorithm. | CO5 | A | 8 |
|  | b. | Compare Neural PR with Statistical PR. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 22. |  | Explain the pattern recognition approaches along with their relevant techniques and examples. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the parametric and non-parametric approaches in supervised learning along with the examples. | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Recommend a best scene classification technique using real time examples. | CO6 | E | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Examine feature extraction and dimensionality reduction techniques to preprocess data for pattern recognition tasks. |
| **CO2** | Apply statistical techniques to model and analyze patterns in multidimensional data. |
| **CO3** | Assess unsupervised learning techniques to identify underlying structures and patterns in data. |
| **CO4** | Develop syntactic pattern recognition models for applications in areas such as natural language processing and image analysis. |
| **CO5** | Examine the activation functions, loss functions, and regularization methods of neural pattern recognition models. |
| **CO6** | Apply pattern recognition techniques to solve real-world problems in domains such as healthcare, autonomous vehicles |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2006** | **Duration** | **3hrs** |
| **Course Title** | **DEEP LEARNING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Give an example of an unsupervised machine-learning algorithm. | | CO1 | U | 1 |
| 2. | Name two common optimization algorithms used in training deep networks. | | CO1 | R | 1 |
| 3. | Define deep learning. | | CO2 | R | 1 |
| 4. | List two activation functions used in deep networks. | | CO2 | R | 1 |
| 5. | Indicate the role of pooling layers in a CNN. | | CO3 | U | 1 |
| 6. | Name one advantage of using an LSTM over a standard RNN. | | CO3 | R | 1 |
| 7. | Define the term ‘latent space’ in autoencoders. | | CO4 | R | 1 |
| 8. | Indicate the key components of a Recurrent Neural Network (RNN). | | CO4 | U | 1 |
| 9. | Differentiate multi-class classification from multi-label classification. | | CO5 | U | 1 |
| 10. | Give one real-world application of deep learning in media. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare machine learning and deep learning with examples. | | CO1 | An | 3 |
| 12. | Paraphrase the importance of weight initialization in deep networks. | | CO2 | U | 3 |
| 13. | Differentiate between AlexNet and ResNet architectures. | | CO3 | An | 3 |
| 14. | Discuss how dropout helps preventing overfitting in deep networks. | | CO4 | U | 3 |
| 15. | Describe the steps involved in building deep networks. | | CO5 | U | 3 |
| 16. | Summarize the applications of deep learning in medical image analysis. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Develop a machine learning model for classifying handwritten digits highlighting its merits and demerits. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. | a. | Evaluate the role of activation functions in deep learning. Compare ReLU, Sigmoid, and Tanh. | CO2 | E | 6 |
|  | b. | Explain the AlexNet architecture and write the real-time applications of AlexNet. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the architecture and the training process of convolutional neural networks for object detection with neat diagrams and mathematical equations. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Discuss the generation of new data using GANs. Discuss its advantages and limitations. | CO4 | U | 6 |
|  | b. | Explain the architecture and applications of long short-term memory (LSTM) networks. | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Summarize the challenges in training deep networks and strategies to overcome them. | CO5 | U | 6 |
|  | b. | Discuss the different categories of hyperparameters used in training a deep learning network. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | Explain the potential applications of deep learning in the field of information retrieval, including search engines and recommendation systems. | CO6 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Examine the architectural components of deep neural networks. How do layers and loss functions contribute to model performance? | CO2 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Predict the use of deep learning for sentiment analysis, including a detailed case study. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Examine the machine learning and deep learning algorithms |
| **CO2** | Assess the architecture and components of deep networks, including layers, neurons, activation functions and loss functions. |
| **CO3** | Evaluate the convolutional neural network architectures including AlexNet and ResNet. |
| **CO4** | Apply deep learning architectures to solve real-time problems. |
| **CO5** | Examine the concepts in tuning deep networks to enhance model accuracy. |
| **CO6** | Assess the deep learning applications in the field of healthcare and media. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2007** | **Duration** | **3hrs** |
| **Course Title** | **NATURAL LANGUAGE PROCESSING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the importance of automata in NLP. | | CO1 | U | 1 |
| 2. | Discuss the concept of tokenization in NLP. | | CO1 | U | 1 |
| 3. | Define the International Phonetic Alphabet (IPA). | | CO2 | R | 1 |
| 4. | Name the two main parts of the vocal tract. | | CO2 | R | 1 |
| 5. | Determine the POS tag for the given corpus.  ‘I like to read books’ | | CO3 | A | 1 |
| 6. | Discover the number of morphemes in the word ‘unladylike’. | | CO3 | An | 1 |
| 7. | Describe how hyponymy and hypernymy are related to each other. | | CO4 | U | 1 |
| 8. | Differentiate between syntax and semantics in NLP. | | CO4 | An | 1 |
| 9. | State the purpose of the Penn Treebank in NLP. | | CO5 | R | 1 |
| 10. | Define Natural Language Understanding (NLU) in a dialogue system. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Justify why low-resource languages present a significant challenge in NLP development. | | CO1 | E | 3 |
| 12. | Sketch the architecture of the vocal organs, label the parts, and mention their functions. | | CO2 | A | 3 |
| 13. | Differentiate between regular and non-regular languages with suitable examples. | | CO3 | An | 3 |
| 14. | Explain how the meaning of the word 'coal' can vary in different contexts and how context helps in identifying the intended sense in the sentence.  “On burning coal we get ash” | | CO4 | U | 3 |
| 15. | Describe how Brill’s Tagger differs from statistical POS taggers. | | CO5 | U | 3 |
| 16. | Analyze the impact of Named Entity Recognition on Information Extraction tasks. | | CO6 | An | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Discuss and analyze the outputs of the following Regular Expressions by applying them to different input strings, explaining how they match patterns and their significance in text processing.   1. /[abcde]\* ii. /([A-Z])\*/g 2. /colou?r/g iv. /o+h/g 3. /baa+/g vi. /([A-Z])+/g | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the classification of speech sounds in articulatory phonetics, detailing how they are categorized based on their place and manner of articulation, and provide relevant examples. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 19. | a. | Describe the concept of feature unification in Natural Language Processing (NLP) and provide a suitable example to illustrate its application. | CO3 | U | 6 |
|  | b. | Explain the method for converting a context-free grammar (CFG) into a parse tree and illustrate the process with an example. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. |  | Evaluate the strengths and limitations of the Lesk and Walker algorithms in performing Word Sense Disambiguation. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. | a. | Compare PropBank and FrameNet in terms of their role in semantic role labeling and highlight their differences in structure and usage. | CO5 | An | 6 |
|  | b. | Analyze how FrameNet contributes to capturing event structures in NLP applications and evaluate its impact on sentence understanding. | CO5 | An | 6 |
|  |  |  |  |  |  |
| 22. | a. | Explain the concept of the N-Best list in multipass decoding and illustrate its role in Speech Recognition with a block diagram. | CO1 | A | 8 |
|  | b. | Differentiate between top-down and bottom-up parsing. | CO2 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Discuss the formal structure of Probabilistic Context-Free Grammar (PCFG) and explain how it differs from a standard Context-Free Grammar (CFG). | CO3 | An | 6 |
|  | b. | Illustrate how Lexical Semantics is represented using a Parse Tree, with an appropriate example. | CO4 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Describe the three stages of a generic Question Answering (QA) system and explain how they interact to produce accurate answers. | CO6 | A | 6 |
|  | b. | Discuss the major challenges in designing an effective QA system, including ambiguity handling and response generation. | CO6 | An | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate regular expressions, automata, and transducers for text processing. |
| **CO2** | Examine phonetics, synthesis, and recognition for advanced speech processing. |
| **CO3** | Assess grammars, parsing, and complexity for syntactic analysis. |
| **CO4** | Examine meaning, lexical semantics, and discourse for computational language understanding. |
| **CO5** | Critique discourse analysis and coreference using lexical resources like WordNet and FrameNet. |
| **CO6** | Assess applications in extraction, answering, summarization, and translation for advanced NLP |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2008** | **Duration** | **3hrs** |
| **Course Title** | **INTRODUCTION TO HUMAN COMPUTER INTERACTION** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define visual angle and explain its role in interpreting visual signals. | | CO1 | R | 1 |
| 2. | State Fitts Law and its significance. | | CO1 | R | 1 |
| 3. | Define null hypothesis. | | CO2 | U | 1 |
| 4. | Describe the 'Express Dynamics Scenario' used in the design process. | | CO2 | U | 1 |
| 5. | Discuss the free rider problem with an application. | | CO3 | U | 1 |
| 6. | Define the term GOMS. | | CO3 | U | 1 |
| 7. | Write the importance of affective science with a real-time application. | | CO4 | U | 1 |
| 8. | Explain the usability of text-based sentiment analysis. | | CO4 | U | 1 |
| 9. | Illustrate the movement of a ball from left to right in an animation. If the animation takes 4 seconds to complete and the ball moves 400 pixels, what is its speed in pixels per second? | | CO5 | U | 1 |
| 10. | Discuss Hover effect with an example. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Discuss the core characteristics of interaction design. | | CO1 | U | 3 |
| 12. | Explain the universal design principles with application-based examples. | | CO2 | U | 3 |
| 13. | Sketch and explain the critical mass diagram used to evaluate the benefits of an organizational structure. | | CO3 | A | 3 |
| 14. | Illustrate an emotion recognition technique with an example in affective computing. | | CO4 | U | 3 |
| 15. | Illustrate Sensory Substitution Devices (SSDs) and their application in prosthetic limbs with haptic feedback, which provides users with a sense of touch and movement. | | CO5 | A | 3 |
| 16. | Discuss gestures used in mobile interaction, focusing on touch-based interactions. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Illustrate the memory structure and its function types using a model diagram and analyze human behavior in real-world tasks of problem solving and user interaction. | CO1 | A | 8 |
|  | b. | Illustrate the flow diagram of the Norman model within interactive design and apply it to improve user experience in a real-world practical application. | CO1 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Design a process flow diagram of interactive interface for a specific application, such as a mobile app, ensuring usability and user-centered interaction. | CO2 | C | 6 |
|  | b. | Illustrate the various types of technical design evaluation methods with application-based examples in system functionality processes. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Illustrate the various types of cognitive models and their techniques with expert systems in medical diagnosis. | CO3 | A | 6 |
|  | b. | Apply the CUSTOM six-stage socio-technical modeling process to address stakeholder concerns in a real-world scenario. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Illustrate detection methods in affective induction for recognizing various emotions in affective states, along with the Facial Expression Recognition (FER) algorithm used in affective detection and its various parameters. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. | a. | Illustrate the concept of Neuro prosthetics and describe its types that interface with the nervous system to restore movement, vision and sensory functions. | CO5 | A | 8 |
|  | b. | Explain the concept of Neuroplasticity in the human brain and its application in stroke rehabilitation, cognitive therapy and skill development to improve learning. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 22. |  | Develop a structured training module to educate employees on proper posture and workspace ergonomics for computer users and conduct an ergonomic assessment to determine if a typical office setup aligns with established guidelines. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. | a. | Illustrate the flow diagram of the waterfall model in interface design and apply it to develop a user-friendly hospital management system within the software life cycle. | CO2 | A | 6 |
|  | b. | Explain the design rules applied in evaluation techniques with their application in user interface (UI) and user experience (UX) design. | CO2 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Design an interaction concept in Mobile HCI for a wearable device, focusing on its application in real-time health tracking and user feedback in fitness bands. | CO6 | C | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Comment on the fundamental components of an interactive system. |
| **CO2** | Assess the design process of a usable interactive system within a software engineering framework. |
| **CO3** | Examine models of cognitive, collaboration and group interaction. |
| **CO4** | Implement groupware systems and examine the role of the world wide web in popularizing hypertext. |
| **CO5** | Appraise the essentials of Mobile HCI. |
| **CO6** | Execute web interface design. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **22EC2015** | **Duration** | **3hrs** |
| **Course Title** | **COMMUNICATION THEORY AND SYSTEMS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State any two benefits of wireless communication. | | CO1 | R | 1 |
| 2. | Identify the transmission mode wherein the device can act as sender and receiver. | | CO1 | U | 1 |
| 3. | Determine the lower side band frequency, if fm=500Hz and fc = 100 KHz. | | CO2 | A | 1 |
| 4. | Relate (Pbsb) sidebands power to total power (Ptotal), during 100% modulation. | | CO2 | A | 1 |
| 5. | Write the equation of FM wave. | | CO3 | A | 1 |
| 6. | Illustrate indirect generation of PM. | | CO3 | U | 1 |
| 7. | State the significance of ISB transmitter. | | CO4 | R | 1 |
| 8. | Indicate the oscillator frequency fo, if fs is 545 KHz and IF is 455 KHz. | | CO4 | U | 1 |
| 9. | Sketch the combined response of pre-emphasis and de-emphasis. | | CO5 | A | 1 |
| 10. | Define Noise figure. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Explain the need of modulation. | | CO1 | U | 3 |
| 12. | Calculate the modulation index value of an AM wave with maximum amplitude 10V and minimum amplitude 2V. | | CO2 | A | 3 |
| 13. | Compare the performance of NBFM with WBFM. | | CO3 | An | 3 |
| 14. | Analyze the characteristics of a receiver. | | CO4 | An | 3 |
| 15. | Explain the role of AFC in stable and accurate FM reception. | | CO5 | A | 3 |
| 16. | Describe Noise temperature. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Explain the functions of Communication system with a suitable block diagram. | CO1 | U | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the generation of DSBSC signal using Balanced modulator with proper diagram and relevant equations. | CO2 | A | 6 |
|  | b. | Explain the demodulation of AM signal using synchronous detector with proper diagram and relevant equations. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 19. | a. | Compare the performance of AM with FM. | CO3 | An | 6 |
|  | b. | Explain the demodulation of FM signal using Balanced slope detector with a suitable diagram. | CO3 | A | 6 |
|  |  |  |  |  |  |
| 20. |  | Explain the achievement of improved stability by a super heterodyne receiver compared to a TRF receiver with a neat block diagram. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | With necessary diagram, explain the role of crystal oscillator in frequency stability of FM transmitter. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Explain the importance of suppressed carrier systems with necessary diagrams and equations. | CO2 | U | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the indirect generation of FM signal using Armstrong modulator and illustrate the role of multipliers and mixers. | CO3 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Deduce the output signal to noise ratio of a SSBSC system. | CO6 | An | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Apply suitable modulation and transmission mode in communication applications. |
| **CO2** | Estimate the power and bandwidth requirements of AM, DSBSC, SSBSC and VSB systems. |
| **CO3** | Choose direct or indirect FM generation for communication. |
| **CO4** | Construct AM transmitter and receiver for communication. |
| **CO5** | Evaluate the performance of FM transmitter and receiver. |
| **CO6** | Calculate the output signal to noise ratio of DSBSC and SSBSC systems. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2020** | **Duration** | **3hrs** |
| **Course Title** | **FPGA BASED SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List three major components of Xilinx FPGA architecture. | | CO1 | R | 1 |
| 2. | Indicate the implementation steps in FPGA design flow. | | CO1 | U | 1 |
| 3. | List two data types used in Verilog HDL. | | CO2 | R | 1 |
| 4. | Determine the output for F = a >> 3 in Verilog HDL if a = 4’b1011. | | CO2 | A | 1 |
| 5. | Define latency in FPGA design. | | CO3 | R | 1 |
| 6. | Define Fall time. | | CO3 | R | 1 |
| 7. | Illustrate one advantage of control-based logic reuse in FPGA design. | | CO4 | U | 1 |
| 8. | Indicate a method to improve speed in FPGA Architecture. | | CO4 | U | 1 |
| 9. | Define clock skew. | | CO5 | R | 1 |
| 10. | Identify two components of the Zynq System-on-Chip architecture. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Assess the impact of clock circuitry on FPGA design performance. | | CO1 | An | 3 |
| 12. | Explain the difference between gate-level and data-flow modeling in Verilog. | | CO2 | U | 3 |
| 13. | Analyze how the critical path influences the maximum operating frequency of an FPGA design. | | CO3 | An | 3 |
| 14. | Discuss the impact of adding asynchronous reset signals on FPGA area. | | CO4 | An | 3 |
| 15. | Evaluate the trade-offs of reducing voltage supply to optimize power in FPGA. | | CO5 | E | 3 |
| 16. | Examine the role of hardware-software co-design in real-time FPGA applications. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Explain the FPGA Design Flow and analyze the role of each stage in creating a functional design. | CO1 | An | 6 |
|  | b. | Illustrate the architecture of the Input/Output (I/O) block in the Xilinx 3000 series FPGA, detailing its key components and functions. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Discuss the structural modeling style in Verilog HDL and demonstrate their application through example. | CO2 | A | 6 |
|  | b. | Differentiate blocking assignments from non-blocking assignments in terms of the execution order in Verilog with necessary examples. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. |  | Analyze timing challenges in FPGA design and explain register balancing and reorder path strategies to manage them effectively. | CO3 | An | 12 |
|  |  |  |  |  |  |
| 20. |  | Evaluate techniques for optimizing area in FPGA designs, focusing on resource sharing and control-based logic reuse. | CO4 | E | 12 |
|  |  |  |  |  |  |
| 21. |  | Illustrate clock control and input control techniques for power optimization in FPGA and explain how they can improve power efficiency. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Design D flip-flop using behavioral modeling in Verilog, ensuring it triggers on the positive edge of the clock | CO2 | A | 6 |
|  | b. | Write a testbench to simulate the D flip-flop, applying different input values and observing the output for correct operation with rising clock edges. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 23. |  | Describe the various operating modes of the Xilinx 3000 FPGA architecture and discuss how each mode impacts its functionality. | CO1 | U | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Examine the hardware-software partitioning in Zynq device with necessary examples and explain Zynq development flow. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the FPGA design flow and Xilinx architectures for their suitability in digital circuit development. |
| **CO2** | Develop Verilog HDL programs to implement digital circuits on FPGA platforms. |
| **CO3** | Assess the speed and timing performance of FPGA architectures for optimized design. |
| **CO4** | Evaluate the area utilization of FPGA architectures to optimize resource efficiency. |
| **CO5** | Apply power reduction techniques to improve energy efficiency in FPGA designs. |
| **CO6** | Design embedded systems using FPGA platforms for real-world applications. |



**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2025** | **Duration** | **3hrs** |
| **Course Title** | **ENERGY HARVESTING FOR IOT DEVICES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify an energy harvesting method that uses Seebeck effect. | | CO1 | R | 1 |
| 2. | List the advantages of incorporating energy harvesting in IoT. | | CO1 | R | 1 |
| 3. | Predict the energy storage device with less charge time. | | CO2 | A | 1 |
| 4. | Examine the microcontroller deployed in Imote2 sensor node. | | CO2 | A | 1 |
| 5. | List the types of RF energy sources. | | CO3 | R | 1 |
| 6. | Identify Friss transmission equation for wireless communication systems. | | CO3 | R | 1 |
| 7. | Interpret the necessity of impedance matching circuit in WEH. | | CO4 | U | 1 |
| 8. | Sketch the circuit of Villard circuit. | | CO4 | A | 1 |
| 9. | Select the preferred hardware instrument to measure S-parameters in RF circuits. | | CO5 | U | 1 |
| 10. | List any two commonly used dielectric materials in transparent antennas. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Select the features of IEEE 802.15.4. | | CO1 | A | 3 |
| 12. | Classify the various types of solar panels based on their material. | | CO2 | U | 3 |
| 13. | Discuss the working principle of Inverted F antennas. | | CO3 | U | 3 |
| 14. | Compute the factors for choosing a Matching network. | | CO4 | A | 3 |
| 15. | Analyze a sensor node that requires 5mW of power to operate continuously for 12 hours. Determine the energy required for a single day. | | CO5 | An | 3 |
| 16. | Sketch the block diagram and equivalent circuit of a voltage doubler. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Categorize the various energy harvesting techniques for wireless communication. Explain the block diagram of energy harvesting system for IoT applications. | CO1 | An | 12 |
|  |  |  |  |  |  |
| 18. | a. | Identify the key features of the Zigbee protocol and explain the roles of various devices within a Zigbee network | CO2 | R | 6 |
|  | b. | Discuss the process of solar energy generation with a neat block diagram. | CO2 | U | 6 |
|  |  |  |  |  |  |
| 19. |  | Explain the various printed antennas used in wireless energy harvesting systems with its necessary diagrams and specifications. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Compute the necessary equations of L-Matching network for maximum power transfer. | CO4 | An | 8 |
|  | b. | Explain the construction and working of schottky diode with its equivalent circuit. | CO4 | A | 4 |
|  |  |  |  |  |  |
| 21. |  | Estimate the significance of metamaterials in the miniaturization of microstrip patch antennas. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 22. | a. | Illustrate working of voltage multiplier with its circuit diagram. | CO1 | U | 4 |
|  | b. | Explain briefly working of Greinacher and delon voltage doubler with its circuit diagrams. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 23. | a. | Summarize the key parameters in the microstrip antenna design. | CO4 | U | 6 |
|  | b. | Explain the different types of antennas based on frequency. | CO5 | A | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain briefly the importance of self-powered wireless sensor node for structural health monitoring. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| **CO1** | Understand the various energy harvesting systems for IoT devices |
| **CO2** | Understand PV based and kinetic based energy harvesting |
| **CO3** | Understand electromagnetic energy harvesting and the recent trends towards IoT devices |
| **CO4** | Understand matching and rectifier circuit for maximum power transfer for IoT devices |
| **CO5** | Understand metamaterial based absorbers energy harvesters |
| **CO6** | Apply their acquired knowledge using different tools to design an energy harvesting system |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2026** | **Duration** | **3hrs** |
| **Course Title** | **IOT DATA ANALYTICS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Name a protocol that is commonly used for low-latency data exchange in IoT communication models. | | CO1 | R | 1 |
| 2. | Give an example of a content-based tag. | | CO1 | U | 1 |
| 3. | Name a Python library that is used for data visualization. | | CO2 | R | 1 |
| 4. | Give an example of a NoSQL database. | | CO2 | U | 1 |
| 5. | Identify a gathering method that involves direct conversations with stakeholders. | | CO3 | U | 1 |
| 6. | Name the document that typically contains all the business requirements. | | CO3 | R | 1 |
| 7. | Define the Agile model. | | CO4 | R | 1 |
| 8. | Indicate the primary purpose of a monetization model. | | CO4 | U | 1 |
| 9. | Name a supervised machine learning algorithm. | | CO5 | R | 1 |
| 10. | Write the significance of streaming analytics in real-time data processing. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Describe the importance of data analytics in IoT. | | CO1 | U | 3 |
| 12. | List the four types of data analytics. | | CO2 | R | 3 |
| 13. | Explain the importance of defining a clear problem statement in use case development. | | CO3 | U | 3 |
| 14. | List three advantages of the waterfall model. | | CO4 | R | 3 |
| 15. | Calculate the 1st Quartile (Q1), 2nd Quartile (Q2) and 3rd Quartile (Q3) for the given dataset: 6,15,59,69,56,34,72,88. | | CO5 | A | 3 |
| 16. | A smart temperature sensor in an IoT-based cold storage unit records the temperature data as follows:  Mean temperature = 5°C  Standard deviation = 1.5°C  Recorded temperature at a given time = 8°C  Calculate the Z-score for the recorded temperature. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Illustrate the semantic model for a smart healthcare system. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Explain the integration of simulation models with data lifecycle stages to replicate and analyze smart city's traffic management system. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Apply the concept of IoT Level 1 to design a low-cost home automation system that can function without internet connectivity. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Apply the core principles and phases of “Value Engineering and Analysis” to illustrate the enhancement of a product value using a practical example. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Calculate the following statistical parameters for the given dataset:   1. Calculate the mean and median Temperature from the dataset. 2. Calculate the standard deviation of Humidity. 3. Calculate the 25th and 75th Percentiles of Temperature. 4. Calculate the correlation between Temperature and CO2 Levels. 5. Calculate the correlation between Temperature and Humidity. 6. Determine the outlier in Humidity using the IQR Method.  |  |  |  |  | | --- | --- | --- | --- | | **Time** | **Temperature (°C)** | **Humidity (%)** | **CO2 Level (ppm)** | | 10:00 | 22.5 | 55 | 400 | | 10:05 | 23.0 | 50 | 420 | | 10:10 | 24.2 | 48 | 450 | | 10:15 | 23.8 | 52 | 430 | | 10:20 | 22.9 | 53 | 410 | | CO5 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Apply the Exclusive Pair Communication Model to ensure secure and reliable data exchange between paired smartphones. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Apply the logistic regression algorithm to classify IoT sensor data for predictive maintenance in a smart factory. Explain the steps involved, including data preprocessing, model training, and performance evaluation. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Apply One-Class SVM for anomaly detection in monitoring patient vitals using wearable IoT devices. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply semantic models, information models, and predictive models to structure, preprocess, and forecast data in IoT solutions. |
| **CO2** | Apply simulation models and data lifecycle stages to replicate real-world IoT scenarios. |
| **CO3** | Assess business requirements, problem statements, and available assets to develop effective use cases for IoT solutions. |
| **CO4** | Evaluate value engineering principles, frameworks, and development models to optimize IoT solutions and monetize use cases effectively. |
| **CO5** | Interpret IoT data through preprocessing, exploratory techniques, and vertical-specific algorithms to derive meaningful insights |
| **CO6** | Evaluate analytics models for anomaly detection, clustering, and predictive insights using cloud/edge methods to measure their performance. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC2027** | **Duration** | **3hrs** |
| **Course Title** | **BRAIN COMPUTER INTERFACE** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | List the advantages of a Brain-Computer Interface (BCI). | | CO1 | R | 1 |
| 2. | Indicate the risk of infection associated with Electrocorticography (ECoG). | | CO1 | U | 1 |
| 3. | Define ‘spikes’ in brain activation | | CO2 | R | 1 |
| 4. | State the location and morphology of the Mu rhythm. | | CO2 | R | 1 |
| 5. | Interpret the significance of spike sorting in electrophysiological recordings and neural data analysis. | | CO3 | An | 1 |
| 6. | Define Phase Locking Value (PLV) in the phase synchronization method used for feature extraction. | | CO3 | R | 1 |
| 7. | State the purpose of regression in data analysis. | | CO4 | R | 1 |
| 8. | Explain the benefits of Support Vector Machine (SVM) in Brain-Computer Interface (BCI) applications. | | CO4 | U | 1 |
| 9. | Explain the limitations of invasive methods for recording brain signals. | | CO5 | U | 1 |
| 10. | Name the latest toolkit published in the field of Brain-Computer Interface. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Classify the types of BCI based on analysis time, signal input, and data processing modality. | | CO1 | An | 3 |
| 12. | Explain the association of distinct components of Movement-Related Potentials (MRPs) with different stages of movement preparation and execution. | | CO2 | A | 3 |
| 13. | Describe the block diagram of blind source separation using Independent Component Analysis (ICA). | | CO3 | U | 3 |
| 14. | Justify the role of an ensemble classifier in enhancing the robustness of a classification model. | | CO4 | E | 3 |
| 15. | Explain the ethical issues associated with brain-computer interfaces. | | CO5 | U | 3 |
| 16. | Estimate the recall value for a classifier network that has TP = 10 and FP = 20, TN = 20, FN = 10. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Evaluate the process of brain signal acquisition using an Electroencephalography (EEG) system and the key processing steps involved in EEG signal analysis. | CO1 | E | 12 |
|  |  |  |  |  |  |
| 18. | a. | Explain the stages of a Brain-Computer Interface (BCI) system with a labeled diagram. | CO1 | A | 8 |
|  | b. | Illustrate the role of fMRI in recording brain signals and its advantages over other neuroimaging techniques. | CO1 | An | 4 |
|  |  |  |  |  |  |
| 19. |  | Justify the relevance of the characteristics, types, measurement techniques, and applications of slow cortical potentials in brain signal analysis. | CO2 | E | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain the significance of frequency domain analysis in Brain-Computer Interface (BCI) systems. | CO3 | A | 6 |
|  | b. | Calculate covariance for the following data: x = {5,3,1,4,6}, y = {7,10,8,3,4} | CO3 | An | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain the structure, learning algorithm, and applications of a perceptron in brain signal classification. | CO4 | A | 8 |
|  | b. | Justify the need for evaluation using performance metrics in signal processing models | CO4 | E | 4 |
|  |  |  |  |  |  |
| 22. |  | Explain invasive Brain-Computer Interfaces (BCIs) for motor rehabilitation with a labeled block diagram. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Evaluate the effectiveness of emotion detection using non-invasive Brain-Computer Interfaces (BCIs) with a labeled block diagram. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain the architecture of Brain-Computer Interfaces (BCIs) and their execution with a labeled diagram. | CO6 | A | 8 |
|  | b. | List the signal processing algorithms implemented in BCILAB in plug-in form. | CO6 | R | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Evaluate the effectiveness of monitoring hardware like EEG, ECoG, MEG, and fMRI. |
| **CO2** | Demonstrate the brain activation patterns related to sensory and cognitive tasks. |
| **CO3** | Apply data processing techniques for artifact reduction and feature extraction. |
| **CO4** | Evaluate classification techniques, including binary, ensemble, and multiclass methods. |
| **CO5** | Examine case studies of invasive and non-invasive BCIs. |
| **CO6** | Implement an event-related potential-based BCI using BCILAB. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **22EC3006** | **Duration** | **3hrs** |
| **Course Title** | **CAD FOR VLSI CIRCUITS** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the concepts of Hierarchy and Abstraction in VLSI complexity reduction with a diagram. | CO1 | A | 10 |
|  | b. | Apply the concepts of Behavioral, Structural, and Physical (Layout) domains in VLSI design and analyze their roles in circuit implementation. | CO1 | A | 6 |
|  |  |  |  |  |  |
| 2. | a. | Apply Dijkstra’s algorithm to the given graph and determine the shortest path from vertex V1 to vertex V2​. | CO2 | A | 10 |
|  | b. | Develop adjacency matrix for the following graph. | CO2 | A | 6 |
|  |  |  |  |  |  |
| 3. | a. | Apply K-L partitioning algorithm and find the solution for the following initial partitioning: | CO3 | A | 10 |
|  | b. | Explain constructive placement with an example | CO3 | A | 6 |
|  |  |  |  |  |  |
| 4. | a. | Develop an area routing algorithm for the given grid representation using wave propagation, backtracking, and clean-up processes. | CO4 | A | 10 |
|  | b. | Construct polar horizontal graph and polar vertical graph for the given floorplan with labelled horizontal and vertical line segments. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 5. | a. | Apply the Liao-Wong algorithm to compute the longest path for the given graph. | CO5 | A | 12 |
|  | b. | Explain the classification of rectangular blocks in a VLSI layout based on their design flexibility in compaction. | CO5 | A | 4 |
|  |  |  |  |  |  |
| 6. |  | 1. Calculate the density of the given set of intervals:   [1,3] [4,8] [2,5] [10,12] [11,12] [7,9] [7,11] [3,8] using the left-edge algorithm.  ii) Draw the interval graph corresponding to this set of intervals and provide the vertex coloring based on the left-edge algorithm solution. | CO4 | A | 16 |
|  |  |  |  |  |  |
| 7. | a. | Develop the floorplan tree for the given floor plan order 5 and the characterization of the operators used. | CO3 | A | 6 |
|  | b. | Explain Shape Functions and Floorplan Sizing. | CO3 | A | 10 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | i) Sketch the structure of selector and Distributor node in DFG  ii) Construct DFG for the following conditional construct program | CO6 | A | 10 |
|  | b. | Analyze the circular arcs and construct circular-arc graph and the minimal coloring of this graph | CO6 | An | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Apply logic simulation and layout verification to validate VLSI designs and verify adherence to functional specifications. |
| CO2 | Develop graph search algorithms to solve VLSI physical design problems |
| CO3 | Apply partitioning and placement algorithms in VLSI design, including circuit representation, to optimize layout and minimize wire-length. |
| CO4 | Develop floor planning and routing techniques in VLSI design for optimization problems. |
| CO5 | Apply VLSI design rules, layout techniques, and compaction algorithms for layout compaction. |
| CO6 | Apply combinational logic synthesis, Binary Decision Diagrams, scheduling algorithms for FPGA implementation. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **23EC1004** | **Duration** | **3hrs** |
| **Course Title** | **C++ AND DATA STRUCTURES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define the concept of ‘Classes’ in C++. | | CO1 | R | 1 |
| 2. | List 2 String functions used in Object-Oriented Programming. | | CO1 | R | 1 |
| 3. | Compare ‘Unary’ with ‘’Binary’ operator overloading in C++. | | CO2 | U | 1 |
| 4. | Define Type conversion’. | | CO2 | R | 1 |
| 5. | Name the ‘Exception Handler’. | | CO5 | R | 1 |
| 6. | Illustrate the use of ‘Templates’. | | CO4 | A | 1 |
| 7. | Describe the purpose of ‘seekp()’. | | CO4 | U | 1 |
| 8. | Write short notes on Stream Hierarchy. | | CO3 | A | 1 |
| 9. | List any two Linear Data structure. | | CO6 | R | 1 |
| 10. | Name the sorting method that adopts ‘Divide and Conquer’ rule. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Compare ‘Structures’ with ‘Classes’. | | CO1 | An | 3 |
| 12. | Develop a program to display the address of a variable. | | CO2 | A | 3 |
| 13. | Explain about ‘This Pointer’. | | CO3 | A | 3 |
| 14. | Explain about the ‘Stream Errors’. | | CO5 | A | 3 |
| 15. | Compare Single and Circular Linked list. | | CO6 | An | 3 |
| 16. | Describe the steps involved in ‘Insertion sort’. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Apply the combination of arithmetic and relational operators to process real-time sensor data. Consider the following:   1. Use arithmetic operators to convert raw sensor data (0-100) into temperature values (in Celsius). 2. Use relational operators to check if the temperature is within a safe range of 20°C to 30°C.   If the temperature falls outside the safe range, issue a warning. | CO1 | A | 8 |
|  | b. | Explain ‘Overloaded Constructors’ in about 200 words. | CO2 | A | 4 |
|  |  |  |  |  |  |
| 18. | a. | Develop a program to overload ‘Binary’ operator. | CO3 | A | 6 |
|  | b. | Explain in detail about the different types of inheritance with necessary syntax. | CO4 | A | 6 |
|  |  |  |  |  |  |
| 19. |  | Construct a program to demonstrate multilevel Inheritance. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 20. | a. | Explain ‘Function Templates’ in about 250 words. | CO6 | A | 4 |
|  | b. | Construct a program using ‘Static Function’. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 21. |  | Compare the Normal member functions accessed with pointers & Virtual member functions accessed with pointers and explain with an object-oriented program. | CO4 | An | 12 |
|  |  |  |  |  |  |
| 22. |  | Develop a program to implement a Student management system using ‘File handling’ operations. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Construct a program to insert and display the data {10, 20, 30} using ‘Single Linked List’. | CO6 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Explain ‘Heap sort’ in around 200 words. | CO6 | A | 8 |
|  | b. | Construct a program to search an item in the list. | CO5 | A | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Solve complex mathematical problems using OOP |
| **CO2** | Develop Object initialization methods using Constructors. |
| **CO3** | Develop Object-oriented programs utilizing encapsulation and modularity features. |
| **CO4** | Develop inheritance models to solve intricate object oriented design challenges in C++ |
| **CO5** | Evaluate exception handling mechanisms to build fault tolerant and reliable applications |
| **CO6** | Develop OOP programs by incorporating data structures. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **23EC2012** | **Duration** | **3hrs** |
| **Course Title** | **NETWORK THEORY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Calculate the current flow across the terminal ‘ab’. | | CO1 | A | 1 |
| 2. | Predict the number of mesh equations that can be formed for the circuit shown.  network-theory-questions-answers-mesh-analysis-q3 | | CO1 | A | 1 |
| 3. | Predict the condition for maximum power transfer from a source to the load. | | CO2 | A | 1 |
| 4. | Sketch the duality of Nortons’s theorem. | | CO2 | A | 1 |
| 5. | Write the formula for reactive power in a 3-phase star connected system. | | CO3 | A | 1 |
| 6. | Write the formula for Time constant of a series RC circuit. | | CO3 | A | 1 |
| 7. | Apply the Laplace Transform to and predict its result. | | CO4 | A | 1 |
| 8. | Analyze the impact of bandwidth on the performance of communication systems. | | CO5 | An | 1 |
| 9. | Write the condition for resonance and formula for resonance frequency. | | CO5 | A | 1 |
| 10. | Choose a filter that allows all frequencies up to the cutoff frequency fc to pass without attenuation while attenuating frequencies above fc. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Calculate the current through 3 ohm resistor. | | CO1 | A | 3 |
| 12. | Analyze the given circuit to find the value of Thevenin equivalent resistance. | | CO2 | An | 3 |
| 13. | Evaluate the power factor for a balanced mesh load of 20∠40⁰ is connected across a 400V, 3 – Ø balanced supply. | | CO3 | E | 3 |
| 14. | Write the expressions for the following properties of the Laplace Transform:  (i) Linearity (ii) Time Differentiation (iii) Time Integration | | CO4 | A | 3 |
| 15. | Calculate the quality factor of a coil for the series RLC circuit consisting of R=5Ω, L=0.01H, C=10µF | | CO5 | A | 3 |
| 16. | Determine the open circuit input impedance Z22 for the given circuit. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. |  | Compute the nodal voltage using nodal analysis. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 18. |  | Apply mesh analysis method to determine the mesh currents in the circuit shown. | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Apply Norton’s theorem to determine the Norton’s equivalent circuit and the current through 4 Ω resistor for the given circuit. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Determine the current through 3Ω resistor in the circuit shown using superposition theorem. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Evaluate the line current, phase current, line voltage, power consumed by the load, and power factor for the following system: A three-phase balanced delta-connected load with an impedance of (3 + j4) Ω is supplied by a 440V, 3Ø balanced source with an RYB phase sequence. | CO3 | E | 12 |
|  |  |  |  |  |  |
| 22. |  | Determine the steady state response of series RL and series RC circuit using Laplace Transform if R= 4 Ω, C= 16 F, L= 2 H and V= 30V. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Estimate the resonant frequency, Q factor, lower cut off frequency, upper cut off frequency and bandwidth of the following circuit specification. A parallel RLC circuit consists of 40 Ω resistor 0.3 H inductance and 12 μF capacitor with an applied voltage of 30V. | CO5 | E | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Determine the short circuit admittance parameters of the network given below | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Design basic electrical circuits with nodal and mesh analysis. |
| **CO2** | Apply various electrical network theorems to analyze circuits and networks. |
| **CO3** | Evaluate the performance metrics in three phase circuits. |
| **CO4** | Apply Laplace Transform for steady state and transient analysis. |
| **CO5** | Analyze the frequency domain techniques. |
| **CO6** | Determine different network functions and design filter circuits. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **23EC2020** | **Duration** | **3hrs** |
| **Course Title** | **PRINTED CIRCUIT BOARD DESIGN AND ARDUINO PROGRAMMING** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Identify one key driver of Industry 4.0. | | CO1 | U | 1 |
| 2. | State one major difference between Industry 3.0 and Industry 4.0 | | CO1 | R | 1 |
| 3. | List two types of temperature sensors. | | CO2 | R | 1 |
| 4. | Name the sensor used to measure acceleration. | | CO2 | R | 1 |
| 5. | Name the programming language commonly used in the Arduino IDE. | | CO3 | R | 1 |
| 6. | State the purpose of the Arduino IDE in microcontroller programming. | | CO3 | R | 1 |
| 7. | Name two arithmetic operators used in Embedded C | | CO4 | R | 1 |
| 8. | Identify the function used to read an analog input in Arduino programming. | | CO4 | R | 1 |
| 9. | Name two methods used for routing in PCB layout design. | | CO5 | R | 1 |
| 10. | Define the role of a Printed Circuit Board (PCB) in electronic circuits. | | CO6 | U | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the impact of digitalization on modern business operations. | | CO1 | U | 3 |
| 12. | With respect to distance measurement, compare ultrasonic and infrared sensors. | | CO2 | U | 3 |
| 13. | Explain the significance of digital and analog I/O ports in Arduino. | | CO3 | U | 3 |
| 14. | List the basic data types used in Embedded C. | | CO4 | U | 3 |
| 15. | Illustrate the syntax and usage of a for loop in Embedded C. | | CO5 | An | 3 |
| 16. | State the purpose of GERBER files in PCB manufacturing. | | CO6 | U | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Justify the importance of cloud computing and big data analytics in Industry 4.0, highlighting their role in decision-making. | CO1 | E | 6 |
|  | b. | Interpret the significance of Internet of Things (IoT) in smart factories and how it contributes to predictive maintenance and real-time monitoring. | CO1 | U | 6 |
|  |  |  |  |  |  |
| 18. | a. | Investigate the different technologies used for distance measurement, including ultrasonic, infrared, and laser sensors, and analyze their suitability for various applications. | CO2 | An | 6 |
|  | b. | Analyze the impact of sensor technology advancements on automation and smart systems, with examples from smart homes, healthcare, and industrial monitoring. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Evaluate the role of control statements (if-else, switch-case, loops) in Arduino-based projects with an example. | CO3 | E | 6 |
|  | b. | Explain the procedure to interface an Arduino with a laptop with an example. | CO3 | U | 6 |
|  |  |  |  |  |  |
| 20. | a. | Develop an Embedded C program to interface a temperature sensor with Arduino and display readings on the serial monitor. | CO4 | U | 6 |
|  | b. | Explain different data types available in Arduino UNO programming (e.g., int, float, char, boolean). | CO4 | U | 6 |
|  |  |  |  |  |  |
| 21. | a. | Explain different types of operators (relational, logical, bitwise) with suitable example | CO5 | U | 6 |
|  | b. | Differentiate between local and global variables with suitable example. | CO5 | U | 6 |
|  |  |  |  |  |  |
| 22. |  | **Discuss** the design process of a PCB using TINA Design Suite. | CO5 | U | 12 |
|  |  |  |  |  |  |
| 23. | a. | Write an Arduino program that integrates variables, operators and expressions with suitable example and result. | CO4 | A | 6 |
|  | b. | Discuss the criteria for selecting the correct component footprint for a PCB design. | CO5 | U | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Illustrate the process of programming an LED blink sequence using Arduino. | CO6 | An | 6 |
|  | b. | Discuss the key considerations when designing a smart PCB for intelligent machines. | CO6 | U | 6 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Importance of Industry 4.0 and its challenges. |
| **CO2** | Interpret the various sensors for embedded systems. |
| **CO3** | Understand the specifications of Arduino and its design flow. |
| **CO4** | Analyze embedded applications through embedded c programming. |
| **CO5** | Apply the knowledge about the packages of Electronic components, types of PCBs and history of PCBs. |
| **CO6** | Develop and program Arduino controllers with different peripheral devices for embedded applications |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| --- | --- | --- | --- |
| **Course Code** | **23EC3003** | **Duration** | **3hrs** |
| **Course Title** | **HARDWARE SECURITY** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. | a. | Examine how the RSA algorithm utilize asymmetric key cryptography for secure communication, and list the computational challenges associated with its security, particularly in the context of quantum computing threats. | CO1 | An | 12 |
|  | b. | Explain how cryptographic hardware implementations on FPGA be optimized in terms of area, power, and latency. | CO1 | A | 8 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Illustrate how different Physical Unclonable Function (PUF) implementations influence inherent hardware variations for secure key generation and list the key challenges in ensuring reliability, uniqueness, and resistance against machine learning attacks. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | Examine the design techniques that can be employed to enhance the resilience of cryptographic hardware against fault injection and side-channel attacks, and how do countermeasures such as redundancy, masking, and error detection improve security without significantly impacting performance? | CO3 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Examine the design techniques used to prevent IP and IC piracy, and how do methods such as hardware obfuscation, watermarking, and split manufacturing enhance the security of semiconductor designs against unauthorized duplication and tampering? | CO4 | An | 20 |
|  |  |  |  |  |  |
| 5. |  | Explain the classification of Hardware Trojans based on their structure, activation mechanism, and payload, and list the different operating modes that enable them to evade detection in modern VLSI systems. | CO5 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Explain the key design techniques used to enhance the reliability, uniqueness, and randomness of PUF responses. | CO2 | A | 20 |
|  |  |  |  |  |  |
| 7. |  | Illustrate how Physical Unclonable Functions (PUFs) be utilized to prevent hardware piracy, and what are the key challenges in integrating PUF-based authentication and encryption mechanisms into modern semiconductor designs? | CO4 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Examine how do logic testing and side-channel analysis techniques detect Hardware Trojans in VLSI systems, and what are the key challenges in distinguishing Trojan-induced anomalies from process variations and environmental noise? | CO5 | An | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. |  | Evaluate how attacks against branch prediction exploit speculative execution vulnerabilities, and what countermeasures can be implemented to mitigate security risks such as Spectre and Branch Target Injection? | CO6 | E | 20 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
| --- | --- |
|  | **COURSE OUTCOMES** |
| CO1 | Interpret and optimize the process of implementing cryptographic algorithms on hardware. |
| CO2 | Classify various Hardware Security Primitives |
| CO3 | Determine the different kinds of attacks that can be mounted against cryptographic algorithms and Physical Unclonable Functions and make them resilient to attacks |
| CO4 | Design Modern IC and Manufacturing Practices and Their Implications |
| CO5 | Analyze the different kinds of Trojans, their impact and learn the effective counter measures for defending against them. |
| CO6 | Infer the different kinds of threats at the micro architectural level and their corresponding Counter measures |



END SEMESTER EXAMINATION – MAY / JUNE 2025

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| **Course Code** | **24EC1002** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR CIRCUIT DESIGN** | **Max. Marks** | **100** |

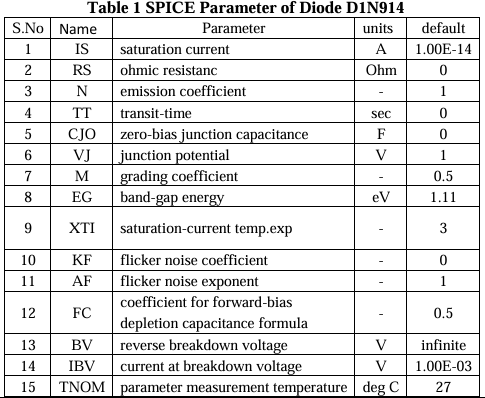
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| --- | --- | --- | --- | --- | --- |
| **Q.**  **No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define SPICE. | | CO1 | R | 1 |
| 2. | List any two basic netlist commands in SPICE. | | CO1 | R | 1 |
| 3. | Name the type of circuit that removes a portion of a waveform. | | CO2 | R | 1 |
| 4. | Illustrate an OR logic gate with logic expressions. | | CO2 | A | 1 |
| 5. | Name the data types available for controls and indicators in LabVIEW. | | CO3 | R | 1 |
| 6. | Illustrate the Icon and Connector pane in LabVIEW. | | CO3 | A | 1 |
| 7. | Define MATLAB. | | CO4 | R | 1 |
| 8. | Define interactive plotting in MATLAB. | | CO4 | R | 1 |
| 9. | Compute the modulation index of a AM wave with its carrier signal amplitude of 5 V, while the modulating signal amplitude of 2 V. | | CO5 | A | 1 |
| 10. | Write a digital modulation that employs phase changes. | | CO6 | A | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Summarize the function of basic netlist commands like .DC, .TRAN, and .PRINT. | | CO1 | U | 3 |
| 12. | Interpret the simulated output waveform of a rectifier circuit. | | CO2 | A | 3 |
| 13. | Illustrate the while loop in LabVIEW. | | CO3 | A | 3 |
| 14. | Review the key functionalities offered by the Image Processing Toolbox. | | CO4 | U | 3 |
| 15. | **Apply** image type conversion to improve processing accuracy and compatibility. | | CO5 | A | 3 |
| 16. | Illustrate frequency modulation by showing how the carrier signal’s frequency increases or decreases based on the amplitude of the modulating signal. | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Solve using a SPICE program to find the node voltages, current and total power dissipation for the given circuit in Figure 1.    Figure 1. Passive Circuit Model | CO1 | A | 12 |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |
| 18. |  | Write a SPICE program to find the node voltages, current and total power dissipation for the given Figure 2 below.    Figure 2. Circuit Description | CO1 | A | 12 |
|  |  |  |  |  |  |
| 19. |  | Illustrate how to build a full-wave rectifier using a Diode D1N914. Refer the SPICE parameters in the Table 1. | CO2 | A | 12 |
|  |  |  |  |  |  |
| 20. |  | Write a SPICE program to simulate a clamper circuit using the D1N914 diode as shown in Figure 3, and analyze its behavior. Refer the SPICE parameters in the Table 1.    Figure 3. Clamper Circuit | CO2 | A | 12 |
| 21. |  | Sketch a VI that generates 50 random numbers and plot it on a waveform chart using For and While Loops. Accumulate the random numbers into an array and display it on waveform graph. | CO3 | A | 12 |
|  |  |  |  |  |  |
| 22. |  | Sketch a VI to compute full adder logic using half adder logic as subVI. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 23. |  | Write a MATLAB program to perform basic logic gate operations (AND, OR, NOT, XOR) on scalar binary inputs and display the results. | CO5 | A | 12 |
|  |  |  |  |  |  |
| 24. |  | Apply the AM formula to compute the modulated signal and visualize the output using subplots. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| **CO1** | Apply SPICE tools to simulate electrical circuits and perform DC, AC, and transient analyses. |
| **CO2** | Evaluate the characteristics of diodes, BJTs, Clippers, Clampers and rectifier circuits, and assess their behavior using SPICE. |
| **CO3** | Apply data types, controls, and indicators in LabVIEW to create functional user interfaces. |
| **CO4** | Design Sub-VIs and place them into a block diagram for effective signal processing and conditioning. |
| **CO5** | Develop scripts using relational operators, logical variables, and conditional statements in MATLAB. |
| **CO6** | Develop basic image processing algorithms using MATLAB to enhance and analyze images. |

**Reference**



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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24EC1003** | **Duration** | **3hrs** |
| **Course Title** | **ELECTRONICS FOR INTELLIGENT MACHINES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | State the purpose of Cyber-Physical Systems (CPS) in Industry 4.0. | | CO1 | U | 1 |
| 2. | Define the term "Machine-to-Machine (M2M) communication" in Industry 4.0. | | CO1 | R | 1 |
| 3. | Name one sensor used in industrial robotics and its function. | | CO2 | R | 1 |
| 4. | How do temperature sensors contribute to process control in industrial applications? | | CO2 | An | 1 |
| 5. | Point out the role of Infrastructure as a Service (IaaS) in cloud computing. | | CO3 | U | 1 |
| 6. | Define Data Center in cloud computing. | | CO3 | U | 1 |
| 7. | Review the Descriptive Analytics in Big Data. | | CO4 | R | 1 |
| 8. | Define "Velocity" in the context of Big Data. | | CO4 | U | 1 |
| 9. | Name a lightweight communication protocol used in IoT applications. | | CO5 | U | 1 |
| 10. | State how Augmented Reality (AR) enhances industrial processes. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | List the key paradigms of Industry 4.0. | | CO1 | U | 3 |
| 12. | Explain the working principle of a proximity sensor in industrial applications. | | CO2 | A | 3 |
| 13. | List the benefits of cloud computing in Industry 4.0. | | CO3 | U | 3 |
| 14. | How does big data analytics improve decision-making in Industry 4.0? | | CO4 | An | 3 |
| 15. | List the essential components of an IoT architecture. | | CO5 | U | 3 |
| 16. | How is Augmented Reality (AR) applied in Industry 4.0? | | CO6 | A | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Describe any five pillars of Industry 4.0 with their significance. | CO1 | U | 6 |
|  | b. | Discuss the impact of Industry 4.0 on manufacturing and supply chains. | CO1 | An | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explore the working principles of three types of sensors used in industrial automation. | CO2 | A | 6 |
|  | b. | Analyze the advantages and challenges of using infrared sensors in process control. | CO2 | An | 6 |
|  |  |  |  |  |  |
| 19. | a. | Compare IaaS, PaaS, and SaaS with examples. | CO3 | An | 4 |
|  | b. | Explain how cloud computing improves data security and storage in Industry 4.0. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 20. | a. | Define Big Data and explain its characteristics. | CO4 | U | 4 |
|  | b. | Explain how Big Data Analytics contribute to predictive maintenance in Industry 4.0. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 21. | a. | Explain the architecture and working principle of IoT in smart industries. | CO5 | R | 8 |
|  | b. | Discuss future trends and challenges in IoT implementation. | CO5 | E | 4 |
|  |  |  |  |  |  |
| 22. | a. | Formulate the role of AI-powered robots and autonomous systems in modern industries. | CO5 | E | 8 |
|  | b. | Compare collaborative robots (Cobots) with traditional industrial robots. | CO5 | An | 4 |
|  |  |  |  |  |  |
| 23. | a. | Explain the role of AI in media streaming and how do AI algorithms personalize media streaming recommendations? | CO6 | A | 6 |
|  | b. | Justify the impact of AI-based content recommendation systems on user experience. | CO6 | E | 6 |
| **COMPULSORY QUESTION** | | | | | |
| 24. | a. | Design an IoT-based solution for real-time health monitoring and Explain the architecture of an IoT-based real-time health monitoring system. | CO6 | C | 8 |
|  | b. | Discuss the challenges and security issues in IoT healthcare applications. | CO6 | An | 4 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Apply the foundational concepts of Industry 4.0 to analyze its interconnections with emerging technological fields |
| **CO2** | Evaluate the role of smart and pervasive computing in modern applications. |
| **CO3** | Relate the principles of cloud computing, data sources, and the infrastructure of data centers in Industry 4.0 |
| **CO4** | Assess the data storage requirements for efficient cloud-based data management. |
| **CO5** | Design Internet of Things (IoT) solutions for diverse services and industry-specific applications. |
| **CO6** | Examine various types of intelligent machines based on their functionalities and applications in Industry 4.0. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24EC1005** | **Duration** | **3hrs** |
| **Course Title** | **PROGRAMMING FOR SYSTEM DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (10 X 1 = 10 MARKS)** | | | | | |
| 1. | Define an automated data acquisition system. | | CO1 | R | 1 |
| 2. | Write the expansion for the acronym LabVIEW. | | CO1 | A | 1 |
| 3. | Define an icon in a VI (Virtual Instrument) environment. | | CO2 | R | 1 |
| 4. | Define a node in the context of LabVIEW. | | CO2 | R | 1 |
| 5. | Identify the function in MATLAB for coloured 3D surface plots. | | CO3 | R | 1 |
| 6. | Evaluate the function “whos” in MATLAB. | | CO3 | E | 1 |
| 7. | Analyze the function “round (clock)” in MATLAB. | | CO4 | An | 1 |
| 8. | Write a MATLAB code to create a matrix of all ones of size 1 X 3. | | CO4 | A | 1 |
| 9. | Define RTOS. | | CO5 | R | 1 |
| 10. | State Laxity. | | CO6 | R | 1 |
| **PART – B (6 X 3 = 18 MARKS)** | | | | | |
| 11. | Analyze the use of terminals in a LabVIEW block diagram. | | CO1 | An | 3 |
| 12. | Evaluate the Data Flow Programming technique in LabVIEW. | | CO2 | E | 3 |
| 13. | Explain “linspace” function in MATLAB with an example. | | CO3 | A | 3 |
| 14. | Write a MATLAB code to add two matrices. | | CO4 | A | 3 |
| 15. | Explain the RTOS terminologies: task, thread and process. | | CO5 | A | 3 |
| 16. | Compare soft real time task with hard real time task. | | CO6 | E | 3 |
| **PART – C (6 X 12 = 72 MARKS)**  **(Answer any five Questions from Q. No. 17 to 23, Q. No. 24 is Compulsory)** | | | | | |
| 17. | a. | Analyze the various windows of a VI (Virtual Instrument) environment with illustrations. | CO1 | An | 6 |
|  | b. | Recommend a VI wiring diagram that simulates the rolling of 2 dice and their addition to form a number from 2 through 12. | CO1 | E | 6 |
|  |  |  |  |  |  |
| 18. | a. | Explain the significance and importance of Sub-VIs in LabVIEW. | CO2 | An | 6 |
|  | b. | Recommend a LabVIEW algorithm to create sub-VI. | CO2 | E | 6 |
|  |  |  |  |  |  |
| 19. | a. | Develop a MATLAB code for element-by-element multiplication of matrices. | CO3 | C | 6 |
|  | b. | Develop a MATLAB code to find if a year is a leap year or not. | CO3 | C | 6 |
|  |  |  |  |  |  |
| 20. |  | Write a MATLAB program to perform all logical operations between two binary images. | CO4 | A | 12 |
|  |  |  |  |  |  |
| 21. |  | Develop a MATLAB code to add all the elements of an array a = [2 4 6 8 10 12] using “for loop” statements. | CO4 | C | 12 |
|  |  |  |  |  |  |
| 22. |  | Analyse the Mixed Criticality-Vestal Model for RTOS applications. | CO5 | An | 12 |
|  |  |  |  |  |  |
| 23. |  | Explain the types of real-time scheduling classes in RTOS. | CO5 | A | 12 |
| **COMPULSORY QUESTION** | | | | | |
| 24. |  | Explain the significance and types of Semaphore and Mutex in RTOS. | CO6 | A | 12 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

|  |  |
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|  | **COURSE OUTCOMES** |
| **CO1** | Develop system designs applying all the concepts and techniques of LabVIEW. |
| **CO2** | Design and develop LabVIEW-based user interfaces using sensors and actuators with data acquisition systems (myDAQ), and visualize data. |
| **CO3** | Apply MATLAB programming techniques to perform various mathematical operations and plots for data visualization and analysis. |
| **CO4** | Apply MATLAB techniques for mathematical operations for processing audio signals and image analysis. |
| **CO5** | Examine the fundamentals of Real-Time Operating Systems (RTOS) mechanisms to design and manage real-time applications. |
| **CO6** | Develop and port FreeRTOS applications using Eclipse IDE, for various case studies. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24EC3004** | **Duration** | **3hrs** |
| **Course Title** | **ANALOG VLSI DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Determine the output voltage for the circuit given below if R=15kΩ. Determine the maximum value of R allowable to keep M1operating in the saturation region. Using the typical NMOS process parameters of Table 1 (given below).    **Table 1**  **Typical Process Parameter for 3µ NMOS and CMOS processes**   |  |  |  |  | | --- | --- | --- | --- | | **Parameter** | **n-channel** | **p-channel** | **units** | | K' | 24 | 8 | µA/V2 | | VTOE | 0.75 | -0.75 | V | | VTOD | -3 | 3 | V | | Ƴ(CMOS) | 0.8 | 0.4 | V1/2 | | Ƴ(NMOS) | 0.4 | - | V1/2 | | Ф | 0.6 | 0.6 | V | | λ | 0.01 | 0.02 | V-1 | | A | CO1 | 12 |
|  | b. | Discuss the small-signal MOSFET model, explaining its equivalent circuit, key parameters, and the impact of channel length modulation on circuit performance. | CO1 | U | 4 |
|  |  |  |  |  |  |
| 2. | a. | Determine the design and operation of a Voltage Scaling DAC with neat circuit diagrams, specifying its architecture, signal conversion process, and performance characteristics. | A | CO2 | 8 |
|  | b. | Illustrate the architecture of a Successive Approximation A/D Converter (SAR ADC) with an example and analyze how the digital code is determined through the successive approximation process. | A | CO2 | 8 |
|  |  |  |  |  |  |
| 3. | a. | **Explain** the concept of resistor emulation in parallel switched capacitor circuits and determine the equivalent resistance (R) value. | CO3 | A | 12 |
|  | b. | Show the value of the capacitor C that will emulate a 1.2 MΩ resistor, if the clock frequency of a Parallel switched capacitor circuit is 150KHz. | CO3 | U | 4 |
|  |  |  |  |  |  |
| 4. | a. | Analyze the design of a CMOS differential amplifier with a current-mirror load by examining how its components influence gain, common-mode rejection ratio (CMRR), and power efficiency. | CO4 | An | 8 |
|  | b. | **Illustrate** the operation of a Class B power amplifier and derive its maximum Power efficiency using appropriate expressions and circuit diagrams. | CO4 | A | 8 |
|  |  |  |  |  |  |
| 5. |  | **Evaluate** the design constraints, phase noise characteristics, and tuning range of a Voltage-Controlled Oscillator (VCO), considering the effects of varactor tuning, supply voltage variations, and the influence of inductor (L) and capacitor (C) values on frequency stability. | CO5 | E | 16 |
|  |  |  |  |  |  |
| 6. | a. | **Explain** the four types of high-gain amplifiers with gain analysis and illustrate their circuit configurations using necessary diagrams. | CO4 | A | 8 |
|  | b. | **Illustrate** the operation of a Class AB power amplifier and derive its maximum power efficiency using appropriate expressions and circuit diagrams. | CO3 | A | 8 |
|  |  |  |  |  |  |
| 7. |  | Distinguish Sah’s and Shichman-Hodges model with neat description and obtain the equivalent circuits for MOSFET in Ohmic and Saturation region. | CO1 | An | 16 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | **Analyze** the operation of a two-stage CMOS comparator in comparison with a single-stage comparator, highlighting the trade-offs in speed, power, and accuracy. | CO6 | An | 12 |
|  | b. | **Illustrate** the track-and-latch stage in a latched comparator and discuss its significance in achieving fast decision-making. | CO6 | A | 8 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Analyze the characteristics of MOS transistors. |
| CO2 | Design data converters for analog systems. |
| CO3 | Examine the different types of switched capacitor circuits. |
| CO4 | Assess the performance characteristics of CMOS amplifiers. |
| CO5 | Illustrate the tuning characteristics of oscillators. |
| CO6 | Design different types of CMOS comparators. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24EC3005** | **Duration** | **3hrs** |
| **Course Title** | **HARDWARE DESIGN VERIFICATION TECHNIQUES** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (5 X 16 = 80 MARKS)**  **(Answer any five from the following)** | | | | | |
| 1. | a. | Explain the impact of functional coverage in modern verification. | CO1 | An | 8 |
|  | b. | Compare layered testbenches with traditional verification methodologies. | CO1 | E | 8 |
|  |  |  |  |  |  |
| 2. | a. | Differentiate between various System Verilog Datatypes used in verification. | CO2 | An | 8 |
|  | b. | Design a randomized testbench for verifying an FSM using System Verilog OOPs. | CO2 | C | 8 |
|  |  |  |  |  |  |
| 3. | a. | Develop downcasting in System Verilog for a flexible testbench structure. | CO3 | A | 8 |
|  | b. | Compare abstract and parameterized classes in System Verilog for Verification efficiency. | CO3 | E | 8 |
|  |  |  |  |  |  |
| 4. | a. | Develop concurrent assertions for verifying a protocol interface. | CO4 | A | 8 |
|  | b. | Explain the benefits of cross-coverage in verification environments. | CO4 | An | 8 |
|  |  |  |  |  |  |
| 5. | a. | Develop a UVM testbench for any digital circuit. | CO5 | A | 8 |
|  | b. | Compare UVM agents and components in terms of reusability. | CO5 | E | 8 |
|  |  |  |  |  |  |
| 6. | a. | Develop a directed verification approach for a digital logic circuit. | CO1 | A | 8 |
|  | b. | Apply procedural statements in System Verilog to automate testbench tasks. | CO2 | A | 8 |
|  |  |  |  |  |  |
| 7. | a. | Analyze the role of virtual methods in reducing redundancy in verification. | CO4 | An | 8 |
|  | b. | Construct a functional coverage model to analyze any digital circuit design. | CO5 | C | 8 |
| **PART – B (1 X 20 = 20 MARKS) [Compulsory Question]** | | | | | |
| 8. | a. | Explain the challenges of cache memory subsystem verification. | CO6 | An | 10 |
|  | b. | Design a hardware/software co-verification framework for a real-time system. | CO6 | C | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Develop layered testbench for functional design verification. |
| CO2 | Construct System Verilog codes for logic circuits. |
| CO3 | Develop System Verilog codes for real time applications. |
| CO4 | Design logic circuits using Open Verification Methodology. |
| CO5 | Examine logic circuits using Universal Verification Methodology. |
| CO6 | Demonstrate hardware verifications technique for practical applications. |

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**END SEMESTER EXAMINATION – MAY / JUNE 2025**

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| **Course Code** | **24EC3014** | **Duration** | **3hrs** |
| **Course Title** | **QUANTUM CIRCUIT DESIGN** | **Max. Marks** | **100** |

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| **Q. No.** | **Questions** | | **CO** | **BL** | **M** |
| **PART – A (4 X 20 = 80 MARKS)**  **(Answer all the Questions)** | | | | | |
| 1. |  | Illustrate the principle of superposition with the representation of a qubit on the Bloch sphere, and explain how Dirac notation can be used to mathematically describe an entangled state of two qubits. | CO1 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 2. |  | Explain how the matrix representation of quantum gates aid in the design of quantum circuits, and how can a simple quantum circuit using Hadamard and CNOT gates demonstrate quantum parallelism. | CO1 | A | 20 |
|  |  |  |  |  |  |
| 3. |  | Explain how single-qubit gates such as Pauli-X, Y, Z, Hadamard, and phase gates manipulate the state of a qubit on the Bloch sphere, and how multi-qubit gates like CNOT, Toffoli, and SWAP enable entanglement and information transfer in a quantum circuit? | CO2 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 4. |  | Evaluate the computation efficiency in quantum algorithms using Quantum Fourier Transform (QFT) and explain how Grover’s search algorithm utilize quantum parallelism and amplitude amplification to achieve quadratic speedup over classical search methods. | CO3 | E | 20 |
|  |  |  |  |  |  |
| 5. |  | Examine how quantum noise and decoherence affect the stability of quantum computations, and how quantum error correction codes like Shor and Steane codes mitigate these errors to preserve quantum information. | CO4 | An | 20 |
|  |  | **(OR)** |  |  |  |
| 6. |  | Evaluate the performance of quantum hardware platforms, such as superconducting qubits, ion traps, and photonic systems, in terms of qubit coherence, gate fidelity, and scalability for practical quantum computing applications. | CO5 | E | 20 |
|  |  |  |  |  |  |
| 7. |  | Illustrate how unitary transformations be implemented in simple quantum circuits, and what role do quantum gates play in designing algorithms for performing specific quantum operations, such as state preparation and quantum Fourier transform. | CO2 | A | 20 |
|  |  | **(OR)** |  |  |  |
| 8. |  | Explain how fault-tolerant design techniques, such as logical qubit encoding and syndrome measurement, prevent error propagation in quantum circuits, and list the key challenges in implementing fault-tolerant quantum computation. | CO4 | A | 20 |
| **COMPULSORY QUESTION** | | | | | |
| 9. | a. | Examine how variational quantum circuits utilize parameterized quantum gates and classical optimization techniques in solving combinatorial optimization problems. | CO6 | A | 10 |
|  | b. | Illustrate how circuit optimization techniques such as gate compression and resource minimization enhance the efficiency of quantum computations, and what are the trade-offs involved in reducing the depth and complexity of quantum circuits. | CO6 | A | 10 |

**CO** – COURSE OUTCOME **BL** – BLOOM’S LEVEL **M** – MARKS ALLOTTED

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|  | **COURSE OUTCOMES** |
| CO1 | Apply quantum mechanics concepts to represent quantum states and gates |
| CO2 | Develop quantum circuits for implementing algorithms like Grover’s and Shor’s |
| CO3 | Evaluate the performance of quantum circuits using simulation tools |
| CO4 | Employ error correction codes to mitigate quantum noise and decoherence |
| CO5 | Evaluate the performance of quantum circuits for their suitability in real-world hardware implementations |
| CO6 | Construct advanced quantum circuit designs in applications like cryptography and optimization |