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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026**DIGITAL SIGNAL PROCESSING**

(Department of Electronics and Communication Engineering)

Time: 3Hrs**Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|--|-------|----|----|
| 1. | i) How is the output of an LTI system computed using convolution? | 1 | 1 | 1 |
| | ii) What is the mathematical equation for frequency-shifting property in Z-Transforms? | 1 | 1 | 1 |
| | iii) Name the two types of commonly used FFT algorithms. | 1 | 2 | 1 |
| | iv) Why Fast Fourier Transform (FFT) is called as in-place algorithm? | 1 | 2 | 2 |
| | v) Relate s-plane and z-plane with mathematical equation. | 1 | 3 | 1 |
| | vi) Find the number of memory locations required to realize an IIR Filter using Direct form-I realization with $M = 2$ and $N = 3$. | 1 | 3 | 2 |
| | vii) Explain Gibb's phenomenon. | 1 | 4 | 2 |
| | viii) What are the digital elements in realization structures of FIR filters? | 1 | 4 | 1 |
| | ix) List the Addressing Modes of TMS320C5X Processor. | 1 | 5 | 1 |
| | x) What is a Digital Signal Processor (DSP)? | 1 | 5 | 1 |
| 2(A) | (i) Identify whether the system defined by $y[n] = x^2[n]$ is causal and time-invariant. | 2 | 1 | 2 |
| | (ii) Apply the overlap-save technique to filter the sequence $x(n) = (2, 1, 3, 2, 1, 3, 2; 1, 3)$ using $h(n) = (1, 2, 1)$. Choose appropriate block size and find the output sequence. | 10 | 1 | 3 |
| OR | | | | |
| 2(B) | Solve the difference equation | 12 | 1 | 3 |
| | $y(n) = x(n) + \frac{5}{6}y(n-1) - \frac{1}{6}y(n-2)$ | | | |
| | for the unit step input sequence. Assume that initial conditions $y(-1) = y(-2) = 1$. Make use of Z- Transform. | | | |
| 3(A) | (i) State and prove any two properties of Discrete Fourier Transform. | 4 | 2 | 2 |
| | (ii) Find circular convolution of the sequences $x_1(n) = \{1, -1, -2, 3, -1\}$ and $x_2(n) = \{1, 2, 3\}$ using concentric circle method. | 8 | 2 | 3 |
| OR | | | | |
| 3(B) | Find 8-point DFT of the sequence given below using DIT and DIF algorithms. | 12 | 2 | 3 |
| | $x(n) = \begin{cases} 1 & 0 \leq n \leq 7 \\ 0 & \text{otherwise} \end{cases}$ | | | |
| 4(A) | (i) Develop an analog butterworth filter that has -2dB passband attenuation at a frequency of 20 rad/sec and atleast -10dB stopband attenuation at a frequency of 30 rad/sec. | 6 | 3 | 4 |

| | | | | |
|---|---|----|---|---|
| (ii) | Find $H(z)$ for an analog Butterworth filter with $H(s) = \frac{9}{(s-4)(s+7)}$ using impulse invariance method for $T=1\text{sec}$. | 6 | 3 | 3 |
| OR | | | | |
| 4(B) | Develop Direct form-II and Parallel structure to realize the system with difference equation given below: $y(n) = -0.1 y(n-1) + 0.2 y(n-2) + 3 x(n) + 3.6 x(n-1) + 0.6 x(n-2)$ | 12 | 3 | 3 |
| 5(A) | Apply Hamming window and design FIR high pass filter with the frequency response for $N=11$. Also find $H(z)$. | 12 | 4 | 4 |
| $H_d(e^{j\omega}) = \begin{cases} 1 & \pi/4 \leq \omega \leq \pi \\ 0 & \omega < \pi/4 \end{cases}$ | | | | |
| OR | | | | |
| 5(B) | Select Direct form and linear phase realization to implement the system function, $H(z) = 1.6 + 9z^{-1} + 15z^{-2} + 18z^{-3} + 15z^{-4} + 9z^{-5} + 1.6z^{-6}$ | 12 | 4 | 3 |
| 6(A) | (i) Explain the internal architecture of TMS320C6X DSP processor. | 8 | 5 | 2 |
| | (ii) Explain On- chip Memory in TMS320C5X Processor. | 4 | 5 | 2 |
| OR | | | | |
| 6(B) | What is a Digital Signal Processor? Explain the Real-Time Processing Requirements of the Digital Signal Processors. | 12 | 5 | 4 |
| ***END*** | | | | |

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)**B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026****MICROWAVE AND OPTICAL COMMUNICATIONS**

(Department of Electronics and Communication Engineering)

Time: 3Hrs**Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|--------|--|-------|----|----|
| 1. | i) Why cannot TEM mode exist in a hollow waveguide? | 1M | 1 | 2 |
| | ii) Write the expression for cutoff frequency of TE_{mn} mode in a rectangular waveguide. | 1M | 1 | 1 |
| | iii) What are the properties of S-matrix? | 1M | 2 | 2 |
| | iv) What is a Magic Tee? Why is it called Magic Tee? | 1M | 2 | 1 |
| | v) What is the significance of VSWR measurements? | 1M | 3 | 1 |
| | vi) What is a microwave bench? | 1M | 3 | 2 |
| | vii) What is meant by total internal reflection in optical fibres? | 1M | 4 | 1 |
| | viii) What is the difference between single-mode fibre and multimode fibre? | 1M | 4 | 2 |
| | ix) What is link power budget? | 1M | 5 | 2 |
| | x) Define shot noise in photodetectors. | 1M | 5 | 2 |
| 2(A) | (i) Derive the expression for power transmitted in a waveguide using the Poynting vector. Explain attenuation in waveguides. (ii) If the average Poynting vector is 50 W/m^2 and area = 0.02 m^2 , calculate transmitted power. | 12M | 1 | 3 |
| | | | | 3 |
| | OR | | | |
| 2(B) | An air-filled resonant cavity with dimensions $a = 5 \text{ cm}$, $b = 4 \text{ cm}$, $c = 10 \text{ cm}$ is made of copper ($\sigma_c = 5.8 \times 10^7 \text{ mhos/m}$). Find: (a) The Five Lowest Order Modes (b) The Quality Factor for the TE_{101} Mode. | 12M | 1 | 3 |
| 3(A) | a) Describe with the neat sketch the constructional details and principle of operation of a reflex klystron tube. With the help of Applegate diagram illustrate the phenomenon of bunching. b) Derive the expressions for bunched beam current and efficiency. | 6M | 2 | 3 |
| | | 6M | 2 | 3 |
| | OR | | | |
| 3(B) | Draw the diagram of a Directional coupler and explain the working. Derive S matrix of a directional coupler. | 12M | 2 | 4 |
| 4(A) | Elaborate the principle of operation of a Gunn diode with a suitable diagram, explaining the phenomenon using the two-valley theory. | 12M | 3 | 3 |
| | OR | | | |
| 4(B) | With the help of a neat sketch, briefly explain the functions of different blocks of a microwave bench. Explain the double minimum method of measuring VSWR. | 12M | 3 | 3 |
| 5(A) | Illustrate Snell's Law with a neat diagram and analyze the characteristics and propagation of light in optical waveguides. Derive the expression for Numerical Aperture (NA) and list the significance of the acceptance angle. | 12M | 4 | 4 |

OR

| | | | | |
|-----------|--|-----|---|---|
| 5(B) | Discuss dispersion in optical fibres along with modal dispersion, chromatic dispersion, and waveguide dispersion. | 12M | 4 | 3 |
| 6(A) | Discuss the physics and structure of PIN and APD photodetectors. Cover: (i) the basic structure and operating principle of each, (ii) the quantum efficiency and responsivity definitions, (iii) the impact ionization process in APDs, (iv) noise characteristics comparison, and (v) advantages and limitations of each type with appropriate applications. | 12M | 5 | 3 |
| OR | | | | |
| 6(B) | Explain the radiation pattern characteristics of semiconductor light sources. Discuss: (a) the difference between edge-emitting and surface-emitting structures, (b) how the dimensions of the active region affect the far-field pattern, (c) the role of waveguiding in controlling radiation pattern, (d) the concept of lateral and transverse modes, and (e) how these patterns affect coupling efficiency to optical fibres. | 12M | 5 | 3 |

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026**VLSI Design****(Department of Electronics and Communication Engineering)****Time: 3Hrs****Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|---|-------|----|----|
| 1. | i) What is IDS–VDS characteristic? | 1 | 1 | 2 |
| | ii) What is threshold voltage in MOSFET? | 1 | 1 | 1 |
| | iii) Define λ -based design rule. | 1 | 2 | 1 |
| | iv) Draw stick diagram for CMOS inverter. | 1 | 2 | 1 |
| | v) What is meant by transmission gate? | 1 | 3 | 1 |
| | vi) What is meant by fringing field capacitance in MOSFET? | 1 | 3 | 1 |
| | vii) Draw a 3-bit even parity generator. | 1 | 4 | 1 |
| | viii) List the advantages of field programmable gate array. | 1 | 4 | 1 |
| | ix) Differentiate on line and off line BIST. | 1 | 5 | 1 |
| | x) List any two scan-based design techniques for DFT. | 1 | 5 | 1 |
| 2(A) | Analyse the mid- point voltage of CMOS inverter with voltage transfer characteristics. | 12 | 1 | 4 |
| OR | | | | |
| 2(B) | Explain the design and operation of BiCMOS inverter and compare it with CMOS inverter. | 12 | 1 | 2 |
| 3(A) | Discuss the stick diagram concepts to represent CMOS NAND gate and explain how it helps in layout design. | 12 | 2 | 3 |
| OR | | | | |
| 3(B) | Analyse scaling of MOS circuits and discuss its impact on device performance. | 12 | 2 | 4 |
| 4(A) | Derive the rise time and fall time expression of CMOS inverter. | 12 | 3 | 4 |
| OR | | | | |
| 4(B) | Discuss the impact of driving large capacitive loads with examples. | 12 | 3 | 3 |
| 5(A) | Design a 4-bit ALU with neat sketches. | 12 | 4 | 4 |
| OR | | | | |
| 5(B) | Design a 2- bit magnitude comparator using logic gates | 12 | 4 | 4 |
| 6(A) | Explain in detail about functional blocks and architecture of built in self-test. | 12 | 5 | 2 |
| OR | | | | |
| 6(B) | Describe the role of scan- based design techniques with neat sketches. | 12 | 5 | 3 |

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE

(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026**Embedded Systems****(Department of Electronics and Communication Engineering)****Time: 3Hrs****Max Marks: 70M**

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|---|-------|----|----|
| 1. | i) Define embedded systems. | 1 | 1 | 1 |
| | ii) What is the role of Flash memory in a microcontroller? | 1 | 1 | 2 |
| | iii) Write the importance of Task Scheduling in embedded systems. | 1 | 2 | 2 |
| | iv) Explain the basic concept of the FreeRTOS kernel? | 1 | 2 | 2 |
| | v) List any two step in UART initialization. | 1 | 3 | 2 |
| | vi) What is shared memory communication between tasks? | 1 | 3 | 2 |
| | vii) List Real-world Applications of ARM-based Embedded Systems. | 1 | 4 | 1 |
| | viii) Why is a hardware timer more power efficient than SysTick delay? | 1 | 4 | 2 |
| | ix) How are decision symbols used in an activity diagram? | 1 | 5 | 2 |
| | x) How does hardware/software partitioning reduce latency? | 1 | 5 | 2 |
| 2(A) | (i) Compare between RISC and CISC. | 6 | 1 | 2 |
| | (ii) Explain the functional relationship between sensors and actuators. | 6 | 1 | 2 |
| OR | | | | |
| 2(B) | Describe the concept of memory-mapped I/O and describe how a processor communicates with peripherals as memory locations. | 12 | 1 | 2 |
| 3(A) | (i) Explain the roles of a cross-compiler and a linker in generating an executable binary for an embedded target processor. | 6 | 2 | 2 |
| | (ii) Discuss the Processes and Threads in multitasking. | 6 | 2 | 2 |
| OR | | | | |
| 3(B) | Sketch and Explain the interrupt vector table mechanism and describe how the processor switches from main program execution to an ISR. | 12 | 2 | 2 |
| 4(A) | (i) Explain the Memory and Synchronization Issues with suitable example. | 6 | 3 | 2 |
| | (ii) Discuss Message Queues and Pipes. | 6 | 3 | 2 |
| OR | | | | |
| 4(B) | Design an I2C-based communication system to interface multiple sensors with a microcontroller and explain the addressing and data transfer mechanism. | 12 | 3 | 3 |
| 5(A) | (i) Explain the advantages of bit-banding in Cortex-M3/M4 for atomic operations compared to read-modify-write sequences. | 6 | 4 | 2 |
| | (ii) Sketch the structure and functions of the System Control Block (SCB) in ARM Cortex-M processors. | 6 | 4 | 2 |
| OR | | | | |
| 5(B) | Summarize how the startup assembly code initializes the .bss section and transfers the .data section from Flash to SRAM during the boot process. | 12 | 4 | 2 |
| 6(A) | (i) Compare the throughput and execution time of two processor architectures for a voice recognition task. | 6 | 5 | 2 |
| | (ii) List the Co-simulation Tools used in Embedded systems. | 6 | 5 | 2 |
| OR | | | | |
| 6(B) | Design a memory partitioning scheme for a multi-core system to minimize data contention and improve bus utilization. | 12 | 5 | 3 |

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Wireless Sensor Networks

(Department of Electronics and Communication Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.
All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|--|-------|----|----|
| 1. | i) Define Wireless Sensor Network? | 1M | 1 | 1 |
| | ii) What is a sink node? | 1M | 1 | 1 |
| | iii) What is the importance of gateway in WSN? | 1M | 2 | 2 |
| | iv) Give the need of frequency allocation in wireless communication? | 1M | 2 | 1 |
| | v) What is IEEE 802.15.4 standard? | 1M | 3 | 1 |
| | vi) Define low duty cycle protocol? | 1M | 3 | 2 |
| | vii) What is clock drift? | 1M | 4 | 1 |
| | viii) Define anchor nodes? | 1M | 4 | 1 |
| | ix) What is WSN simulation tool? | 1M | 5 | 1 |
| | x) What is a sensor network simulator? | 1M | 5 | 1 |
| 2(A) | Describe the role of sensing, processing, and communication units in WSN nodes. | 12M | 1 | 2 |
| OR | | | | |
| 2(B) | Discuss the characteristics and constraints of wireless sensor networks. | 12M | 1 | 2 |
| 3(A) | Explain the transceiver design considerations for wireless sensor nodes. | 12M | 2 | 2 |
| OR | | | | |
| 3(B) | Discuss the impact of network topology on WSN performance. | 12M | 2 | 2 |
| 4(A) | Discuss the S-MAC protocol with its advantages and limitations. | 12M | 3 | 2 |
| OR | | | | |
| 4(B) | Explain the wakeup radio concepts in wireless sensor networks. | 12M | 3 | 2 |
| 5(A) | Explain the Reference Broadcast Synchronization (RBS) protocol. | 12M | 4 | 2 |
| OR | | | | |
| 5(B) | Discuss the localization techniques used in wireless sensor networks. | 12M | 4 | 2 |
| 6(A) | Describe in detail the hardware architecture of Berkeley Motes with neat diagram used in wireless sensor networks. | 12M | 5 | 2 |
| OR | | | | |
| 6(B) | Discuss the importance of simulation tools in the design and testing of Wireless Sensor Networks. | 12M | 5 | 2 |

END

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Radar Engineering

(Department of Electronics and Communication Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|--|-------|----|----|
| 1. | i) What is the function of a duplexer? | 1 | 1 | 1 |
| | ii) Define minimum detectable signal (MDS). | 1 | 1 | 1 |
| | iii) Give the advantages of FM-CW radar. | 1 | 2 | 1 |
| | iv) What information does Doppler frequency provide? | 1 | 2 | 2 |
| | v) What are the blind ranges? | 1 | 3 | 1 |
| | vi) What are the COHO and STALO in MTI radars? | 1 | 3 | 1 |
| | vii) What does "tracking accuracy" in radar systems refer to? | 1 | 4 | 1 |
| | viii) How does mono-pulse tracking differ from conical scan? | 1 | 4 | 1 |
| | ix) Define array factor. | 1 | 5 | 1 |
| | x) What is a direction finder (DF)? | 1 | 5 | 1 |
| 2(A) | (i) Write about radar system losses | 6 | 1 | 2 |
| | (ii) Explain the terms integration loss and radar cross-section of a target | 6 | 1 | 2 |
| OR | | | | |
| 2(B) | Explain the block diagram of a radar with a neat diagram and write its advantages, limitations and applications. | 12 | 1 | 2 |
| 3(A) | (i) What is the need of Non-zero IF receiver? Explain the function | 6 | 2 | 2 |
| | (ii) Explain the working principle of multiple frequency CW radar. What are the limitations of CW radar? | 6 | 2 | 2 |
| OR | | | | |
| 3(B) | (i) What is the major limitation of CW Radar and how it can be overcome? Calculate the Doppler frequency of an aircraft moving with a speed of 450 Knots and when the CW radar is working with $\lambda = 9$ cm. | 6 | 2 | 3 |
| | (ii) Explain the need of isolation between transmitter and receiver. Suggest suitable components | 6 | 2 | 2 |
| 4(A) | (i) Explain the working principle of a delay line canceller in radar and how it helps in differentiating between stationary and moving targets? | 6 | 3 | 2 |
| | (ii) Write short notes on Range Gated Doppler Filters. | 6 | 3 | 2 |
| OR | | | | |
| 4(B) | Explain MTI radar with a power oscillator transmitter with a necessary block diagram and mentioned advantages, limitations and applications. | 12 | 3 | 2 |
| 5(A) | Differentiate how mono-pulse tracking is performed in two angular coordinates (azimuth and elevation) and relate it to tracking accuracy. | 12 | 4 | 3 |
| OR | | | | |
| 5(B) | Examine range tracking by illustrating and explaining the echo pulse, early-late range gates, and their difference signal. | 12 | 4 | 2 |
| 6(A) | Evaluate different noise reduction techniques in radar systems. | 12 | 5 | 3 |
| OR | | | | |
| 6(B) | Analyze the working principle of the LORAN (Long Range Navigation) system and examine how it is utilized to provide accurate navigational aids for ships and transoceanic aircraft. | 12 | 5 | 3 |

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MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE, MADANAPALLE
(UGC-AUTONOMOUS INSTITUTION)

B. Tech III Year II Semester (R23) Regular End Semester Examinations, May 2026

Satellite Communications

(Department of Electronics and Communication Engineering)

Time: 3Hrs

Max Marks: 70M

Attempt all the questions. All parts of the question must be answered in one place only.

All parts of Q.no 1 are compulsory. In Q.no 2 to 6 answer either A or B only

| S. No. | Question | Marks | CO | BL |
|-----------|---|-------|----|----|
| 1. | i) State Kepler's first law. | 1 | 1 | 1 |
| | ii) What is escape velocity? | 1 | 1 | 1 |
| | iii) Define spacecraft subsystem. | 1 | 2 | 1 |
| | iv) Mention any two environmental tests carried out on satellites. | 1 | 2 | 1 |
| | v) How does CDMA use codes to separate users? | 1 | 3 | 1 |
| | vi) What is ALOHA? | 1 | 3 | 1 |
| | vii) Expand EIRP. | 1 | 4 | 1 |
| | viii) State link margin. | 1 | 4 | 1 |
| | ix) Recall the purpose of a radome in Earth station antenna design? | 1 | 5 | 1 |
| | x) Outline "step-track" method in antenna tracking. | 1 | 5 | 1 |
| 2(A) | (i) Describe various multistage rocket performance parameters. | 6 | 1 | 3 |
| | (ii) Derive the orbital velocity expression. | 6 | 1 | 3 |
| OR | | | | |
| 2(B) | Analyze and explain in detail the step-by-step procedure for preparing a complete satellite link budget for a Ku-band geostationary satellite link. Clearly indicate all major components, typical practical values, and discuss the significance of each parameter in ensuring reliable communication. | 12 | 1 | 3 |
| 3(A) | (i) Illustrate the elements of communication satellite design. | 6 | 2 | 3 |
| | (ii) Describe payload and bus integration and associated challenges. | 6 | 2 | 2 |
| OR | | | | |
| 3(B) | Describe EPS, AOCS and Thermal subsystems of a communication satellite. | 12 | 2 | 2 |
| 4(A) | (i) Discuss the concept of CDMA in satellite communication with block diagram. | 6 | 3 | 2 |
| | (ii) Compare its capacity advantages and interference handling with FDMA/TDMA. | 6 | 3 | 3 |
| OR | | | | |
| 4(B) | With a neat sketch, describe the concept of Satellite On-Board Processing (OBP). | 12 | 3 | 3 |
| 5(A) | A satellite communication system operating in Ku-band is experiencing frequent link outages during the monsoon season in a tropical region. Analyze the possible causes and propose a comprehensive set of design modifications (both at satellite and ground segment) to improve link availability to at least 99.7% while keeping cost increase moderate. | 12 | 4 | 4 |
| OR | | | | |
| 5(B) | Analyze the basic principles of Satellite Link Design with necessary equations and block diagram | 12 | 4 | 4 |
| 6(A) | Evaluate and validate the working of a satellite broadcasting system with a neat block diagram. Explain the function of each component and justify how the system ensures reliable signal distribution. | 12 | 5 | 4 |
| OR | | | | |
| 6(B) | Analyze the complete signal flow in a typical Earth station for both transmit and receive chains using a neat block diagram. Examine the role of each major subsystem and analyze how redundancy techniques are implemented to ensure high availability. | 12 | 5 | 4 |

END