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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 19EI6PCESD **Max Marks: 100**
Course: EMBEDDED SYSTEM DESIGN

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

UNIT - I

1	a)	With a neat block diagram, explain typical elements of an Embedded System.	**06**
	b)	Discuss the working of sensors and actuators in any embedded system by giving an example for each.	**07**
	c)	Explain any two onboard serial communication interfaces that help connecting integrated circuits with the controller within an embedded system.	**07**

OR

2	a)	What is Embedded System Firmware? Analyze the development flow of Firmware.	**06**
	b)	List out the quality attributes of an embedded system. Discuss any two-domain specific embedded systems, in which quality attributes become critical parameters to measure.	**07**
	c)	Define RTOS. How do they help in execution of parallel tasks? Compare and contrast interrupt driven embedded programming from RTOS based programming.	**07**

UNIT - II

3	a)	With a block schematic, explain the architectural features of ARM Cortex M3. Mention the core features of STM microcontroller IC.	**07**
	b)	Explain the working of GPIO for different modes of operation in STM32Fxxx Microcontroller.	**07**
	c)	Write simplified Clock Circuit of STM32F0xx microcontroller and bring out the features of Reset and Control Circuit (RCC).	**06**

OR

4	a)	Discuss the Memory organization of STM32Fxxx microcontroller. Hence bring out the specific features of Flash memory. Explain Boot from Flash process in the microcontroller**.**	**07**
	b)	What is the difference between AHB and APB busses in the STM Microcontrollers?	**03**
	c)	With example of assembly instructions, show the executional efficiency of bit banding and memory aliasing in ARM Cortex M3.	**10**

UNIT - III

5 a) Explain the working of I2C protocol to read data from a sensor and display on LCD. Compare features of I2C with those of SPI protocol. **10**

b) Briefly discuss the utility of USB and CAN protocols. **06**

c) Mention three comparative points between Bluetooth and Zig-Bee. **04**

UNIT - IV

6 a) STM32Fxxx System on Chip GPIO PA-7 is connected to Push button key and PC-3 is connected to LED. Write an Embedded 'C' program to perform the task as: when key is pressed, LED glows. Include all the necessary supporting files. **10**

b) What are interrupt request handlers (IRQs) in ST Microcontroller? With an example of time delay calculations using Timer, show how interrupt-based delay generation can help in creating required baud rate for USART serial communication **10**

UNIT - V

7 a) Briefly explain the ARM-GCC tool chain to produce the binary executable file of an application. **06**

b) How does multiple Multiply and Accumulate (MAC) units in the ARM-6 architecture help in faster computations? Explain. **06**

c) **08**

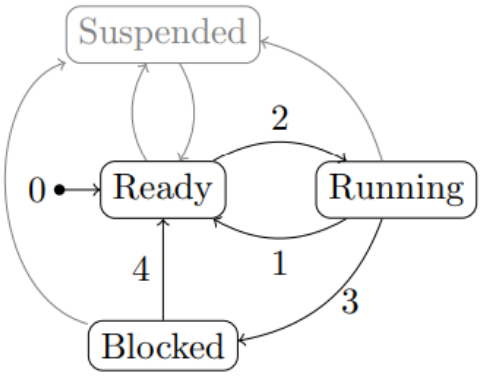

Fig:01

Explain with execution of threads and their transitions with respect to the given state diagram in Fig:01.

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**

Course Code: 22EI6PCESD **Max Marks: 100**

Course: Embedded System Design

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			MODULE - I	*CO*	*PO*	Marks
1	a)		What are the characteristics of a typical Embedded System? Relate the characteristics to any two Embedded application examples	*CO1*	*PO1*	**07**
	b)		Discuss any two actuators that are generally used to build Electro Mechanical Systems using microcontroller.	*CO1*	*PO1*	**08**
	c)		Describe (i) Interrupt Latency (ii) Real time Issues for Embedded system design	*CO1*	-	**05**
			OR			
2	a)		Define an Embedded System. List the quality attributes of a typical Embedded System and explain any two in detail	*CO1*	*PO1*	**07**
	b)		Discus about the product development life cycle of an Embedded System with relevant diagram.	*CO1*	*PO1*	**08**
	c)		Explain various types of memories used in Embedded System Design	*CO1*	-	**05**
			MODULE - II			
3	a)		Differentiate embedded software and firmware, and how are they typically used in embedded systems?	*CO2*	*PO2*	**08**
	b)		What are the main differences between standard C programming and embedded C programming? List Embedded ‘C’ datatypes used in microcontroller programming	*CO2*	*PO2*	**06**
	c)		What is an Interrupt Service Routine (ISR), and why are ISRs crucial in embedded systems? Explain	*CO2*	*PO2*	**06**
			OR			

	4	a)	How do modifiers such as 'volatile' and 'const' affect the behavior of variables in embedded C? Discuss with an example	*CO2*	*PO2*	**08**
		b)	What is a peripheral device driver? How does it help in Embedded programming? Give an example	*CO2*	*PO2*	**06**
		c)	Discuss the challenges and considerations in implementing multithreading in embedded software.	*CO2*	*PO2*	**06**
			MODULE - III			
	5	a)	What do you mean by Alternate function mode of operation in General Purpose Input Output (GPIO) Ports of STM Microcontroller? Build the logic, with relevant configuration of registers, that are necessary for GPIO ports operation for (i) Bit Set Reset Mode (ii) Alternate function mode	*CO3*	*PO3*	**10**
		b)	Why is the hardware delay generated by general purpose Timers in ST Controller is more accurate than the software delay? How will Auto Reload Register (ARR), Pre-scalar Register (PSR) and the Counter Register (CNTR) are used to program TIM3 in STM Controller in hardware delay generation? Build an Embedded 'C' program to generate a delay of I Millisecond with programmable timer using IRQs.	*CO3*	*PO3*	**10**
			MODULE - IV			
	6	a)	Illustrate the working of USART in the STM Microcontroller for Asynchronous serial communication with relevant programming steps and build an embedded 'C' program to transmit the data serially from one microcontroller to the other.	*CO4*	*PO3*	**08**
		b)	Differentiate Bluetooth from ZigBee protocol in terms of number of users, power consumption and data rate supported.	*CO4*	*PO2*	**06**
		c)	Provide the configuration of GPIO pins for alternate functions in STM controller for SPI serial communication interface.Which are the major steps to be followed while programming SPI protocol for master slave operation in STM microcontroller?	*CO4*	*PO2*	**06**
			MODULE - V			
	7	a)	With the help of a block diagram of a Rasberry -Pi based on ARM7 microprocessor, bring out the features of processor that are different from a Cortex M microcontroller for enhanced speed of operation. Discus processor based application example.	*CO5*	*PO2*	**10**
		b)	Justify the need of a RTOS in Embedded system with an example	*CO5*	*PO2*	**06**
		c)	How does GCC tool-chain with emulator help in cross compilation? Discuss	*CO5*	*PO2*	**04**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**

Course Code: 22EI6PCIDN **Max Marks: 100**

Course: Industrial Data Networks

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			MODULE - I	*CO*	*PO*	Marks
1	a)		Explain the ISO model with its importance of each layer. Also, give its significance in Industrial Process automation with example.	*CO1*	*PO1*	**10**
	b)		Describe the HDLC frame format and different types & transfer modes in HDLC.	*CO1*	*PO1*	**10**
			OR			
2	a)		With neat sketch explain the concept of CSMA/CD networks.	*CO1*	*PO1*	**10**
	b)		Explain TCP/IP and MAC protocol in LAN network	*CO1*	*PO1*	**10**
			MODULE - II			
3	a)		Illustrate with suitable diagrams how Network connects to other networks through repeaters, bridges, and routers.	*CO2*	*PO2*	**10**
	b)		Summarize about the characteristic features, advantages and disadvantages of ARCnet with respect to industrial data networks.	*CO2*	*PO2*	**10**
			MODULE - III			
4	a)		For an automation industry with a 4-20mA analog signal, a standard data acquisition system should be upgraded with digital data transmission. Suggest suitable protocol for the given context and explain its working in detail.	*CO2*	*PO2*	**10**
	b)		Discuss HART protocol message format, its commands, and implementation of the OSI layer model.	*CO2*	*PO2*	**10**
			MODULE - IV			
5	a)		Elucidate the general foundation FIELDBUS architecture.	*CO3*	*PO2*	**10**

		b)	Generalize and interpret the concept of OLE for process control. Discuss the major components and importance of OPC.	*CO3*	*PO2*	**10**
			OR			
	6	a)	Describe the specification of BITBUS, CAN and WORLDFIP.	*CO3*	*PO2*	**10**
		b)	Summarize the functionality of a Fieldbus system.	*CO3*	*PO2*	**10**
			MODULE - V			
	7	a)	Design a MODBUS function code to Read output coil status and Read digital input status by developing request and response frame.	*CO3*	*PO3*	**10**
		b)	Compare and contrast between Profibus FMS, DP and PA versions.	*CO3*	*PO2*	**10**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**

Course Code: 22EI6PCLOI **Max Marks: 100**

Course: Laser and Optical Instrumentation

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			MODULE - I	*CO*	*PO*	Marks
1	a)		With relevant energy level diagram explain the construction and working principle of CO2 Laser.	*CO1*	*PO1*	**10**
	b)		Define laser mode locking? With relevant representation explain the concept of mode locking in Laser.	*CO1*	*PO1*	**06**
	c)		List the characteristics of the laser light.	*CO1*	*PO1*	**04**
			OR			
2	a)		With the help of neat labelled diagram and relevant energy level diagram, explain the construction and working principle of Nd-YAG Laser.	*CO1*	*PO1*	**10**
	b)		Summarize the Q-switching method to obtain "GIANT PULSE" with Rotating Mirror.	*CO1*	*PO1*	**06**
	c)		List the difference between three energy level and four energy level laser.	*CO1*	*PO1*	**04**
			MODULE - II			
3	a)		Discuss how beam modulation telemetry method can be used to measure intermediate distances m to km.	*CO2*	*PO2*	**10**
	b)		"Hologaphy is a technique that records the light scattered from an object and subsequently at a later time, reconstructs the object's image", justify this statement using relevant diagrams.	*CO2*	*PO2*	**10**
			MODULE - III			
4	a)		Write the advantages of optical fiber over conventional coaxial cable.	*CO3*	*PO1*	**04**
	b)		What is Intermodal dispersion? Derive a formula for Δt_{max}, the maximum intermodal dispersion.	*CO2*	*PO2*	**08**

		c)	With relevant diagram explain the different types of optical fibers relevant to refractive index and modes.	*CO3*	*PO2*	**08**
			OR			
	5	a)	Calculate the number of allowed modes in an optical fibre which has a core refractive index of 1.53 and cladding refractive index of 1.50. The Vacuum wavelength of incident ray is 1.3μm. Core has diameter of 200μm.	*CO3*	*PO2*	**04**
		b)	Using ray theory concept derive the expression of the numerical aperture and acceptance angle of the optical fiber.	*CO2*	*PO2*	**08**
		c)	Explain the following losses in optical fiber i) Absorption loss, ii) Scattering loss and iii) Radiation loss	*CO2*	*PO2*	**08**
			MODULE - IV			
	6	a)	With a neat schematic diagram explain the passive fiber optic displacement transducers.	*CO3*	*PO2*	**06**
		b)	With relevant diagrams explain the following phase modulated fiber optic sensor. i) Mach-Zehnder Interferometer ii) Michelson Interferometer	*CO3*	*PO2*	**08**
		c)	"Fiber optic sensors are used to measure the current using principle of polarization", justify this statement with relevant diagram.	*CO3*	*PO1, PO6*	**06**
			MODULE - V			
	7	a)	"Fiber optic Gyroscope is used to measure the angular motion", Justify this statement with relevant diagrams and mathematical expressions.	*CO3*	*PO2*	**10**
		b)	What is Fiber Bragg gratings? Explain how FBG sensors are used to measure the strain with relevant diagrams.	*CO3*	*PO2*	**10**

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B.M.S. College of Engineering, Bengaluru-560019

Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics & Instrumentation Engineering **Duration: 3 hrs.**

Course Code: 22EI6PCPSA **Max Marks: 100**

Course: Process Automation

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

		MODULE- I	CO	PO	Marks
1	a)	Distinguish the features of the three major types of automation systems. Bring their unique features & relative advantages and disadvantages.	*CO1*	*PO2*	**06**
	b)	Illustrate the architecture of PLC with neat sketch. Draw the block schematic of AC/DC input circuit & their interface.	*CO3*	*PO4* *PO6*	**08**
	c)	Explain the working of Data Acquisition System (DAS) with a neat diagram.	*CO1*	*PO2*	**06**
		MODULE- II			
2	a)	Design a PLC program using ladder logic or functional block diagram to control the water level in atank system based on three operation modes viz OFF,MANUAL,AUTOMATIC	*CO2*	*PO2* *PO3*	**06**
	b)	Develop suitable ladder logic per IEC 6113-3 standards for automatic stacking process and justify the execution of the program.	*CO2*	*PO2* *PO3*	**08**
	c)	Explain the function of UP-DOWN counter with the help of PLC program for a particular application.	*CO2*	*PO2* *PO3*	**06**
		OR			
3	a)	Draw the relay ladder diagram & ladder logic programs for AND, OR, NOT, AND-OR & OR-AND logic. A relay based controller will allow 3 switches in a room to control a single light. Solve and draw the ladder program using all combination of switch position	*CO2*	*PO2* *PO3*	**08**
	b)	Bring out the differences between on delyTimer ON, Retentive timer & Timer OFF delay with its corresponding instructions. Develop the ladder logic that will turn on output light, 22 seconds after switch 'A' has been turned on.	*CO2*	*PO2* *PO3*	**06**
	c)	With a suitable ladder diagram, explain how cascading of counters can be implemented to achive high count values.	*CO2*	*PO2* *PO3*	**06**

			MODULE - III			
	4	a)	Interpret data transfer and data compare instructions as they apply to a PLC program. Explain the MOV & Masked move instruction with associated status bits & its addressing format.	*CO2*	*PO2* *PO3*	**08**
		b)	Design a ladder logic as per IEC6113-3 standards to automate a vessel overfill system.	*CO2*	*PO2* *PO3*	**06**
		c)	Justify how SQL instruction can be used in PLC programming to automate a process.	*CO2*	*PO2* *PO3*	**06**
			MODULE - IV			
	5	a)	State the functional components in overall Distributed Control System (DCS) with neat diagram.	*CO3*	*PO4* *PO6*	**08**
		b)	Define Distributed Control System (DCS). Explain the three control zones (DCN,DM2,PIN) in a DCS and how they interact with each other.	*CO3*	*PO4* *PO6*	**06**
		c)	Explain the typical architecture of DCS with a labeled diagram	*CO1*	*PO2*	**06**
			MODULE - V			
	6	a)	Enumerate the advantages and disadvantages of operator stations.	*CO1*	*PO2*	**08**
		b)	What is HMI? List different functions in a process control automation.	*CO1*	*PO2*	**06**
		c)	Compare HMI and desktop based operator interfaces.	*CO1*	*PO2*	**06**
			OR			
	7	a)	Draw the architecture of different generations of SCADA Systems (First generation to 4th generation). Why 4th generation SCADA architecture more reliable & economical?	*CO3*	*PO4* *PO6*	**08**
		b)	Explain the client server architecture of SCADA	*CO1*	*PO2*	**06**
		c)	Enumerate the advantages of SCADA.	*CO1*	*PO2*	**06**

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June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**

Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**

Course Code: 22EI6PE2AM **Max Marks: 100**

Course: Artificial Intelligence & Machine Learning

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

			MODULE - I	*CO*	*PO*	Marks
1	a)		What are the 3 different ways of solving the Tic-Tac-Toe Problem applying AI? Show the improvements obtained from one over the other using better knowledge representation.	*1*	*1*	**08**
	b)		Enumerate and explain the advantages of Breadth First Search and Depth First Search.	*1*	*1*	**04**
	c)		What is meant by uniformed search? State and explain Depth-first-search strategy with an example.	*1*	*1*	**08**
			OR			
2	a)		What is an AI technique? Explain in terms of knowledge representation.	*1*	*1*	**06**
	b)		Write a short note on problem area in Artificial Intelligence.	*1*	*1*	**08**
	c)		Explain the following uninformed search strategies. i) Depth Limited Search ii) Uniform Cost Search	*1*	*1*	**06**
			MODULE - II			
3	a)		Explain how AND-OR graphs are used in problem reduction.	*2*	*2*	**06**
	b)		What is Heuristic search? Write and explain Generate and Test algorithm.	*2*	*2*	**08**
	c)		Explain in detail about the means–end analysis procedure with example.	*2*	*2*	**06**
			OR			
4	a)		Explain constraint satisfaction and solve the cryptoarithmetic problem: SEND + MORE = MONEY.	*2*	*2*	**08**
	b)		Write and explain hill-climbing and steepest hill-climbing search algorithms in artificial intelligence.	*2*	*2*	**12**

<table>
<tr><td></td><td></td><td></td><td colspan="3">MODULE - III</td><td></td><td></td><td></td></tr>
<tr><td></td><td>5</td><td>a)</td><td>What is machine learning? Explain different perspectives and issues in concepts of Machine learning.</td><td>3</td><td>2</td><td>08</td></tr>
<tr><td></td><td></td><td>b)</td><td>Write candidate- elimination algorithm. Apply the algorithm to obtain the final version space for the training example given in the below table 1.

Table 1
<table><tr><th>Sl. No.</th><th>Sky</th><th>Air Temp</th><th>Humidity</th><th>Wind</th><th>Water</th><th>Forecast</th><th>Enjoy Sport</th></tr><tr><td>1.</td><td>Sunny</td><td>Warm</td><td>Normal</td><td>strong</td><td>warm</td><td>same</td><td>yes</td></tr><tr><td>2.</td><td>Sunny</td><td>Warm</td><td>High</td><td>strong</td><td>warm</td><td>same</td><td>yes</td></tr><tr><td>3.</td><td>Rainy</td><td>cool</td><td>High</td><td>strong</td><td>warm</td><td>change</td><td>no</td></tr><tr><td>4.</td><td>Sunny</td><td>warm</td><td>High</td><td>strong</td><td>cool</td><td>change</td><td>yes</td></tr></table></td><td>3</td><td>3</td><td>12</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">MODULE - IV</td><td></td><td></td><td></td></tr>
<tr><td></td><td>6</td><td>a)</td><td>List and explain appropriate problems for decision tree learning.</td><td>4</td><td>2</td><td>06</td></tr>
<tr><td></td><td></td><td>b)</td><td>Describe the hypothesis space search in decision tree learning.</td><td>4</td><td>2</td><td>06</td></tr>
<tr><td></td><td></td><td>c)</td><td>List and explain issues in decision tree learning.</td><td>4</td><td>2</td><td>08</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">MODULE - V</td><td></td><td></td><td></td></tr>
<tr><td></td><td>7</td><td>a)</td><td>Draw the perceptron network with the notation. Derive an equation of gradient descent rule to minimize the error.</td><td>4</td><td>2</td><td>10</td></tr>
<tr><td></td><td></td><td>b)</td><td>Write an algorithm for BACKPROPAGATION which uses stochastic gradient descent method. Comment on the effect of adding momentum to the network.</td><td>4</td><td>2</td><td>10</td></tr>
</table>

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Autonomous Institute Affiliated to VTU

June / July 2024 Semester End Main Examinations

Programme: B.E. **Semester: VI**
Branch: Electronics and Instrumentation Engineering **Duration: 3 hrs.**
Course Code: 22EI6PE2BI **Max Marks: 100**
Course: Biomedical Instrumentation

Instructions: 1. Answer any FIVE full questions, choosing one full question from each unit.
2. Missing data, if any, may be suitably assumed.

Important Note: Completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. Revealing of identification, appeal to evaluator will be treated as malpractice.

				CO	PO	Marks
			MODULE - I			
1	a)		Summarize the classification of biomedical instruments.	*CO1*	*PO1*	**08**
	b)		Specify the significance of microelectrodes, its types and explain any one commercial microelectrode with a neat figure.	*CO1*	*PO1*	**08**
	c)		Enumerate the general constraints in designing a medical instrumentation system.	*CO1*	*PO3*	**04**
			MODULE - II			
2	a)		Define overpotential and elaborate on the three different components of the overpotential.	*CO2*	*PO1*	**10**
	b)		State the difference between body surface electrodes and internal electrodes. Explain the common forms of internal electrodes.	*CO2*	*PO1*	**10**
			OR			
3	a)		Elaborate on the different types of biosignals that can be measured and specify its importance.	*CO2*	*PO1*	**10**
	b)		EEG is measured using 10-20 electrodes, specify the reason behind its naming as 10-20 electrodes.	*CO2*	*PO1*	**05**
	c)		Identify the need for signal conditioning in biomedical instrumentation.	*CO2*	*PO3*	**05**
			MODULE - III			
4	a)		Discuss the various components of an ECG machine with the help of neat block diagram.	*CO3*	*PO3*	**08**
	b)		Discuss the principle of blood pressure measured based on Korotkoff sounds.	*CO1*	*PO1*	**06**
	c)		Specify the significance of the following devices i) Pacemakers ii) Defibrillators	*CO1*	*PO3*	**06**
			MODULE - IV			
5	a)		Elaborate on the single channel telemetry system which is suitable for the transmission of an electrocardiogram.	*CO4*	*PO1*	**12**

		b)	Identify and explain the essential parameters for telemedicine.	*CO4*	*PO1*	**08**
			OR			
	6	a)	Analyze how implantable telemetry system is employed for blood pressure and blood flow measurement.	*CO4*	*PO1*	**10**
		b)	Discuss the transmission of medical video, images and audio files.	*CO4*	*PO1*	**10**
			MODULE - V			
	7	a)	Identify and mention the challenges in Hospital Administration.	*CO5*	*PO1*	**05**
		b)	Enumerate the different types of biomedical waste and its management.	*CO5*	*PO1*	**08**
		c)	Discuss the role of medical informatics in improving patient care and clinical decision making.	*CO5*	*PO1*	**07**

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