Reg. No.																

Question Paper Code	14621

M.E. / M.Tech. - DEGREE EXAMINATIONS, APRIL / MAY 2026

Second Semester

M.E. - Communication Systems

24PCOEL207 - SOFTWARE DEFINED RADIO

Regulations - 2024

Duration: 3 Hours | Max. Marks: 100

PART – A (i) (MCQ)
(16 × 1 = 16 Marks)
Answer ALL Questions

		Marks	K – Level	CO
1.	Infer primary advantage of Software Defined Radio (SDR) is a) Fixed architecture b) Low flexibility c) Reconfigurability through software d) Limited bandwidth	1	K2	CO1
2.	Which among the following is a military SDR initiative? a) GSM b) JTRS c) LTE d) WiMAX	1	K1	CO1
3.	Identify the primary use of the RF front end in SDR. a) Encryption b) Frequency translation and amplification c) Image processing d) File compression	1	K3	CO1
4.	Infer the dynamic range of an RF receiver. a) Antenna size b) Range of operating temperatures c) Ability to process weak and strong signals simultaneously d) ADC clock frequency	1	K2	CO2
5.	Choose the component that introduces quantization error in SDR systems? a) Mixer b) Oscillator c) ADC d) Antenna	1	K3	CO2
6.	MEMS technology in SDR is mainly used for _____ a) Audio coding b) Flexible RF system implementation c) Image filtering d) Image filtering	1	K1	CO2
7.	Which filter structure is most computationally efficient for implementing a Decimator? a) Standard FIR Filter b) Polyphase FIR Filter c) IIR Butterworth Filter d) Cascaded Integrator-Comb (CIC) Filter	1	K2	CO3
8.	Digital filter banks are commonly used for _____ a) Spectrum decomposition b) Data encryption c) Data encryption d) Clock synchronization	1	K1	CO3
9.	Choose the primary role of a "Gardner Interpolator" in a digital receiver. a) To perform frequency up-conversion b) To adjust sampling instances for symbol timing recovery c) To reduce quantization noise d) To compensate for carrier phase offset	1	K3	CO3

10.	Identify the advantage of "Bandpass Sampling" in SDR receivers: a) It requires a sampling rate higher than the highest RF frequency b) It allows for the direct digitization of an IF signal with a lower sampling rate than traditional Nyquist c) It eliminates the need for an ADC d) It increases the total power consumption	*1*	*K2*	*CO4*
11.	Which ADC architecture provides very high conversion speed? a) Flash ADC b) Dual slope ADC c) Dual slope ADC d) Counter type ADC	*1*	*K1*	*CO4*
12.	What improvement does a smart antennas primarily provide? a) Storage capacity b) Storage capacity c) Storage capacity d) Battery charging speed	*1*	*K2*	*CO4*
13.	FPGA stands for _____ . a) Field Programmable Gate Array b) Fixed Programmable Gate Architecture c) Fast Programming Grid Array d) Field Processor Gate Array	*1*	*K1*	*CO5*
14.	Select the technique that can be applied to an ADC to "spread" quantization noise and improve the Effective Number of Bits (ENOB)? a) Decimation b) Oversampling c) Overclocking d) Under-sampling	*1*	*K3*	*CO5*
15.	Identify the purpose of an "Object Broker" (like CORBA) in the JTRS SCA environment? a) To sell software licenses online b) To provide a standardized middleware for communication between distributed software components c) To encrypt the RF signal d) To manage the physical power distribution of the radio hardware	*1*	*K3*	*CO6*
16.	USRP is commonly used in SDR as _____ a) USRP is commonly used in SDR as b) A software compiler c) SDR hardware platform d) A networking protocol	*1*	*K2*	*CO6*

PART – A (ii) (Short Answer Questions)
(6 × 3 = 18 Marks)
Answer ALL Questions

17.	Examine Software Defined Radio and list any two advantages of SDR.	*3*	*K4*	*CO1*
18.	Identify the importance of RF front end in SDR systems and explain.	*3*	*K3*	*CO2*
19.	Calculate the output sampling rate for a system that cascades an upsampler(L=3) and a downsampler (M=2) on a 48kHz signal.	*3*	*K3*	*CO3*
20.	Distinguish between DAC and ADC architecture.	*3*	*K4*	*CO4*
21.	Illustrate the hardware requirements for implementing digital beamforming in a smart antenna array.	*3*	*K3*	*CO5*
22.	Compare FPGA and ASIC technologies used in SDR implementation.	*3*	*K4*	*CO6*

PART - B (Descriptive Answer Questions)
(6 × 11 = 66 Marks)
Answer ALL Questions

23.	a)	Identify need, characteristics and design principles of Software Defined Radio. Discuss the benefits of SDR over conventional radio systems.	*11*	*K3*	*CO1*
		OR			
	b)	Demonstrate the architecture and features of SPEAKeasy, JTRS and SDR-3000 systems. Compare their applications in modern wireless communication.	*11*	*K3*	*CO1*

24.	a)	Examine the RF receiver front end topologies used in SDR systems. Discuss the importance of dynamic range and overall RF performance.	*11*	*K4*	*CO2*
		OR			
	b)	Inspect ADC and DAC distortion effects in detail. Describe transmitter architecture in SDR systems and explain various sources of noise and distortion in the RF chain.	*11*	*K4*	*CO2*
25.	a)	Identify the principle behind sample rate conversion in multirate signal processing. Discuss interpolation and decimation techniques with suitable diagrams.	*11*	*K3*	*CO3*
		OR			
	b)	Apply the concept of multirate signal processing in describe digital filter banks and timing recovery techniques used in digital receivers. Explain the role of multirate digital filters in SDR systems.	*11*	*K3*	*CO3*
26.	a)	Examine the approaches used for Direct Digital Synthesis in SDR. Discuss the generation and analysis of spurious signals with suitable examples.	*11*	*K4*	*CO4*
		OR			
	b)	Analyze the generation of random sequences used in communication systems. Discuss their applications in spread spectrum and digital communication systems.	*11*	*K4*	*CO4*
27.	a)	Apply data converter enhancement techniques. Explain how oversampling, noise Shaping, and dithering are used to increase the dynamic range and SFDR of a low-resolution ADC.	*11*	*K3*	*CO5*
		OR			
	b)	Identify the digital signal processing chain required for real-time beamforming in hardware implementation of Smart Antennas and explain briefly.	*11*	*K3*	*CO5*
28.	a)	Identify the difference that exist between computer based programming and object oriented programming in SDR and explain briefly.	*11*	*K3*	*CO6*
		OR			
	b)	Identify various digital hardware and software choices available for SDR implementation. Explain the role of DSP processors, FPGA, ASIC, GNU Radio and USRP in SDR development.	*11*	*K3*	*CO6*