

**BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI  
(END SEMESTER EXAMINATION)**

**CLASS: B.TECH  
BRANCH: ECE**

**SEMESTER: IV/ADD  
SESSION: SP/2025**

**SUBJECT: EC253 R2 ANALOG COMMUNICATION**

**TIME: 3 Hours**

**FULL MARKS: 50**

**INSTRUCTIONS:**

1. The question paper contains 5 questions each of 10 marks and total of 50 marks.
  2. Attempt all questions.
  3. The missing data, if any, may be assumed suitably.
  4. Before attempting the question paper, be sure that you have got the correct question paper.
  5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.
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|  | CO  | BL      |
| Q.1(a) Define and prove the frequency shifting property of Fourier transform.  | [5] | CO1 BL2 |
| Q.1(b) Find the energy of a sinc pulse given by $A \text{sinc}(2Wt)$   | [5] | CO1 BL3 |
|  |     |         |
| Q.2(a) Explain the advantages of SSB-SC modulation over the amplitude modulation technique.  | [5] | CO2 BL4 |
| Q.2(b) An AM transmitter of 1 kW power is fully modulated. Calculate the power transmitted, if it is transmitted as SSB.   | [5] | CO2 BL4 |
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| Q.3(a) Assuming single-tone modulation, derive necessary expressions to show that a narrowband FM-modulated signal and an AM signal have similar forms. Draw the phasor diagrams for both cases.   | [5] | CO3 BL5 |
| Q.3(b) Compute the bandwidth requirement for transmitting an FM signal with a frequency deviation of 75 kHz and an audio bandwidth of 10 kHz.  | [5] | CO3 BL4 |
|  |     |         |
| Q.4(a) Explain how a PPM signal may be converted into a PAM signal? How can it be demodulated?   | [5] | CO4 BL3 |
| Q.4(b) The signal $x(t) = 2 \cos 200\pi t + 6 \cos 180\pi t$ is ideally sampled at a frequency of 150 samples per second. The sampled version is passed through a unit gain ideal LPF with a cutoff frequency of 110 Hz. What frequency components will be present at the output of the LPF?                                       | [5] | CO4 BL5 |
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| Q.5(a) What is the origin of thermal noise? Draw a model of a noisy resistor and derive an equation to find the r.m.s. value of voltage across the resistor R.   | [5] | CO5 BL2 |
| Q.5(b) A DSB-SC signal is transmitted over a noisy channel, with the power spectral density of the noise being as shown in Figure. The message bandwidth is 4 kHz, and the carrier frequency is 200 kHz. Assuming that the average power of the modulated wave is 10 watts, find the output signal-to-noise ratio of the receiver. | [5] | CO5 BL5 |

