Roll No. .....

Question Booklet Number

O. M. R. Serial No.

M. Sc. (Fourth Semester)

(NEP) EXAMINATION, 2025-26

PHYSICS

(Electronics—II)

Paper Code							
B	0	1	1	0	0	3	T

Questions Booklet Series
A

Time : 1:30 Hours] [*Maximum Marks : 75*

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.

2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.

3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।

2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।

3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, तो उसे तुरन्त बदल लें।

(Remaining instructions on the last page) **(शेष निर्देश अन्तिम पृष्ठ पर)**

1. In a diode detector circuit, the capacitor's primary role is to :

(A) Rectify the signal

(B) Smoothen the rectified signal (create the envelope)

(C) Amplify the input signal

(D) Remove noise

2. Coherent detection requires :

(A) Envelope detector

(B) Low-pass filter

(C) Synchronous carrier generator

(D) Phase-synchronized local oscillator

3. In an SSB system, if the modulating signal is 2 kHz and the carrier frequency is 1 MHz, the frequencies present in the upper sideband are :

(A) 0.998 MHz - 1.002 MHz

(B) 1.000 MHz 1.002 MHz

(C) 0.998 MHz - 1.000 MHz

(D) 1.002 MHz - 1.004 MHz

4. The modulation index m for an AM wave is given by :

(A) V_c/V_m

(B) V_m/V_c

(C) $V_m \times V_c$

(D) $V_m + V_c$

5. The bandwidth of an SSB modulated signal is approximately equal to :

(A) Twice the message signal bandwidth

(B) The message signal bandwidth

(C) The carrier frequency

(D) Carrier plus sidebands

6. What is the primary advantage of SSB over conventional AM ?

(A) Reduced bandwidth and reduced power consumption

(B) Improved fidelity

(C) Simplified generation process

(D) Improved fidelity and reduced bandwidth and reduced power consumption both.

7. The carrier suppression ratio in an SSB system is :

(A) Infinite

(B) Very high but not infinite

(C) Zero

(D) Equal to modulation index

8. Vestigial sideband modulation is primarily used in :

(A) Radio broadcasting

(B) Satellite communication

(C) Television transmission

(D) Optical communication

9. If the modulation index of an AM signal is increased from 0.5 to 0.75, by what does the transmitted power increase ?

(A) 18.75%
(B) 25%
(C) 37.5%
(D) 50%

10. What is the primary function of the envelope detector in AM demodulation ?

(A) Filter the carrier signal
(B) Reconstruct the original modulating signal
(C) Extract the envelope of the modulated signal
(D) Amplify the RF signal

11. The diode detector works efficiently when :

(A) Carrier frequency is high
(B) Modulation index is less than 1
(C) RC time constant is optimized
(D) The bandwidth is minimum

12. What is the bandwidth of an amplitude-modulated signal with a carrier frequency of 1 MHz and a modulating signal frequency of 15 kHz ?

(A) 30 kHz
(B) 1 MHz
(C) 15 kHz
(D) 2 MHz

13. Which demodulation technique is appropriate for SSB signals ?

(A) Envelope detection
(B) Coherent detection
(C) Frequency demodulation
(D) Ring modulation

14. In the ring modulator, the carrier frequency is :

(A) Modulated with the message signal
(B) Combined with the message signal through nonlinear mixing
(C) Detected using a low-pass filter
(D) Rectified before modulation

15. Coherent detectors require a/an :

(A) Band-pass filter
(B) High-speed diode
(C) Local oscillator synchronized with the carrier frequency
(D) Envelope detector

16. In Double-Sideband Suppressed Carrier (DSBSC) modulation, the carrier :

(A) contains all the power

(B) is partially transmitted

(C) is completely suppressed

(D) has no effect

17. The primary requirement for coherent detection of DSBSC signals is :

(A) A balanced modulator

(B) An envelope detector

(C) A carrier with correct phase and frequency

(D) A high Q-factor filter

18. In a ring modulator circuit, the diodes are arranged :

(A) In a bridge configuration

(B) Parallel to the carrier signal

(C) As rectifiers

(D) Opposite to each other

19. In VSB, the transmitted spectrum consists of :

(A) Carrier and both sidebands

(B) Only one sideband

(C) Carrier, one complete sideband, and a part of the other sideband

(D) Carrier and modulating signal

20. In a square-law modulator, the input signal is :

(A) Nonlinearly mixed with the carrier signal

(B) Linearly mixed with the modulating signal

(C) Differentiated with respect to time

(D) Rectified and amplified

21. For an AM wave with a modulation index *m* of 0.6, what percentage of the total power in the sidebands ?

(A) 33.33%

(B) 50%

(C) 18%

(D) 66%

22. The output signal from the coherent detection of a DSBSC wave contains :

(A) Carrier and upper sideband

(B) Modulating signal and lower sideband

(C) Modulating signal only

(D) Recovered modulating signal

23. The bandwidth of a VSB modulated signal is :

(A) Equal to twice the message bandwidth

(B) Equal to the carrier bandwidth

(C) Slightly greater than the message bandwidth

(D) Equal to half the message bandwidth

24. Calculate the carrier frequency of an AM signal with sidebands at 455 kHz and 465 kHz :

(A) 460 kHz

(B) 470 kHz

(C) 465 kHz

(D) 455 kHz

25. If the carrier frequency is 1 MHz and the modulating signal is a 3 kHz sinusoidal wave, the AM signal will have frequencies at :

(A) 997 kHz and 1003 kHz only

(B) 1 MHz, 997 kHz, and 1003 kHz

(C) 1 MHz, 1.003 MHz, and 996 kHz

(D) 1 MHz only

26. Which method is widely used for generating SSB signals ?

(A) Balanced modulation

(B) Filter method

(C) Ring modulation

(D) Square-law modulation

27. Which circuit component in a square-law modulator is primarily responsible introducing nonlinearity ?

(A) Inductor

(B) Diode

(C) Resistor

(D) Nonlinear device (transistor)

28. A guard band of very small width is laid on either side of VSB to avoid :

(A) interference

(B) suppression

(C) attenuation

(D) overlapping

29. Which component in a diode detector ensures rectification of the AM signal ?

(A) Capacitor

(B) Inductor

(C) Diode

(D) Resistor

30. The spectrum of a DSBSC signal includes :

(A) Lower sideband only

(B) Upper sideband only

(C) Carrier only

(D) Both sidebands without carrier

31. In ..... encoding, the duration of the bit is divided into two halves. The voltage remains at one level during the first half and moves to the other level in the second half. The transition the middle of the bit provides synchronization :

(A) Manchester

(B) Differential Manchester

(C) Both (A) and (B)

(D) Neither (A) nor (B)

32. The phenomenon by virtue of which a high frequency component in the spectrum of the signal takes the identity of a lower frequency component :

(A) Smoothening

(B) Sharpening

(C) Aliasing

(D) Summation

33. What does the term "band-limited function" refer to ?

(A) A function that has a limited duration in the time domain

(B) A function that has a limited amplitude in the frequency domain

(C) A function whose Fourier transform is non-zero only over a finite frequency range

(D) A function that has a limited amplitude in the time domain

34. The Fourier transform of sin *c* function $\sin c(x) = \frac{\sin(\pi x)}{\pi x}$ is :

(A) Rectangular function

(B) Triangular function

(C) Gaussian function

(D) Exponential function

35. The signal can be reconstructed :

(A) At Nyquist rate

(B) Above Nyquist rate

(C) At and above the Nyquist rate

(D) None of the above

36. The band-limited function can be recovered from its samples if the acquired samples are at a rate twice the highest frequency. This theorem is called :

(A) Fourier Transform Theorem

(B) Nyquist-Shannon Sampling theorem

(C) Sampling theorem

(D) Signal Reconstruction principle

37. Find the Nyquist rate and Nyquist interval of sin (2πt).

(A) 1 Hz, 1 sec

(B) 2 Hz, 2 sec

(C) 2 Hz, 1/2 sec

(D) 1/2 Hz, 2 sec

38. What determines the minimum transmission bandwidth of a PAM (Pulse Amplitude Modulation) Time Division Multiplexing (TDM) channel ?

(A) Number of channels multiplexed

(B) Amplitude of the pulse

(C) Sampling rate

(D) Duration of each pulse

39. The first step in pulse code modulation (PCM) is :

(A) Sampling

(B) Quantization

(C) Modulation

(D) None of the above

40. The most common technique to change an analog signal to digital data is called :

(A) PCM

(B) PAL

(C) Sampling

(D) None of the above

41. Which of the following best describes a bandpass waveform ?

(A) A waveform that spans a wide frequency range

(B) A waveform with frequencies above and below the baseband

(C) A waveform with frequencies centered around a specific frequency range

(D) A waveform that contains low frequency components

42. Which of the following best describes the convolution operation in signal processing ?

(A) Multiplication of two signals

(B) Correlation of two signals

(C) Addition of two signals

(D) None of the above

43. If there are M channels in TDM, band limited to f_m, then minimum bandwidth of transmission channel will be equal to :

(A) $2Mf_m$

(B) $\frac{f_m}{2M}$

(C) $\frac{f_m}{M}$

(D) Mf_m

44. Sample and Hold circuit is used for which type of sampling :

(A) Natural Sampling

(B) Ideal Sampling

(C) Flat top Sampling

(D) None of the above

45. What effect is observed in flat top sampling due to the limited aperture of the sampling window :

(A) Aliasing

(B) Aperture effect

(C) Quantization error

(D) Over Sampling

46. What is undersampling in signal processing :

(A) Sampling a signal at a rate lower than the Nyquist rate

(B) Sampling a signal at a rate higher than the Nyquist rate

(C) Sampling a signal at its maximum frequency

(D) Sampling a signal using an anti-aliasing filter

47. In ..... encoding, we use three levels : positive, zero, and negative.

(A) Unipolar

(B) Bipolar

(C) Polar

(D) None of the above

48. In the context of digital signal processing, what is the primary purpose of using a low-pass filter ?

(A) To attenuate high frequency components in a signal

(B) To attenuate low frequency components in a signal

(C) To increase the signal to noise ratio

(D) None of the above

49. What distinguishes a baseband waveform from other types of waveforms ?

(A) It has a lower frequency range compared to other waveforms

(B) It has a higher frequency range compared to other waveforms

(C) It contains both low and high-frequency components

(D) It is characterized by its amplitude variations

50. The Nyquist rate and Nyquist interval for a signal with a maximum frequency component of 5 kHz are :

(A) 10 kHz, 0.1 milliseconds

(B) 5 kHz, 0.2 milliseconds.

(C) 2.5 kHz, 0.4 milliseconds

(D) 5 kHz, 0.1 milliseconds.

51. In Time Division Multiplexing (TDM), each user gets :

(A) A fixed frequency band

(B) The entire bandwidth for a fixed time slot

(C) A fixed amplitude

(D) A fixed position

52. The error introduced due to difference between original and quantized signal is called :

(A) Aperture effect

(B) Aliasing

(C) Quantization error

(D) Oversampling

53. The first step in PCM transmitter section is :

(A) Encoding

(B) Quantization

(C) Sampling

(D) Multiplexing

54. Which modulation technique has the highest immunity to noise ?

(A) PPM

(B) PWM

(C) PAM

(D) None of the above

55. The circuit used to maintain constant amplitude during flat-top sampling is :

(A) Natural sampler

(B) Sample and Hold circuit

(C) Low-pass filter

(D) Quantizer

56. In flat-top sampling, distortion due to finite pulse width is called :

(A) Aliasing

(B) Quantization error

(C) Aperture effect

(D) Oversampling

57. The time-domain version of a rectangular filter used in reconstruction is :

(A) Gaussian function

(B) Sinc function

(C) Triangular function

(D) Exponential function

58. In PCM, increasing the number of quantization levels (n) :

(A) Increases quantization noise

(B) Decreases bandwidth requirement

(C) Has no effect on accuracy

(D) Decreases quantization noise but increases data rate

59. In TDM, if each of M channels is band-limited to f_m, the signaling rate is :

(A) Mf_m

(B) $2f_m$

(C) $M/2f_m$

(D) $\geq 2Mf_m$

60. A baseband waveform differs from a bandpass waveform because :

(A) Both are centered around a non-zero frequency

(B) Baseband is centered around zero frequency, bandpass around a carrier frequency

(C) Baseband requires higher bandwidth

(D) Bandpass cannot be sampled

61. Frequency modulation varies the :

(A) Frequency of the carrier

(B) Amplitude of the carrier

(C) Phase of the carrier

(D) Bandwidth

62. The main advantage of FM over AM is :

(A) Lower bandwidth

(B) Better noise immunity

(C) Easier detection

(D) Lower complexity

63. The device commonly used in varactor diode modulators is :

(A) Varactor diode

(B) Zener diode

(C) Tunnel diode

(D) Schottky diode

64. Armstrong method of FM generation is :

(A) Direct method

(B) Indirect method

(C) Balanced method

(D) None of the above

65. The reactance modulator works by :

(A) Varying amplitude

(B) Using ratio detection

(C) Varying bandwidth

(D) Changing effective reactance of circuit

66. Foster-Seeley discriminator is used for :

(A) AM detection

(B) FM detection

(C) PM detection

(D) PCM decoding

67. Ratio detector is an improvement over :

(A) Varactor diode

(B) Armstrong method

(C) FosterSeeley discriminator

(D) Reactance modulator

68. The bandwidth of FM signal is given by :

(A) Carson's rule

(B) Nyquist theorem

(C) Sampling theorem

(D) Fourier theorem

69. The frequency spectrum of sinusoidal FM consists of :

(A) Only carrier

(B) Carrier + one sideband

(C) Carrier + two sideband

(D) Carrier + infinite sidebands

70. In nonsinusoidal modulation, the spectrum contains :

(A) Only carrier

(B) Carrier + harmonics of modulating signal

(C) Only sidebands

(D) None of the above

71. The modulation index in FM is defined as :

(A) Ratio of carrier frequency to modulating frequency

(B) Ratio of amplitude deviation to carrier amplitude

(C) Ratio of frequency deviation to modulating frequency

(D) Ratio of bandwidth to carrier frequency

72. Narrowband FM is characterized by :

(A) Small modulation index (≤ 1)

(B) Large modulation index (> 1)

(C) Infinite bandwidth

(D) No carrier component

73. Wideband FM requires :

(A) Small modulation index (≤ 1)

(B) Large modulation index (> 1)

(C) No carrier

(D) Zero deviation

74. The Armstrong method uses :

(A) Phase modulation followed by frequency conversion

(B) Direct frequency deviation

(C) Varactor diode

(D) Ratio detector

75. Foster-Seeley discriminator requires :

(A) Varactor diode

(B) Two tuned circuits

(C) One tuned circuit

(D) No tuned circuit

76. Ratio detector differs from Foster-Seeley because :

(A) It eliminates amplitude variations (AM noise)

(B) It increases bandwidth

(C) It reduces frequency deviation

(D) It uses varactor diode

77. The preemphasis circuit in FM is used to :

(A) Reduce bandwidth

(B) Suppress carrier

(C) Reduce deviation

(D) Boost high frequency components before transmission

78. The deemphasis circuit in FM receiver is used to :

(A) Attenuate boosted high frequency components

(B) Increase deviation

(C) Suppress carrier

(D) Reduce bandwidth

79. In FM, if modulation index increases, the number of significant sidebands :

(A) Decreases

(B) Increases

(C) Remains constant

(D) Becomes zero

80. In ratio detector, the output is proportional to :

(A) Amplitude of carrier

(B) Bandwidth

(C) Frequency deviation

(D) Phase deviation

81. Binary modulation schemes include :

(A) ASK, FSK, PSK

(B) QAM, MSK

(C) OFDM

(D) None of the above

82. M-ary schemes use :

(A) 2 symbols

(B) More than 2 symbols

(C) Only binary

(D) None of the above

83. MSK stands for :

(A) Minimum Signal Keying

(B) Minimum Shift Keying

(C) Maximum Shift Keying

(D) None of the above

84. QAM combines :

(A) Frequency and phase

(B) Amplitude and frequency

(C) Amplitude and phase

(D) None of the above

85. Constellation diagram X-axis represents :

(A) In-phase carrier

(B) Quadrature carrier

(C) Amplitude

(D) None of the above

86. In FSK, bit '0' and '1' are represented by :

(A) Different phases

(B) Different amplitudes

(C) Different frequencies

(D) None of the above

87. QPSK transmits :

(A) 1 bit per symbol

(B) 2 bits per symbol

(C) 3 bits per symbol

(D) None of the above

88. M-ary PSK increases :

(A) Bandwidth efficiency

(B) Noise immunity

(C) Data rate

(D) None of the above

89. QAM constellation points depend on :

(A) Frequency only

(B) Amplitude and phase

(C) Noise

(D) None of the above

90. In digital modulation, bandwidth efficiency improves with :

(A) Binary schemes

(B) Analogue modulation

(C) M-ary schemes

(D) None of the above

91. In QPSK, phase difference between adjacent symbols is :

(A) 45°

(B) 90°

(C) 180°

(D) None of the above

92. MSK ensures :

(A) Abrupt phase changes

(B) Random amplitude

(C) Continuous phase changes

(D) None of the above

93. Higher-order QAM (like 64-QAM) increases :

(A) Bandwidth

(B) Noise immunity

(C) Data rate but reduces robustness

(D) None of the above

94. In FSK, minimum frequency separation is :

(A) Equal to the symbol rate

(B) Half the symbol rate

(C) Twice the symbol rate

(D) None of the above

95. Constellation diagram of QPSK has :

(A) 2 points

(B) 4 points

(C) 8 points

(D) None of the above

96. In 16-QAM, each symbol carries :

(A) 2 bits

(B) 3 bits

(C) 4 bits

(D) None of the above

97. Bandwidth efficiency is measured in :

(A) bits/sec/Hz

(B) Hz

(C) dB

(D) per sec

98. In PSK, phase ambiguity can be resolved using :

(A) Amplitude reference

(B) Differential encoding

(C) Frequency offset

(D) None of the above

99. Constellation diagram of 8-PSK has :

(A) 4 points

(B) 8 points

(C) 16 points

(D) None of the above

100. The main advantage of QAM over PSK is :

(A) Higher data rate for same bandwidth

(B) Simpler design

(C) Better noise immunity

(D) None of the above

(Only for Rough Work)

4. Four alternative answers are mentioned for each question as—A, B, C & D in the booklet. The candidate has to choose the correct answer and mark the same in the OMR Answer-Sheet as per the direction :

Example :

Question :

Q. 1 (A) ● (C) (D)
Q. 2 (A) (B) ● (D)
Q. 3 (A) ● (C) (D)

Illegible answers with cutting and over-writing or half filled circle will be cancelled.

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager and cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. : On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर—A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छाँटना है। उत्तर को OMR आन्सर-शीट में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)
प्रश्न 2 (A) (B) ● (D)
प्रश्न 3 (A) ● (C) (D)

अपठनीय उत्तर या ऐसे उत्तर जिन्हें काटा या बदला गया है, या गोले में आधा भरकर दिया गया, उन्हें निरस्त कर दिया जाएगा।

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ. एम. आर. उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका के अन्त में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैलकुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण : प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्न-पुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरीज की दूसरी प्रश्न-पुस्तिका प्राप्त कर लें।