Code No.	V – 2362

Entrance Examination for Admission to the M.Tech. Courses in the Teaching Departments, 2025

CSS

ELECTRONICS AND COMMUNICATION
(Optoelectronics and Optical Communication)

For office use only

General Instructions

1. The Question Paper is having 100 Objective Questions, each carrying one mark.
2. The answers are to be (✓) 'tick marked' **only** in the "**Response Sheet**" provided.
3. **Negative marking** : **0.25 marks** will be deducted for each wrong answer .

Time : 2 Hours **Max. Marks : 100**

To be filled in by the Candidate									
Register Number	in Figures								
	in words								

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Choose appropriate answer from the options in the questions.

(100 × 1 = 100 marks)

1. For the Zinc blende structure, the number of atoms per unit cell is

A. 1 B. 3

C. 2 D. 4

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2. The interplanar spacing for (321) plane in a simple cubic lattice with interatomic spacing (a = 4.21 Å) is

   A. 0.08 Å
   B. 1.01 Å
   C. 2 Å
   D. 3.1 Å

3. Which of the following crystal has ionic bonding?

   A. NaCl
   B. Diamond
   C. H_2O
   D. HF

4. With the parameters having the usual meaning, the reciprocal lattice vector is given by

A. $G = d_{hkl}$

B. $G = \frac{1}{d_{hkl}}$

C. $G = d_{hkl}^2$

D. $G = \frac{1}{d_{hkl}^2}$

5. Which element has a K_α X-ray line of wavelength 0.71 Å?

A. Platinum

B. Silver

C. Molybdenum

D. Copper

6. The Hall coefficient is inversely proportional to

A. magnetic field

B. electron mass

C. electron charge

D. mobility

7. The range of the k values of electrons in the second Brillouin zone is

A. $\frac{-\pi}{a} < k < \frac{\pi}{a}$

B. $\frac{\pi}{a} < k < \frac{2\pi}{a}$

C. $\frac{-2\pi}{a} < k < \frac{2\pi}{a}$

D. $0 < k < \frac{2\pi}{a}$

8. The E-k relation for an electron in a solid is given by the relation $E = ak^2$ + constant. The effective mass of the electron is

A. $\hbar^2 a$

B. $\hbar/2$

C. $\hbar^2/2a$

D. $\hbar/2a$

9. For an intrinsic semiconductor the Fermi level lies at

A. $\frac{E_g}{3}$ B. $\frac{E_g}{4}$

C. $\frac{2}{3}E_g$ D. $\frac{E_g}{2}$

10. The energy gap of silicon is

A. 0.7 eV B. 2 eV

C. 1.1 eV D. 0.5 eV

11. The unit of polarization is

A. C/m B. C/m^2

C. Cm D. C^2m^2

12. Which equation represents the total polarization of a material?

A. Langevin-Debye equation B. Claussius- Mosotti equation

C. Curie — Weiss equation D. Langevin — Lorentz equation

13. One of the most important materials which is also known as solar grade silicon is

A. Crushed silicon B. Crystalline silicon

C. Powdered silicon D. Amorphous silicon

14. Dye sensitized solar cells are made from _____ organic dye.

A. Ruthium metallo B. Anilleine

C. Saframine D. Induline

15. Which of the following LED colors is not present in an LED TV panel?

A. Green
B. Blue
C. White
D. Red

16. The flux linked with a coil is $\Phi(t) = (5t^2 + 4t)$ weber. The magnitude of the emf induced in the coil at t = 2 s is

A. 10 V
B. 24 V
C. 31 V
D. 28 V

17. Differential form of Gauss's law in magnetostatics is

A. div $B = \rho/\varepsilon_0$
B. div $B = 0$
C. div $B = -dB/dt$
D. div $B = \mu J$

18. Which of the following laws do not form a Maxwell equation?

A. Gauss's law
B. Faraday's law
C. Ampere's law
D. Planck's law

19. The polarization vector in air when the susceptibility is 5 and electric field is 12 units is

A. 3
B. 2
C. 60
D. 6

20. Which of the following is the expression for Lorentz force?

A. qE
B. q (V $\times$ B)
C. ma + qE
D. qE + q(V $\times$ B)

21. If the electric field in some region of space is $E = kr^3\hat{r}$ in spherical polar coordinates then the charge density ρ is

A. $5\,\varepsilon_0 kr^2$ B. $\varepsilon_0 kr^2$

C. $4\,\varepsilon_0 kr^2$ D. $3\,\varepsilon_0 kr^2$

22. Given $D = 2xy\,\hat{i} + x^2\hat{j}$. The volume charge density is

A. $2x$ B. $2x^2$

C. $2y$ D. $2y^2$

23. The charge density in a region where the potential is given by $-\left(2x^2 + y^2\right)$ is

A. $2\varepsilon_0$ B. $3\varepsilon_0$

C. $4\varepsilon_0$ D. $6\varepsilon_0$

24. If two identical 3A, 4 Ω Nortan's equivalent circuits are connected in parallel with like polarity. The combined Nortan's equivalent circuit will be

A. 3 A, 80 Ω B. 6 A, 8 Ω

C. 0 A, 2 Ω D. 6 A, 2 Ω

25. Thevinin's theorem is true for

A. Linear networks

B. Nonlinear networks

C. Linear and nonlinear networks

D. Neither linear nor nonlinear networks

26. Millman's theorem yields equivalent

A. Voltage source B. Resistive source

C. Admittance source D. Impedance source

27. If light goes normally from glass $(n_1 = 3/2)$ to water $(n_2 = 4/3)$, then percentage of the reflection for the interface is approximately

A. 0.15 B. 0.25

C. 0.35 D. 0.50

28. The imaginary part of the wave vector is estimated to be 50 km^{-1} for a conducting medium. The corresponding skin depth in μm is

A. 2 B. 5

C. 10 D. 20

29. The phase difference between the current and voltage in LCR circuit at resonance is

A. 0 B. $\pi/2$

C. π D. $\pi/3$

30. With the parameters having the usual meaning the power factor of an LCR-AC circuit is

A. Z/R B. R/Z

C. RX_L D. RXc

31. A graded index optical fiber has a parabolic refractive index profile value of

A. 1 B. 2

C. 4 D. 1.5

32. The refractive indices of core and cladding of an optical fiber are 1.40 and 1.14 respectively. The value of the numerical aperture is

A. 0.312 B. 0.812

C. 0.646 D. 0.552

33. In the core of optical fiber transmission link, LED's and LASER's are used as

A. Detectors
B. Repeaters
C. Sources
D. Amplifiers

34. Optical fibers are used in

A. CAT Scans
B. X-ray photos
C. Ultrasound Scans
D. Endoscopy

35. Standard single mode fibers (SSMF) are utilized mainly for operation in

A. C-band
B. L-band
C. O-band
D. C and L band

36. Each part of a hologram contains information about

A. entire object
B. part of the object
C. front side of the object
D. back side of the object

37. The image produced by holography is

A. 1-dimensional
B. 2-dimensional
C. 3-dimensional
D. 4-dimensional

38. Nd:YAG laser is a _____ laser.

A. two level
B. three level
C. four level
D. five level

39. The ratio of He to Ne laser is

A. 1:10 B. 2:13

C. 10:1 D. 3:15

40. Which of the following is a characteristic of semiconductor laser?

A. high efficiency B. narrow bandwidth

C. pulsed output D. low efficiency

41. Which of the following gas is not a part of the active medium in a CO_2 laser

A. CO_2 B. N_2

C. He D. O_2

42. The bandwidth in fiber optical communication is represented in terms of

A. frequency B. wavelength

C. amplitude D. energy

43. The wavelength of a third generation communication system is around

A. 1.3 μm B. 1.55 μm

C. 1.20 μm D. 4.3 μm

44. How many domains support the measurements of fiber dispersion?

A. one B. three

C. four D. two

45. Optical fiber couplers are also called an

A. Isolators
B. Circulators
C. Directional couplers
D. Attenuators

46. The splitting loss of a 30×30 port multimode star coupler with 1 mW of optical powers launched into an input port is approximately

A. 13 dB
B. 15 dB
C. 18 dB
D. 20 dB

47. The base material used for a blue LED is

A. Si
B. Ge
C. GaP
D. GaN

48. The semiconductor lasers employing the DFB mechanism are classified in categories

A. one
B. two
C. three
D. four

49. In EDFAs the emitted photons from _____ ions are amplified.

A. europium
B. erbium
C. dysprosium
D. einsteinium

50. Mostly _____are used in nonlinear applications.

A. SOAs
B. EDFAs
C. RFAs
D. FPASs

51. A half wave rectifier has a 200 V_{rms} source and the step-down transformer has a turns ratio of 4:1. What will be the peak voltage across the load ignoring the drop across the diode?

A. 70.7V
B. 50V
C. 100V
D. 141.1V

52. Which of the following is a current controlled device?

A. MOSFET
B. BJT
C. IGBT
D. JFET

53. In a transistor, the collector current is 4.5mA and base current is 20 μA. The emitter current is

A. 4.52 mA
B. 4.48 mA
C. 4.5 mA
D. none of these

54. What is the output of a 2 m^2 solar panel with 15% efficiency if the input radiant energy is 1000 W/m^2?

A. 30 kW
B. 15 kW
C. 300 W
D. 150 W

55. An LED has a rating of 2 V and 10 mA. If it is connected to a 6V battery, the minimum value of series resistance is

A. 40Ω
B. 100Ω
C. 200Ω
D. 400Ω

56. In which type of counter is the last stage of shift register fed back to D of first stage?

A. Ring
B. Round
C. Johnson
D. Strait

57. An 8-bit binary ripple up counter with a modulus of 256 is holding the count 01111111. What will be the count after 135 clock pulses?

A. 00000101
B. 1111 1001
C. 0000 0110
D. 0000 0111

58. The number of comparator circuits required to build a 3-bit simultaneous A/D converter is

A. 15
B. 7
C. 8
D. 16

59. In 8085 microprocessors, MVI A, 24H is an example of which addressing mode?

A. Register addressing
B. Immediate addressing
C. Direct addressing
D. Indirect addressing

60. In 8051 mocrocontroller, the resultant of two numbers added is

A. Erased
B. Not stored anywhere
C. Stored in the accumulator
D. Stored in the register

61. A 230V, 50A energy meter on full load test makes 61 revolutions in 37 seconds. If the meter constant is 520 rev/kWh, then the percentage error is

A. 0.67%
B. 1%
C. 0.76%
D. 0.24%

62. The maximum conversion time for a 10-bit digital ramp ADC using 500 1 KHz clock is

A. $2048\,\mu s$ B. $2064\,\mu s$

C. $2046\,\mu s$ D. $2084\,\mu s$

63. Which of the following is an active transducer?

A. Solar cell-LVDT B. Thermocouple-Thermistor

C. Thermistor-Solar cell D. Thermocouple-Solar Cell

64. If the slew rate for an opamp is $0.5V/\mu s$, what is the maximum frequency that we can get the undistorted output of 1V peak?

A. 500 kHz B. 1000 kHz

C. 80 kHz D. 250 kHz

65. Which transducers are used in vibration and shock testing?

A. Pneumatic transducers

B. Seismic instrument

C. Strain Gauge

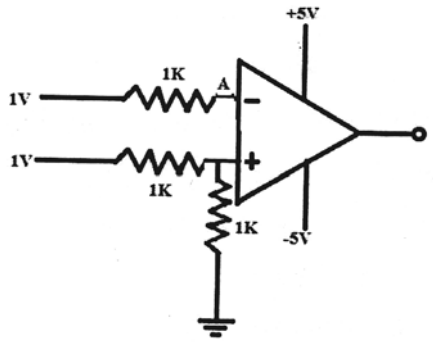
D. Piezoelectric accelerators

66. A signal of frequency 10 kHz is being digitized by an A/D converter. A possible sampling time which can be used is

A. $100\mu s$ B. $40\mu s$

C. $60\mu s$ D. $200\mu s$

67. In the operational amplifier circuit below, the voltage at point A is



A. $1.0V$ B. $0.5V$

C. $0\,V$ D. $-5.0V$

68. An LED operates at I.5V and 5mA in forward bias. Assuming an 80% external efficiency of the LED, how many photons are emitted per second?

A. 5.0×10^{16} B. 1.5×10^{16}

C. 0.8×10^{16} D. 2.5×10^{16}

69. Band-pass and band-reject filters can be implemented by combining a low pass and a high pass filter in series and in parallel, respectively. If the cut-off frequencies of the low pass and high pass filters are ω_0^{LP} and ω_0^{HP} respectively, the condition required to implement the band-pass and band-reject filters are respectively,

A. $\omega_0^{HP} < \omega_0^{LP}$ and $\omega_0^{HP} < \omega_0^{LP}$ B. $\omega_0^{HP} < \omega_0^{LP}$ and $\omega_0^{HP} > \omega_0^{LP}$

C. $\omega_0^{HP} > \omega_0^{LP}$ and $\omega_0^{HP} < \omega_0^{LP}$ D. $\omega_0^{HP} > \omega_0^{LP}$ and $\omega_0^{HP} > \omega_0^{LP}$

70. If the analog input to an 8-bit successive approximation ADC is increased from 1.0 V to 2.0V, then the conversion time will

A. remain unchanged B. double

C. decrease to half its original value D. none of these

71. If one of the inputs of a JK FF is high and the other is low, then the outputs Q and $\overline{Q}$

A. oscillate between low and high in race around condition

B. toggle and the circuit acts like a T flip flop

C. are opposite to the inputs

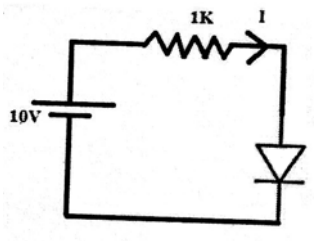
D. follow the inputs and the circuit acts like an R-S flip flop

72. An RC network produces a phase-shift of 30°. How many such RC networks should be cascaded together and connected to a common emitter amplifier so that the final circuit behaves as an oscillator?

A. 6 B. 12

C. 9 D. 3

73. The I-V characteristics of the diode in the circuit below is given by



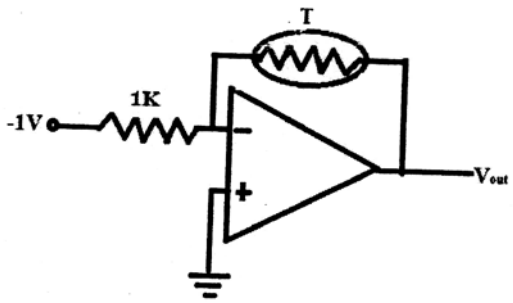
$$I = \begin{cases} \dfrac{(V - 0.7)}{500} & for \quad V \geq 0.7 \\ 0 & for \quad V < 0.7 \end{cases}$$

where V is measured in volts and I is measured in amperes. The current I in the circuit is

A. 10.0 mA B. 9.3 mA

C. 6.2 mA D. 6.7 mA

74. In the circuit given below, the thermistor has a resistance $3k\Omega$ at 25°C. Its resistance decreases by 150Ω per °C upon heating. The output voltage of the circuit at 30°C is



A. $-3.75V$ B. $-2.25V$

C. $2.25V$ D. $3.75V$

75. The following Boolean expression $Y = A\overline{B}\,\overline{C}\,\overline{D} + \overline{A}B\overline{C}D + \overline{A}\,\overline{B}\,\overline{C}D + \overline{A}\,\overline{B}CD + \overline{A}BCD + A\overline{B}\,\overline{C}D$ can be simplified to

A. $\overline{A}\,\overline{B}C + A\overline{D}$ B. $\overline{A}B\overline{C} + A\overline{D}$

C. $A\overline{B}\,\overline{C} + \overline{A}D$ D. $A\overline{B}C + \overline{A}D$

76. Input AC voltage of $v_{in} = 6\sin\omega t$ is applied across a silicon diode of $R = 30\Omega$ in series with load resistance 500Ω in a half wave rectifier circuit. The dc output current is

A. 11.3 mA B. 10 mA

C. 10.6 mA D. 12 mA

77. For a MOD-12 counter, the FF has a propagation delay time, t_{pd} of 60 ns. The NAND gate has a t_{pd} of 25ns. The clock frequency is

A. 3.774 MHz B. 3.774 kHz

C. 4.167 MHz D. 4.167 kHz

78. The decimal number *5.625* is equivalent to the binary number

A. 101.110 B. 101.101

C. 110.101 D. 110.110

79. What is the power in an amplitude modulated wave when modulation is 100% and the carrier power is 100W?

A. 100 W B. 10 KW

C. 66.67 W D. 150 W

80. The clock frequency of an 8085 microprocessor is 5 MHz. If the time required to execute an instruction is $1.4\mu s$, then the number of T-states needed for executing the instruction is

A. 1 B. 6

C. 7 D. 8

81. The output of a particular opamp increases 8V in $12\mu s$. The slew rate is _____.

A. $90V/\mu s$ B. $0.67V/\mu s$

C. $1.5V/\mu s$ D. none

82. 10101 binary number corresponds to the decimal number

A. 31 B. 21

C. 11 D. 3

83. A power amplifier gives 150 W output for an input of *1.5* W. The gain in dB is

A. 10 B. 20

C. 54 D. 100

84. The power in an amplitude modulated wave having modulation 100% and carrier power 10 W is

A. 10 W B. 15 W

C. 20 W D. 25 W

85. The logic expression $\overline{A}BC + \overline{A}\overline{B}C + AB\overline{C} + A\overline{B}\overline{C}$ can be simplified to

A. A XOR C
B. A AND $\overline{C}$
C. 0
D. 1

86. An amplifier has a gain of 300. When negative feedback is applied, the gain is reduced to 240, then the feedback ratio is

A. $5/4$
B. $1/200\,A$
C. 60
D. $-1/300\,A$

87. A signal of frequency 10k *Hz* is being digitalized by an A/D converter. A possible sampling time which can be used is

A. $100\,\mu s$
B. $40\,\mu s$
C. $60\,\mu s$
D. $200\,\mu s$

88. A live music broadcast consists of a radio-wave of frequency 7 MHz, amplitude modulated by a microphone output consisting of signals with a maximum frequency of 10 kHz. The spectrum of modulated output will be zero outside the frequency band

A. 7.00 MHz to 7.01 MHz
B. 6.99 MHz to 7.01 MHz
C. 6.99 MHz to 7.00 MHz
D. 6.995 MHz to 7.005 MHz

89. If the analog input to an 8-bit successive approximation ADC is increased from 1.0 V to 2.0 V, then the conversion time will

A. remain unchanged
B. double
C. decrease to half its original value
D. increase four times

90. When equal voltages are applied to two input terminals of an ideal Op-Amp, the output is _____.

A. Infinity
B. Zero
C. very high
D. very low

91. The ratio of Stimulated emission rate to spontaneous emission rate is

A. $\frac{1}{e^{\frac{h\vartheta}{kT}-1}}$
B. $\frac{1}{e^{\frac{h\vartheta}{kT}+1}}$
C. $\frac{h\vartheta}{ekT}+1$
D. $\frac{h\vartheta}{ekT}+1$

92. Which of the following is the most compact laser?

A. Diode laser
B. Quantum well laser
C. Quantum cascade laser
D. Quantum dot laser

93. The impedance of free space in ohms is

A. 307
B. 317
C. 377
D. 337

94. Which of the parameters having the usual meaning in acceptance angle (α) of an optical fiber is

A. $\sin^{-1}\left(n_1^2-n_2^2\right)^{1/2}$
B. $\sin^{-1}\left(n_2^2-n_1^2\right)^{1/2}$
C. $\cos^{-1}\left(n_1^2-n_2^2\right)^{1/2}$
D. $\cos^{-1}\left(n_2^2-n_1^2\right)^{1/2}$

95. If the optical index of ordinary glass relative to air is *1.5,* then the critical angle is approximately

A. 51 degrees
B. 32 degrees
C. 41 degrees
D. 24 degrees

96. If ρ \ *rhop* is the charge density and P is the polarization then ρ is given by,

A. $\nabla.P$
B. $-\nabla.P$
C. $\nabla\times P$
D. $-\nabla\times P$

97. The total energy density (W) associated with an electromagnetic Wave is

A. $\varepsilon_0 E_0^2$
B. $\varepsilon_0{}^2 E_0^2$
C. $\varepsilon_0^2 E_0$
D. ε_0^2 / E_0

98. Which of the following lattices does not Possess the mirror plane?

A. Monoclinic
B. Hexagonal
C. Trigonal
D. Triclinic

99. The density of electrons in a crystal as per the free electron model depends on the Fermi energy as

A. $E_F{}^{1/3}$
B. $E_F{}^{1/2}$
C. $E_F{}^{2/3}$
D. $E_F{}^{3/2}$

100. The electrical conductivity Varies with collision time τ^x as, where x is

A. ½ A
B. 1
C. 2
D. 3

RESPONSE SHEET

1	A	B	C	D	E	26	A	B	C	D	E	51	A	B	C	D	E	76	A	B	C	D	E
2	A	B	C	D	E	27	A	B	C	D	E	52	A	B	C	D	E	77	A	B	C	D	E
3	A	B	C	D	E	28	A	B	C	D	E	53	A	B	C	D	E	78	A	B	C	D	E
4	A	B	C	D	E	29	A	B	C	D	E	54	A	B	C	D	E	79	A	B	C	D	E
5	A	B	C	D	E	30	A	B	C	D	E	55	A	B	C	D	E	80	A	B	C	D	E
6	A	B	C	D	E	31	A	B	C	D	E	56	A	B	C	D	E	81	A	B	C	D	E
7	A	B	C	D	E	32	A	B	C	D	E	57	A	B	C	D	E	82	A	B	C	D	E
8	A	B	C	D	E	33	A	B	C	D	E	58	A	B	C	D	E	83	A	B	C	D	E
9	A	B	C	D	E	34	A	B	C	D	E	59	A	B	C	D	E	84	A	B	C	D	E
10	A	B	C	D	E	35	A	B	C	D	E	60	A	B	C	D	E	85	A	B	C	D	E
11	A	B	C	D	E	36	A	B	C	D	E	61	A	B	C	D	E	86	A	B	C	D	E
12	A	B	C	D	E	37	A	B	C	D	E	62	A	B	C	D	E	87	A	B	C	D	E
13	A	B	C	D	E	38	A	B	C	D	E	63	A	B	C	D	E	88	A	B	C	D	E
14	A	B	C	D	E	39	A	B	C	D	E	64	A	B	C	D	E	89	A	B	C	D	E
15	A	B	C	D	E	40	A	B	C	D	E	65	A	B	C	D	E	90	A	B	C	D	E
16	A	B	C	D	E	41	A	B	C	D	E	66	A	B	C	D	E	91	A	B	C	D	E
17	A	B	C	D	E	42	A	B	C	D	E	67	A	B	C	D	E	92	A	B	C	D	E
18	A	B	C	D	E	43	A	B	C	D	E	68	A	B	C	D	E	93	A	B	C	D	E
19	A	B	C	D	E	44	A	B	C	D	E	69	A	B	C	D	E	94	A	B	C	D	E
20	A	B	C	D	E	45	A	B	C	D	E	70	A	B	C	D	E	95	A	B	C	D	E
21	A	B	C	D	E	46	A	B	C	D	E	71	A	B	C	D	E	96	A	B	C	D	E
22	A	B	C	D	E	47	A	B	C	D	E	72	A	B	C	D	E	97	A	B	C	D	E
23	A	B	C	D	E	48	A	B	C	D	E	73	A	B	C	D	E	98	A	B	C	D	E
24	A	B	C	D	E	49	A	B	C	D	E	74	A	B	C	D	E	99	A	B	C	D	E
25	A	B	C	D	E	50	A	B	C	D	E	75	A	B	C	D	E	100	A	B	C	D	E

ROUGH WORK

ROUGH WORK

ROUGH WORK