Code No.	J – 2287

Entrance Examination for Admission to the M.Tech. Degree Courses in the Teaching Departments, 2020

CSS

ELECTRONICS & COMMUNICATION (OPTOELECTRONICS & OPTICAL COMMUNICATION)

General Instructions

1. The Question Paper is having two Parts — Part 'A' Objective type (60%) & Part 'B' Descriptive type (40%).
2. Objective type questions which carry 1 mark each are to be (✓) 'tick marked' in the response sheets against the appropriate answers provided.
3. 8 questions are to be answered out of 12 questions carrying 5 marks each in Part 'B'.
4. **Negative marking** : 0.25 marks will be deducted for each wrong answer in Part 'A'.

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

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

PART – A

(Objective Type)

Choose appropriate answer from the options in the questions. **One** mark **each**.

(60 × 1 = 60 marks)

1. The circuit that provides the best stabilization of operating point is

   a) Base resistor bias b) Collector feedback bias

   c) Potential divider bias d) None of the above

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2. In a transistor, the base current is about ———————— of emitter current.

   a) 25%
   b) 20%
   c) 35%
   d) 5%

3. The ends of a load line drawn on a family of curves determine

   a) saturation and cutoff
   b) operating point
   c) power curve
   d) amplification factor

4. The input control parameter of a JFET is

a) gate voltage
b) source voltage
c) drain voltage
d) gate current

5. The input impedance of a MOSFET is of the order of

a) Ω
b) a few hundred Ω
c) k Ω
d) several M Ω

6. For a half wave or full wave rectifier the Peak Inverse Voltage of the rectifier is always

a) Greater than the input voltage
b) Smaller than the input voltage
c) Equal to the input voltage
d) Greater than the input voltage for full wave rectifier and smaller for the half wave rectifier

7. If output is measured between two collectors of transistor, then the differential amplifier with two input signal is said to be configured as

a) Dual Input Balanced Output
b) Dual Input Unbalanced Output
c) Single Input Balanced Output
d) None of the above

8. Obtain the collector voltage, for collector resistors (RC) = 5.6 k Ω, IE = 1.664 mA and VCC = 10 V for single input unbalanced output differential amplifier

a) 0.987 V
b) 0.682 V
c) 0.555 V
d) None of the mentioned

9. Negative feedback is employed in

a) Oscillators
b) Rectifiers
c) Amplifiers
d) None of the above

10. In Colpitt's oscillator, feedback is obtained

a) By magnetic induction
b) By a tickler coil
c) From the centre of split capacitors
d) None of the above

11. Capacitor discharge interval in monostable circuits is known as

a) Refresh time
b) Recovery time
c) Dynamic time
d) Static time

12. In CMOS monostable circuit element which is used to prevent input voltage signal from rising above supply voltage is

a) Capacitor
b) Resistor
c) Inductor
d) Diode

13. Convert the binary equivalent 10101 to its decimal equivalent.

a) 21
b) 12
c) 22
d) 31

14. Simplify $Y = ABC + A\overline{B}C + AB\overline{C}$

a) ABC
b) $A(B+C)$
c) $B(A+C)$
d) $A + BC$

15. A Karnaugh map (K-map) is an abstract form of ———————— diagram organized as a matrix of squares.

a) Venn Diagram
b) Cycle Diagram
c) Block Diagram
d) Triangular Diagram

16. At 100% modulation, the power in each sideband is ———————— of that of carrier

a) 50%
b) 40%
c) 60%
d) 25%

17. Superhetrodyne principle refers to

a) Using a large number of amplifier stages
b) Using a push-pull circuit
c) Obtaining lower fixed intermediate frequency
d) None of the above

18. Delta modulation uses ———————— bits per sample.

a) One
b) Two
c) Four
d) Eight

19. In PCM encoding, quantization level varies as a function of

a) Frequency
b) Amplitude
c) Square of frequency
d) Square of amplitude

20. Lempel-Ziv algorithm is

a) Fixed to variable length algorithm
b) Variable to fixed length algorithm
c) Fixed to fixed length algorithm
d) Variable to variable length algorithm

21. For a Gaussian channel of 1 MHz bandwidth with the signal power to noise spectral density ratio of about 10^4 Hz, what would be the maximum information rate?

a) 12000 bits/sec
b) 28000 bits/sec
c) 14400 bits/sec
d) 32500 bits/sec

22. Which clock pulses are generated by the microprocessor so as to handle the timing and control operations related to internal functioning level?

a) single phase clock pulses
b) multi-phase clock pulses
c) anti-phase clock pulses
d) none of the above

23. The number of address and data lines of 8085 are

a) 8 and 8
b) 16 and 8
c) 8 and 16
d) 16 and 16

24. Instruction Pointer (IP) contains offset address of ———————— segment.

a) Data segment
b) Code segment
c) Stack segment
d) Extra segment

25. Which ionization layer exists during day time and usually vanishes at night due to highest recombination rate?

a) D-region
b) Normal E-region
c) Sporadic E-region
d) Appleton region

26. At which angles does the front to back ratio specify an antenna gain?

a) 0° & 180°
b) 90° & 180°
c) 180° & 270°
d) 180° & 360°

27. Which conversion mechanism is performed by parabolic reflector antenna?

a) Plane to spherical wave
b) Spherical to plane wave
c) Both (a) and (b)
d) None of the above

28. A ———————— determines the target range by measuring the round trip time of a pulsed microwave signal.

a) Pulse radar
b) Doppler radar
c) Cross section radar
d) None of the mentioned

29. What is meant by TDMA?

a) Time division modulation amplifier
b) Time division multiple amplifier
c) Time division multiple access
d) None of these

30. Current amplification factor of a CB configuration is 0.88. Then the value of the base current when the emitter current is 1 mA will be

a) 0.12 mA
b) 0.1 mA
c) 1 mA
d) 10 mA

31. The spontaneous life time of an upper laser level emitting at 500 nm is 16 ns. The natural line width (FWHM) of the emission line is approximately.

a) 5 MHz
b) 10 MHz
c) 8 MHz
d) 4 MHz

32. The electric field in a certain region is $\vec{E} = kr^2\hat{r}$ in spherical coordinates. The charge density will be

a) $\in_o kr$
b) $2 \in_o kr$
c) $4 \in_o kr$
d) $3 \in_o kr$

33. A certain JK flip flop has t_{pd} = 12 ns. The largest MOD counter that can be constructed from these flip flops and still operate upto 10 MHz is

a) any
b) 8
c) 256
d) 10

34. The clock frequency of an 8085 microprocessor is 5 MHz. If the time required to execute an instruction is 1.4 μs, then the number of T states needed for executing the instruction is

a) 1 b) 6

c) 7 d) 8

35. A relativistic electron gains energy so that its mass becomes 2 m_o. Its speed is

a) $\frac{3}{4}c$ b) $\frac{\sqrt{3}}{2}c$

c) $\frac{1}{2}c$ d) $\sqrt{\frac{3}{2}}c$

36. Consider a system of 3 particles, which can occupy any of the 5 available energy states with equal probability

a) 5 K_B ln 3 b) 5 K_B ln 8

c) 3 K_B ln 8 d) 3 K_B ln 5

37. The internal energy E of system is $E = aS^2/NV$, where a is a constant. The temperature of the system is

a) $\frac{2E}{S}$ b) $\frac{E}{2S}$

c) $\frac{3E}{2S}$ d) $\frac{2S}{3E}$

38. The average number of photons in equilibrium inside a radiation cavity of volume V at temperature T is proportional to

a) T b) T^2

c) T^3 d) T^4

39. For a Bose-Einstein Condensate (BEC), the maximum value of fugacity at the degeneracy temperature is

a) 0 b) 1

c) 1/2 d) 3/2

40. The Lande g factor for the $^3D_3$ level is

a) $\frac{2}{3}$ b) $\frac{3}{2}$

c) $\frac{3}{4}$ d) $\frac{4}{3}$

41. If a 500 W carrier is amplitude is modulated to a depth of 60%, the power in the modulated wave is (in W)

a) 650 b) 500

c) 1150 d) 590

42. The position of the first Stokes line in the rotational Raman spectrum of a diatomic molecule is at 12 cm^{-1}. The spacing between any two adjacent Stokes lines is

a) 4 cm^{-1} b) 6 cm^{-1}

c) 10 cm^{-1} d) 8 cm^{-1}

43. How much current will flow in a series RLC circuit, when V_T = 100 V, X_L = 160 Ω, X_c = 80 Ω and R = 60 Ω?

a) 1 A b) 1 mA

c) 6.28 A d) 10 A

44. A filter that passes frequencies between two designated cut-off frequencies and alternate all other frequencies is called

a) High-pass filter b) Band elimination filter

c) Band-pass filter d) Low-pass filter

45. The number of degrees of freedom for a circular disc rolling on a horizontal plane is

a) 2 b) 6

c) 4 d) 1

46. The Laplace transform of a function $f(t)$ is

a) $\int_0^{\infty} f(t)e^{-st}$ b) $\int_{-\infty}^{0} f(t)e^{-st}$

c) $\int_0^{\infty} f(t)e^{st}$ d) $\int_{-\infty}^{0} f(t)e^{st}$

47. Conservation of energy is due to

a) Isotropy of space b) Homogeneity of space

c) Homogeneity of time d) None of the above

48. In Hamilton's principle expression L has the dimension of

a) Energy b) Action

c) Angular momentum d) None of the above

49. The voltage gain of a negative feedback amplifier without feedback is 200 and the feedback ratio is 0.02. Its feedback factor is

a) 10^4 b) 4

c) 10^{-4} d) 0.02

50. A particle and its antiparticle

a) must have the same mass

b) must be different from each other

c) can always annihilate into two photons

d) none of the above

51. The minimum kinetic energy of an electron confined within the nucleus of diameter 10^{-14} m is

a) 614.9 MeV
b) 6.149 MeV
c) 0.6149 MeV
d) 61.49 MeV

52. The value of integral $\int_{-\infty}^{\infty} \frac{1}{x^2+1} dx$ is

a) $-\pi$
b) $+\pi$
c) 0
d) Indeterminate

53. The Curie law holds for

a) Diamagnetic substances
b) Paragmagnetic substances
c) Ferromagnetic substances
d) All of the above

54. If the applied DC voltage (V_0) across the Josephson junction is greater than critical voltage V_c, the average current through the junction is

a) $\langle I \rangle \neq 0$
b) $\langle I \rangle = \langle I \rangle_{max}$
c) $\langle I \rangle = 0$
d) $\langle I \rangle = \infty$

55. The velocity of an electron from (*E*-*k*) curve is

a) $v = \frac{1}{\hbar} \frac{dE}{dK}$
b) $v = \hbar \frac{dE}{dK}$
c) $v = \frac{1}{\hbar} \frac{d^2E}{dk^2}$
d) $v = \frac{\hbar}{\left(\frac{dE}{DK}\right)}$

56. $\hat{A}$ is an operator and ψ_1 and ψ_2 are two wave functions such that $\hat{A}\psi_1 = \psi_2$ and $\hat{A}\psi_2 = \psi_1$ then the eigen function of $\hat{A}^2$ is

a) $(\psi_1 + \psi_2)^2$

b) $\psi_1^2 + \psi_2^2$

c) $\psi_1 + \psi_2$

d) $\psi_1^2 + \psi_2$

57. In a pin photodiode if w is the width of $i - Si$ layer and ϑ is the drift velocity, then the transit time is

a) $w\vartheta$

b) $\frac{w}{\vartheta}$

c) $\frac{\vartheta}{w}$

d) $\frac{0.1\,\vartheta}{w}$

58. The term Fill factor is often referred to

a) Photodiode

b) APD

c) Phototransistor

d) Solar cell

59. In a semiconductor laser photons are confined by

a) Polarization

b) Interference

c) Diffraction

d) Total internal reflection

60. A matrix representing rotation in the x-y plane is $\begin{bmatrix} \cos(\theta) & -\sin(\theta) \\ \sin(\theta) & \cos(\theta) \end{bmatrix}$. The eigen value is

a) $\cos(\theta)$

b) $\sin(\theta)$

c) $e^{\pm\theta}$

d) $e^{\pm i\theta}$

ANSWER SHEET — PART – A

1	A	B	C	D	E	21	A	B	C	D	E	41	A	B	C	D	E
2	A	B	C	D	E	22	A	B	C	D	E	42	A	B	C	D	E
3	A	B	C	D	E	23	A	B	C	D	E	43	A	B	C	D	E
4	A	B	C	D	E	24	A	B	C	D	E	44	A	B	C	D	E
5	A	B	C	D	E	25	A	B	C	D	E	45	A	B	C	D	E
6	A	B	C	D	E	26	A	B	C	D	E	46	A	B	C	D	E
7	A	B	C	D	E	27	A	B	C	D	E	47	A	B	C	D	E
8	A	B	C	D	E	28	A	B	C	D	E	48	A	B	C	D	E
9	A	B	C	D	E	29	A	B	C	D	E	49	A	B	C	D	E
10	A	B	C	D	E	30	A	B	C	D	E	50	A	B	C	D	E
11	A	B	C	D	E	31	A	B	C	D	E	51	A	B	C	D	E
12	A	B	C	D	E	32	A	B	C	D	E	52	A	B	C	D	E
13	A	B	C	D	E	33	A	B	C	D	E	53	A	B	C	D	E
14	A	B	C	D	E	34	A	B	C	D	E	54	A	B	C	D	E
15	A	B	C	D	E	35	A	B	C	D	E	55	A	B	C	D	E
16	A	B	C	D	E	36	A	B	C	D	E	56	A	B	C	D	E
17	A	B	C	D	E	37	A	B	C	D	E	57	A	B	C	D	E
18	A	B	C	D	E	38	A	B	C	D	E	58	A	B	C	D	E
19	A	B	C	D	E	39	A	B	C	D	E	59	A	B	C	D	E
20	A	B	C	D	E	40	A	B	C	D	E	60	A	B	C	D	E

ELECTRONICS & COMMUNICATION (OPTOELECTRONICS & OPTICAL COMMUNICATION)

PART – B

(Descriptive Type)

Answer **any eight** questions. **(8 × 5 = 40 Marks)**

1. What is cross talk in communication? How can it be reduced?

2. Explain the master slave action of a JK flip flop.

3. Explain the basic principles of JFET, MESFET and MOSFET.

4. Explain automatic gain control.

5. Explain Young's double slit experiment and derive the expression for bandwidth.

6. Derive Hamilton's equation of motion.

7. Explain Cayley Hamilton theorem.

8. Derive Klein Gordon equations and what are its limitations.

9. Give a brief note on Type I and Type II superconductors.

10. Explain L-S and j-j coupling.

11. Deduce Maxwell's thermodynamic relations.

12. Discuss the meson theory of nuclear forces.