POST GRADUATE COMMON ENTRANCE TEST-2019

DATE and TIME	COURSE	SUBJECT
20-07-2019 2.30 p.m. to 4.30 p.m.	ME/M.Tech/M.Arch/ courses offered by VTU/UVCE/UBDTCE	ELECTRICAL SCIENCES (E & E / E & C / TC / IT / BME / ME)

MAXIMUM MARKS	TOTAL DURATION	MAXIMUM TIME FOR ANSWERING
100	150 Minutes	120 Minutes

MENTION YOUR PGCET NO.					QUESTION BOOKLET DETAILS	
					VERSION CODE	SERIAL NUMBER
					G	131943

DOs :

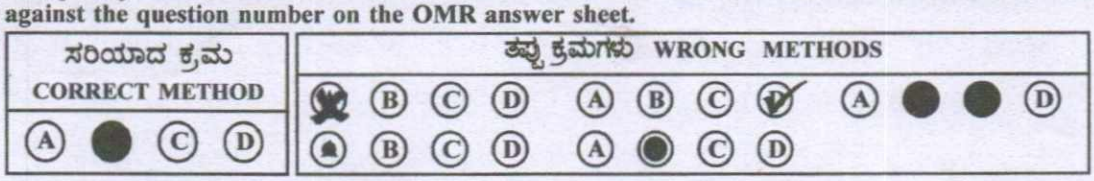
1. Candidate must verify that the PGCET number & Name printed on the OMR Answer Sheet is tallying with the PGCET number and Name printed on the Admission Ticket. Discrepancy if any, report to invigilator.
2. This question booklet is issued to you by the invigilator after the **2nd bell i.e., after 2.25 p.m.**
3. The Version Code of this Question Booklet should be entered on the OMR Answer Sheet and the respective circle should also be shaded completely.
4. The Version Code and Serial Number of this question booklet should be entered on the Nominal Roll without any mistakes.
5. Compulsorily sign at the bottom portion of the OMR answer sheet in the space provided.

DON'Ts :

1. **The timing and marks printed on the OMR answer sheet should not be damaged / mutilated / spoiled.**
2. The **3rd Bell rings at 2.30 p.m., till then;**
   - Do not remove the paper seal / polythene bag present on the right hand side of this question booklet.
   - Do not look inside this question booklet.
   - Do not start answering on the OMR answer sheet.

IMPORTANT INSTRUCTIONS TO CANDIDATES

1. This question booklet contains 75 (items) questions and each question will have one statement and four answers. (Four different options / responses.)
2. After the **3rd Bell is rung at 2.30 p.m.,** remove the paper seal / polythene bag on the right hand side of this question booklet and check that this booklet does not have any unprinted or torn or missing pages or items etc., if so, get it replaced by a complete test booklet. Read each item and start answering on the OMR answer sheet.
3. During the subsequent 120 minutes:
   - Read each question (item) carefully.
   - Choose one correct answer from out of the four available responses (options / choices) given under each question / item. In case you feel that there is more than one correct response, mark the response which you consider the best. In any case, choose **only one response** for each item.
   - **Completely darken / shade the relevant circle with a BLUE OR BLACK INK BALLPOINT PEN against the question number on the OMR answer sheet.**



4. Use the space provided on each page of the question booklet for Rough Work. Do not use the OMR answer sheet for the same.
5. After the **last Bell is rung at 4.30 p.m.,** stop marking on the OMR answer sheet and affix your **left hand thumb impression** on the OMR answer sheet as per the instructions.
6. Handover the **OMR ANSWER SHEET** to the room invigilator as it is.
7. After separating the top sheet (KEA copy), the invigilator will return the bottom sheet replica (Candidate's copy) to you to carry home for self-evaluation.
8. Preserve the replica of the OMR answer sheet for a minimum period of **ONE year.**
9. Only **Non-programmable** calculators are allowed.

Marks Distribution

PART-A : (Section I) 30 Questions : $30 \times 1 = 30$ (Section II) 15 Questions : $15 \times 2 = 30$
PART-B : (Section I) 20 Questions : $20 \times 1 = 20$ (Section II) 10 Questions : $10 \times 2 = 20$

EE - G

ELECTRICAL SCIENCES
(Common to E & E / E & C / TC / BME & ME / IT)
PART – A
(SECTION – I)

Each question carries one mark. **(30 × 1 = 30)**

1. MOSFET can be used as
   (A) Current controlled capacitor
   (B) Voltage controlled capacitor
   (C) Current controlled inductor
   (D) Voltage controlled inductor

2. A number is expressed in binary two's complement as 10011. Its decimal equivalent value is
   (A) 19 (B) –19
   (C) –13 (D) 13

3. In a microprocessor, the service routine for a certain interrupt starts from a fixed location of memory which cannot be externally set, but the interrupt can be delayed or rejected. Such an interrupt is
   (A) non-maskable and non-vectored
   (B) maskable and non-vectored
   (C) maskable and vectored
   (D) non-maskable and vectored

4. A microprocessor uses 3 MHz oscillator. The duration of one T state is
   (A) 1 μs (B) 0.666 μs
   (C) 0.333 μs (D) 3 μs

5. Microprogramming technique commonly used to implement
   (A) data path of a processor
   (B) cache memory
   (C) control unit of a processor
   (D) address lines

6. Compared to a CICS processor, an RISC processor has
   (A) reduced cache memory
   (B) reduced number of interrupts
   (C) less number of instructions
   (D) reduced address lines

7. The rank of matrix $\begin{bmatrix} 10 & 11 & 12 \\ 13 & 14 & 15 \\ 16 & 17 & 18 \end{bmatrix}$ is
   (A) 0 (B) 1
   (C) 2 (D) 3

8. If $u = x^y$, then $\frac{\partial u}{\partial y}$ is
   (A) $y\,x^{y-1}$ (B) $x^y \log x$
   (C) $x^y \log y$ (D) $y \log x$

9. The particular integral of $\frac{dy}{dx} = x^2 + \sin x$ is
   (A) $2x + \cos x$ (B) $x^3 - \cos x$
   (C) $\frac{x^3}{3} - \cos x$ (D) $\frac{x^3}{3} + \cos x$

10. Inverse Laplace transform of $\frac{1}{(S+a)^2}$ is
    (A) $t\,e^{-at}$ (B) $t\,e^{at}$
    (C) $t^2\,e^{-at}$ (D) $t^2\,e^{at}$

11. Maximum value of probability is
    (A) Infinity (B) 0
    (C) 1 (D) –1

Space For Rough Work

12. Root of $x^3 + 2x^2 - 3x - 19 = 0$ lies between

(A) (0, 2) (B) (2, 3)

(C) (3, 4) (D) (4, 5)

13. Two capacitors of 16 μF each are connected in series. Another capacitor of 16 μF is connected in parallel with this combination. The total capacitance will be

(A) $\frac{32}{3}$ μF

(B) 32 μF

(C) 48 μF

(D) 24 μF

14. An RLC series circuit has Q = 100 (quality factor) and the resonant frequency (W_0) is 20 rad/sec. The bandwidth is

(A) 2 rad/sec

(B) 20 rad/sec

(C) 2000 rad/sec

(D) 0.2 rad/sec

15. For a symmetrical network

(A) $h_{11} = h_{22}$

(B) $h_{12} = h_{21}$

(C) $h_{11} h_{22} - h_{12} h_{21} = 0$

(D) $h_{11} h_{22} - h_{12} h_{21} = 1$

16. An inductor of inductance 0.1 H carrying current of 6 Amps will store energy of

(A) 36 joules (B) 6 joules

(C) 3.6 joules (D) 1.8 joules

17. 'E' is electric field intensity, and 'V' is potential, then which of the following equations is correct ?

(A) E = grad V (B) E = –grad V

(C) V = grad E (D) V = –grad E

18. Inside a 741-Op-Amp the last functional block is

(A) Differential amplifier

(B) Level shifter

(C) Class-A power amplifier

(D) Class-AB power amplifier

19. If the common base DC current gain of a BJT is 0.98, its common emitter DC current gain is

(A) 51 (B) 1

(C) 0.02 (D) 49

20. In a BJT cascade pair, a

(A) Common base follows common emitter

(B) Common base follows common collector

(C) Common collector follows common base

(D) Common emitter follows common base

Space For Rough Work

21. Gray code for number '7' is
(A) 1100 (B) 1001
(C) 0110 (D) 0100

22. Which of the following technology results in least power dissipation ?
(A) CMOS (B) ECL
(C) TTL (D) NMOS

23. The voltage gain of a common emitter amplifier is
(A) Directly proportional to collector bias current
(B) Inversely proportional to collector bias current
(C) Independent of collector bias current
(D) Proportional to square of collect bias current

24. Number of comparators needed to build a 6-bit simultenous A/D converter is
(A) 63 (B) 64
(C) 7 (D) 6

25. For which of the following ultraviolet light is used to erase stored contents ?
(A) EPROM (B) PROM
(C) EEPROM (D) PLA

26. A 4-bit synchronous counter uses flip-flops with propagation delay of 25 ns each. The maximum possible time required for change of state will be
(A) 25 ns (B) 50 ns
(C) 100 ns (D) 75 ns

27. Consider the following statements : Feedback in control system is used
1. to reduce the sensitivity of the system to parameter variations and disturbances.
2. to change time constant of the system.
3. to increase loop gain of the system.
Which of the statements given above are correct ?
(A) 1, 2 and 3 (B) 1 and 2
(C) 2 and 3 (D) 1 and 3

28. If the gain margin of a system in decibels is negative, then the system is
(A) stable
(B) unstable
(C) marginally stable
(D) could be quasi stable

29. The logical expression $Y = A + \bar{A}B$ is equivalent to
(A) $Y = AB$ (B) $Y = A + B$
(C) $Y = \bar{A}B$ (D) $Y = \bar{A} + B$

30. In a series RLC circuit R = 2 kΩ, L = 1 H and $C = \frac{1}{400}$ μF.
The resonant frequency is
(A) 2×10^4 Hz
(B) $\frac{1}{\pi} \times 10^4$ Hz
(C) 10^4 Hz
(D) $2\pi \times 10^4$ Hz

Space For Rough Work

(SECTION – II)

Each question carries two marks. **(15 × 2 = 30)**

31. A second order control system has a transfer function $\frac{16}{s^2 + 4s + 16}$. What is the time for the first overshoot ?

(A) $\frac{2\pi}{\sqrt{3}}$ sec (B) $\frac{\pi}{\sqrt{3}}$ sec

(C) $\frac{\pi}{2\sqrt{3}}$ sec (D) $\frac{\pi}{4\sqrt{3}}$ sec

32. Which one of the following is the transfer function of a linear system whose output is t^2e^{-t} for a unit step input ?

(A) $\frac{S}{(S+1)^3}$ (B) $\frac{1}{S^2(S+1)}$

(C) $\frac{2S}{(S+1)^3}$ (D) $\frac{2}{S(S+1)^2}$

33. The first column of a Routh array is

S^5	1
S^4	2
S^3	$\frac{3}{2}$
S^2	$-\frac{1}{3}$
S^1	10
S^0	2

How many roots of the corresponding characteristic equation are there in the left-half of the S-plane ?

(A) 3 (B) 4

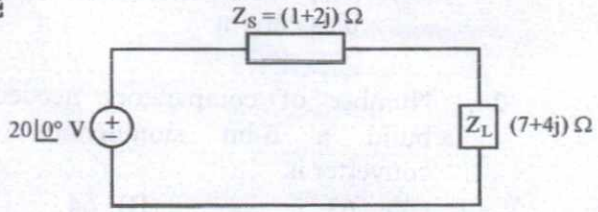
(C) 2 (D) 5

34. If each branch of a Delta circuit has impedance $\sqrt{3}Z$, then each branch of the equivalent Wye circuit has impedance

(A) $\frac{Z}{\sqrt{3}}$ (B) 3Z

(C) $3\sqrt{3} \cdot Z$ (D) $\frac{Z}{3}$

35. An AC source of RMS voltage 20 V with internal impedance $Z_S = (1 + 2j)\ \Omega$ feeds a load impedance $Z_L = (7 + 4j)\ \Omega$ in the figure below. The reactive power consumed by the load is



(A) 25 VAR (B) 8 VAR

(C) 16 VAR (D) 32 VAR

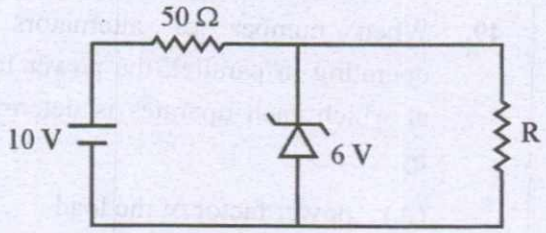
36. The resistivity of a uniformly doped n-type silicon sample is 0.5 Ω cm. If the electron mobility (μn) is 1250 cm^2/V-sec and the charge of an electron is 1.6×10^{-19} coulomb, the donor impurity concentration (N_D) in the sample is

(A) 2×10^{16} / cm^3 (B) 1×10^{16} / cm^3

(C) 2.5×10^{15} / cm^3 (D) 2×10^{15} / cm^3

Space For Rough Work

37. The 6 V Zener diode is shown in the figure has zero Zener resistance and a knee current of 5 mA. The minimum value of R so that the voltage across it does not fall below 6 V is



(A) 1.2 kΩ (B) 80 ohms
(C) 50 ohms (D) 0 ohm

38. The magnetic flux ϕ in weber linked with a coil at an instant of time t (in second) is given by $\phi(t) = 2t^2 - 20t + 40$. The induced emf in the coil at the instant t = 2 second is

(A) 22 V (B) 12 V
(C) 20 V (D) 10 V

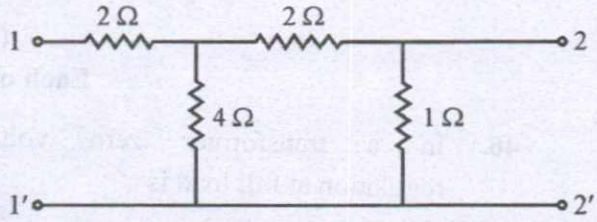
39. In a full wave rectifier circuit using centre tapped transformer, the peak voltage across half the secondary winding is 40 V. If diodes used are ideal diodes, the average output voltage is approximately

(A) 13 V (B) 26 V
(C) 30 V (D) 40 V

40. The 8 bit DAC produces 1.0 V for a digital input of 00110010. What is the largest output it can produce ?

(A) 5 V (B) 5.5 V
(C) –5 V (D) 5.10 V

41. For the two port network shown below the Z_{11} is



(A) 10/3 Ω (B) 2 Ω
(C) 6 Ω (D) 26/7 Ω

42. RMS value of $f(t) = 10(1 + \sin \omega t)$ is

(A) 10 (B) $\frac{10}{\sqrt{2}}$
(C) $\sqrt{50}$ (D) $\sqrt{150}$

43. If $\vec{f} = 3xyi - y^2j$ and c is the curve in xy-plane $y = 2x^2$ from (0, 0) to (1, 2) then $\int_C \vec{f} d\vec{r} =$ _____.

(A) $-\frac{7}{6}$ (B) $\frac{7}{6}$
(C) $\frac{1}{6}$ (D) $-\frac{1}{6}$

44. Constant term a_0 in the Fourier series expansion of $x - x^2$ in $[-\pi, \pi]$ is

(A) $\frac{\pi^2}{3}$ (B) $-\frac{\pi^2}{3}$
(C) $\frac{2\pi^2}{3}$ (D) $-\frac{2\pi^2}{3}$

45. If x is a Poisson variable such that $3P(x = 2) = P(x = 4)$, then the mean is

(A) 1 (B) 2
(C) 3 (D) 6

Space For Rough Work

E & E : ELECTRICAL AND ELECTRONICS ENGINEERING

PART – B

(SECTION – I)

Each question carries one mark. **(20 × 1 = 20)**

46. In a transformer zero voltage regulation at full load is

(A) not possible

(B) possible at leading power factor load

(C) possible at lagging power factor load

(D) possible at unity power factor load

47. The voltage per turn of the primary of transformer is _____ the voltage per turn of the secondary.

(A) same as

(B) more than

(C) less than

(D) double that of secondary

48. An under-excited synchronous motor behaves as

(A) a resistor

(B) an inductor

(C) a capacitor

(D) a thermistor

49. When number of alternators are operating in parallel, the power factor at which each operates is determined by

(A) power factor of the load

(B) driving torque of the prime mover

(C) its field excitation

(D) peripheral speed

50. A four speed squirrel cage induction motor uses stator windings

(A) four

(B) three

(C) one

(D) two

51. DC shunt motors are used in applications where the requirement is

(A) high starting torque

(B) practically constant speed

(C) high no load speed

(D) variable speed

Space For Rough Work

52. Sheath are used in cables to

(A) provide proper insulation

(B) provide mechanical strength

(C) prevent ingress of moisture

(D) reduce partial discharge

53. For stability and economic reasons we operate the transmission line with power angle in the range

(A) 10° to 25°

(B) 60° to 75°

(C) 65° to 80°

(D) 30° to 45°

54. A voltage controlled bus is treated as a load bus in subsequent iteration when its

(A) voltage limit is violated.

(B) active power limit is violated.

(C) reactive power limit is violated.

(D) phase angle limit is violated.

55. Load flow study is carried out for

(A) fault calculations

(B) stability studies

(C) system planning

(D) load frequency control

56. A cyclo converter fed induction motor drive is most suitable for which one of the following ?

(A) Compressor drive

(B) Machine tool drive

(C) Paper mill drive

(D) Cement mill drive

57. A motor armature supplied through phase controlled SCRS receives a smoother voltage shape of

(A) High motor speed

(B) Low motor speed

(C) Rated motor speed

(D) Nearly half the rated motor speed

Space For Rough Work

58. An SCR is in conducting state, a reverse voltage is applied between anode and cathode but it fails to turn off. What could be the reason ?
(A) Positive voltage is applied to the gate.
(B) The reverse voltage is small.
(C) The anode current is more than the holding current.
(D) Turn-off time of SCR is large.

59. Turn-on and turn-off times of transistor depends on
(A) static characteristics
(B) junction capacitance
(C) current gain
(D) dynamic characteristics

60. The unit protection scheme provides
(A) Primary protection
(B) Backup protection
(C) Simultaneous protection
(D) Remote protection

61. The voltages across the various discs of a string of suspension insulators having identical discs is different due to
(A) surface leakage currents
(B) series capacitance
(C) shunt capacitance to ground
(D) series and shunt capacitances

62. The insulation of the modern EHV lines is obtained based on
(A) the lightening voltage
(B) corona
(C) the switching voltage
(D) radio interference

63. Back to back connection is used in HVDC systems to
(A) provide a synchronous tie
(B) provide bulk power transmission
(C) reduce voltage drop
(D) improve stability

64. For stable operation of interconnected system the passive element that can be used as the interconnecting element is
(A) Capacitor
(B) Resistor
(C) Reactor
(D) Resistor and Capacitor

65. ACSR conductors have
(A) All conductors made of aluminium
(B) Outer conductors made of aluminium
(C) Inner conductors made of aluminium
(D) No conductors made of aluminium

Space For Rough Work

SECTION – II (10 × 2 = 20)

Each question carries two marks.

66. What is the load at which maximum efficiency occurs in case of a 100 kVA transformer with iron loss of 1 kW and full load copper loss of 2 kW ?

(A) 100 kVA

(B) 25.2 kVA

(C) 50.5 kVA

(D) 70.7 kVA

67. An eight pole DC generator has a simple wave wound armature containing 32 coils of 6 turns each. Its flux per pole is 0.06 Wb. The machine is running at 250 rpm. The generated voltage is

(A) 96 V

(B) 192 V

(C) 384 V

(D) 768 V

68. The current drawn by a 120V DC motor with back emf of 110V and armature resistance of 0.4 ohm is

(A) 4 A (B) 25 A

(C) 274 A (D) 300 A

69. A relay is connected to a 400/5 A current transformer and set for 150%. The primary fault current of 2400 A needs a plug setting multiplier of

(A) 2

(B) 4

(C) 6

(D) 8

70. The zero sequence current of a generator for line to ground fault is j 2.4 pu. Then the current through the neutral during the fault is

(A) j 2.4 pu

(B) j 0.8 pu

(C) j 7.2 pu

(D) j 0.24 pu

Space For Rough Work

71. A power station has a maximum demand of 2500 kW and number of kWh generated per year are 45×10^5. The load factor is

(A) 20.5%

(B) 10.25%

(C) 41%

(D) 82%

72. What is the approximate value of the surge impedance loading of a 400 kV, 3 phase 50 Hz overhead single circuit transmission line ?

(A) 230 MW

(B) 1000 MW

(C) 1600 MW

(D) 400 MW

73. A 10 pole, 25 Hz alternator is directly coupled to and is driven by 60 Hz synchronous motor. What are the number of poles for the synchronous motor ?

(A) 48 (B) 24

(C) 12 (D) 16

74. What is the operating slip of a 400 V, 50Hz, 6pole, 3phase induction motor, while the speed is 936 rpm with a 400 V, 48 Hz, 3 phase supply ?

(A) 0.036 (B) 0.064

(C) 0.025 (D) 0.075

75. A 4 kVA, 400 V/200 V single phase transformer has resistance of 0.02 pu and reactance of 0.06 pu. The resistance and reactance referred to high voltage side are

(A) 0.8 Ω and 2.4 Ω

(B) 0.2 Ω and 0.6 Ω

(C) 0.08 Ω and 0.24 Ω

(D) 1 Ω and 3 Ω

Space For Rough Work

(E & C AND TC : ELECTRONICS AND COMMUNICATION ENGINEERING AND TELECOMMUNICATION ENGINEERING)

PART – B

(SECTION – I)

Each question carries one mark. **(20 × 1 = 20)**

46. The most suitable device for high frequency inversion in SMPS is :
(A) BJT (B) IGBT
(C) MOSFET (D) GTO

47. The $\frac{di}{dt}$ protection for an SCR is achieved through the use of :
(A) R in series with SCR
(B) RL in series with SCR
(C) RL across SCR
(D) L in series with SCR

48. Which one of the following devices can be turned 'ON' or 'OFF' by applying gate signal ?
(A) SCR (B) SCS
(C) TRIAC (D) UJT

49. The junction capacitance of a p-n junction depends on :
(A) doping concentration only
(B) applied voltage only
(C) both doping concentration and applied voltage
(D) barrier potential only

50. What is the Nyquist rate for $x(t) = \cos 2000\,\pi t + 3 \sin 6000\,\pi t$?
(A) 2 kHz (B) 4 kHz
(C) 6 kHz (D) 12 kHz

51. A system with an input $x(t)$ and output $y(t)$ is describe by the relation :
$y(t) = tx(t)$
This system is
(A) Linear and time invariant
(B) Non-linear and time invariant
(C) Linear and time varying
(D) Non-linear and time varying

52. The modulation index of an amplitude modulated wave is changed from 0 to 1. The transmitted power is :
(A) Doubled
(B) Halved
(C) Increased by 50 percent
(D) Unchanged

53. In a Class-AB amplifier, the current flows through the active device for
(A) Less than half of the duration of input cycle.
(B) Half duration of input cycle
(C) More than half but less than full cycle duration
(D) full duration of input cycle

54. Which statement is true regarding a behaviour modeling in VHDL ?
(A) There can be more than one process statement in an architecture which interact concurrently.
(B) Behavioural style of architecture can have only concurrent assignment statements.
(C) Process is not a single concurrent statement.
(D) A process need to have sensitivity list for proper implementation.

55. The channel capacity under the Gaussian noise environment for a discrete memoryless channel with a bandwidth of 4 MHz and SNR of 31 is
(A) 20 Mbps (B) 4 Mbps
(C) 4 Kbps (D) 8 Kbps

Space For Rough Work

56. A very lossy, $\lambda/4$ long 50 ohm transmission line is open circuited at the load end. The input impedance measured at the other end of the line is approximately :
(A) 0 (B) ∞
(C) 50 ohms (D) 1 ohm

57. Which one of the following antenna structures is best for generating a circularly polarised radiation ?
(A) Helical antenna
(B) Log-periodic antenna
(C) Rhombic antenna
(D) Dipole antenna

58. The Gunn diode is made from :
(A) Gallium Arsenide
(B) Silicon
(C) Germanium
(D) Selenium

59. Mathematical modeling for random processes is mainly based on :
(A) z-transform
(B) Fourier series
(C) Probability theory
(D) Dirichelet conditions

60. The output data lines of microprocessor and memories are usually tristuted, because
(A) the data lines can be multiplexed for both input and output
(B) more than one device can transmit information over the data bus at the same time
(C) more than one device can transmit information over the data bus by enabling only one device at a time.
(D) it increases the speed of the data transfers over the data bus

61. Which one of the following devices is NOT used as the controller in a stabilizer ?
(A) DIAC (B) TRIAC
(C) Power transistor (D) SCR

62. A Geostationary orbit is chosen for communication satellites because
(A) it is stationary at one point in space.
(B) this orbit provides earth's coverage of more than 50% using a single satellite.
(C) with respect to a spot on earth it looks stationary.
(D) the length of 4700 km is convenient for launching.

63. Which one of the following is the correct statement ? The region of convergence of z-transform $x \mid n \mid$ consists of the values z for which $x \mid n \mid r^{-n}$ is
(A) absolutely integrable
(B) unity
(C) absolutely summuble
(D) less than 1

64. Which one of the following block is not common in both AM and FM receivers ?
(A) RF amplifier
(B) Mixer
(C) IF amplifier
(D) Slope detector

65. Increasing the trans conductance (g_m) results in :
(A) increases input capacitance
(B) decreases area occupied
(C) decreasing in input capacitance
(D) decrease in output capacitance

Space For Rough Work

(SECTION – II)

Each question carries two marks. **(10 × 2 = 20)**

66. An audio frequency of 15 kHz is frequency modulated with a deviation 75 kHz. The resulting bandwidth is :

(A) 150 kHz
(B) 210 kHz
(C) 180 kHz
(D) 240 kHz

67. A source generates four messages with probability $\frac{1}{8}, \frac{1}{8}, \frac{1}{4}$ and $\frac{1}{12}$

What is the entropy of the source (bits/message) ?

(A) 1 (B) 1.75
(C) 2 (D) 4

68. A micro strip line with alumina substrate $\epsilon_r = 9$ has a strip width w = 3 mm. Substrate thickness h = 0.5 mm. What is the approximate characteristic impedance of the line, assuming TEM wave propagation and negligible fringing field ?

(A) 50 Ω (B) 26 Ω
(C) 21 Ω (D) 10 Ω

69. Find the duty cycle of a radar with a PW of 3 μs and PRT of 6 ms :

(A) 0.0005 (B) 0.018
(C) 0.0018 (D) 0.005

70. The tuned circuit of the oscillator in a simple AM transmitter employs a 50 μH coil and a 1-nanofarad capacitor. If the oscillator output is modulated by audio frequencies upto 10 kHz. What is the frequency range occupied by side bands ?

(A) 702 – 722 kHz
(B) 10.1 to 10.2 kHz
(C) 9.99 to 10.1 kHz
(D) 900 – 902 kHz

71. Determine the discrete time Fourier transform for the signal

$X(n) = [-2, -1, 0, 1, 2]$
$\uparrow$
$n = 0$

(A) $2j\,(2 \sin 2\omega + \sin \omega)$
(B) $2(2 \cos 2\omega + \cos \omega)$
(C) $-2j\,(2 \sin 2\omega + \sin \omega)$
(D) $-2\,[2 \cos 2\omega - \cos \omega)$

72. A source has a unidirectional cosine radiation intensity, its directivity is :

(A) 1.5 (B) 4
(C) 2 (D) 6

73. A standard rectangular wave guide has inside wall dimensions of a = 2.286 cm, b = 1.016 cm. What is the cut off wavelength for TE_{01} mode ?

(A) 4.572 cm (B) 2.032 cm
(C) 2.286 cm (D) 1.857 cm

74. The noise figure of a receiver is 1.6. Its equivalent noise temperature is

(A) 464.00 K (B) 174.00 K
(C) 108.75 K (D) 181.25 K

75. A parabolic dish has a diameter of 10 m. The maximum possible gain of antenna at $\lambda = 341$ cm will be :

(A) 30 dB (B) 60 dB
(C) 40 dB (D) 50 dB

Space For Rough Work

(BME & ME : BIOMEDICAL ENGINEERING & MEDICAL ELECTRONICS)

PART – B

(SECTION – I)

Each question carries one mark. **(20 × 1 = 20)**

46. Which of the following has to be computed to determine transmittance and absorbance at various frequencies ?

(A) Ratio of signal and noise

(B) Ratio of sample and reference spectra

(C) Sample spectra

(D) Reference spectra

47. Mass spectrometers are used to determine which of the following ?

(A) Composition in sample

(B) Concentration of elements in sample

(C) Relative mass of atoms

(D) Properties of sample

48. Inverse fourier transform of a signal

$X(j\omega) = 2\pi\delta(\omega) + \pi\delta(\omega - 4\pi) + \pi\delta(\omega + \pi)$

(A) $1 + \cos 4\pi t$

(B) $\pi (1 - \cos 4\pi t)$

(C) $2\pi (1 - \cos 4\pi t)$

(D) $2\pi (1 + \cos 4\pi t)$

49. A system with an input $x(t)$ and output $y(t)$ is described by the relation :

$y(t) = t\, x(t)$. This system is

(A) Linear and time invariant

(B) Linear and time varying

(C) Non-linear and time variant

(D) Non-linear and time invariant

50. In digital image of M-rows and N-columns and L-discrete gray levels, calculate the bits required to store a digitized image for M = N= 32 and L = 16.

(A) 16384

(B) 4096

(C) 8192

(D) 512

51. Which of the following filters response is based on ranking of pixels ?

(A) Non-linear smoothing filters

(B) Linear smoothing filters

(C) Sharpening filters

(D) Geometric mean filters

Space For Rough Work

52. In ECG machine, standard cable colour code for right arm is

(A) White

(B) Black

(C) Red

(D) Brown

53. The mercury in a manometer rises to a height of 120 mmHg. The absolute pressure will be

(A) 120 mmHg

(B) 240 mmHg

(C) 760 mmHg

(D) 880 mmHg

54. The output of a bimetallic element will be

(A) Strain (B) Pressure

(C) Displacement (D) Voltage

55. Which of the following can be used for measuring temperature ?

(A) Metallic diaphragm

(B) Fluid expansion system

(C) Capsule

(D) Bourdon tube

56. The energy must be reflected and returned through a single 30° prism, so that it passes through the prism in both directions is called

(A) Cornu mounting

(B) Mono mounting

(C) Littrow mounting

(D) Trio mounting

57. Which of the following is not the advantage of Fourier Transform Spectrometer ?

(A) Signal to noise ratio is high.

(B) Information could be obtained on all frequencies.

(C) Retrieval of data is possible.

(D) Easy to maintain.

58. What is the nature of the following function $y[n] = y[n-1] + X[n]$?

(A) Integrator

(B) Differentiator

(C) Subtractor

(D) Accumulator

Space For Rough Work

59. Discrete-time signals are

(A) Continuous in amplitude and continuous in time

(B) Continuous in amplitude and discrete in time

(C) Discrete in amplitude and discrete in time

(D) Discrete in amplitude and continuous in time

60. In sonography, what is range of ultrasonic energy transmitted into the body ?

(A) $0 - 5\ mW/cm^2$

(B) $5 - 10\ mW/cm^2$

(C) $10 - 15\ mW/cm^2$

(D) $15 - 20\ mW/cm^2$

61. Which one of the following is not the category of ECG compression techniques ?

(A) Transformation domain

(B) Parameter extraction

(C) Frequency domain

(D) Time domain

62. Which of the following is an example of an open loop system ?

(A) Household refrigerator

(B) Respiratory system of an animal

(C) Stabilization of air pressure entering into the mask

(D) Execution of program by computer

63. Galvanic Skin Response (GSR) gives

(A) Activity of sweat glands

(B) Baseline value of skin resistance

(C) Activity of endocrine glands

(D) Base line value of breathing

64. The electrodes used to obtain the biopotential of a cell is called

(A) Needle electrode

(B) Microelectrode

(C) Suction cup electrode

(D) Surface electrode

65. PET stands for

(A) Polyethylene Terephthalate

(B) Personal Electronic Transactor

(C) Photon Emission Tomography

(D) Positron Emission Tomography

Space For Rough Work

(SECTION – II)

Each question carries two marks. **(10 × 2 = 20)**

66. The tissue having volume of 0.2 m^3 and the resistivity of $1.6 \times 10^3\ \Omega - m$. If the current density is 0.36 A/m^2, then power dissipated is

(A) 41.6 W (B) 36.6 W
(C) 82.1 W (D) 100 W

67. The biomedical signal level of 800 μV rms expressed in dBm is

(A) –48.9 dBm (B) –8.1 dBm
(C) 0 dBm (D) +8.1 dBm

68. Determine the discrete-time Fourier transform for the signal

$X[n] = [-2, -1, 0, 1, 2]$

$- \longleftarrow \underset{n=0}{\uparrow} \longrightarrow +$

(A) $2j(2 \sin 2\omega + \sin \omega)$
(B) $-2j(2 \sin 2\omega + \sin \omega)$
(C) $2(2 \cos 2\omega + \cos \omega)$
(D) $-2(2 \cos 2\omega - \cos \omega)$

69. If the atmospheric pressure at sea level is 760 mmHg, then the partial pressure of oxygen is

(A) 159.30 mmHg (B) 230.00 mmHg
(C) 760.00 mmHg (D) 890.60 mmHg

70. What is the z-transform of the signal $X[n] = \alpha^n u(n)$?

(A) $X(z) = \frac{1}{z-1}$ (B) $X(z) = \frac{1}{1-z}$
(C) $X(z) = \frac{z}{z-\alpha}$ (D) $X(z) = \frac{1}{z-\alpha}$

71. The mask shown in figure below belongs to which type of filter ?

$\frac{1}{9} \times$

1	1	1
1	1	1
1	1	1

(A) Sharpening spatial filter
(B) Median filter
(C) Smoothing spatial filter
(D) Sharpening frequency filter

72. In diagnostic X-ray unit the grid ratio is in the range from

(A) 2 : 1 to 4 : 1 (B) 2 : 1 to 16 : 1
(C) 4 : 1 to 16 : 1 (D) 4 : 1 to 32 : 1

73. An X-ray machine working on 100 kVp potential and the maximum energy that an electron can acquire is 100 keV. Then the energy of an X-ray photon with wavelength of

(A) 0.012 Å (B) 0.024 Å
(C) 0.124 Å (D) 0.246 Å

74. What is the energy stored in a 16 μF capacitor, charged to a potential of 5 kV dc defibrillator ?

(A) 50 J (B) 100 J
(C) 150 J (D) 200 J

75. What is the particular solution of the first order difference equation $Y(n) + ay(n + 1) = X(n)$ where $|a| < 1$, when the input of the system $X(n) = U(n)$?

(A) $\frac{1}{(1+a)} u(n)$ (B) $\frac{1}{(1-a)} u(n)$
(C) $\frac{1}{(1+a)}$ (D) $\frac{1}{(1-a)}$

Space For Rough Work

(IT : INSTRUMENTATION TECHNOLOGY)

PART – B

(SECTION – I)

Each question carries one mark. **(20 × 1 = 20)**

46. The difference between the measured value and the true value is called

(A) gross error

(B) relative error

(C) probable error

(D) absolute error

47. The device processing the highest photosensitivity is :

(A) photo conductive cell

(B) photo voltaic cell

(C) photo diode

(D) photo transistor

48. A Hall effect transducer can be used to measure

(A) displacement, temperature and magnetic flux

(B) displacement, position and velocity

(C) position, magnetic flux and pressure

(D) displacement, position and magnetic flux

49. Harmonic distortion analyser

(A) measures the amplitude of each harmonic component

(B) measures RMS value of all the harmonic components except the fundamental frequency component

(C) measures the value of RMS value of fundamental frequency component

(D) displays the RMS value of each harmonic component on the screen of a CRO.

50. Which of the following materials are piezoelectric ?

(A) Mica and Quartz

(B) Mica, Barium titanate and Quartz

(C) Mica and Diamond

(D) Barium titanate and Quartz

51. The sum of two or more arbitrary sinusoids is :

(A) always periodic

(B) periodic under certain conditions

(C) never periodic

(D) periodic only if all the sinusoids are identical in frequency and phase

Space For Rough Work

52. Which one of the following in simple elemental forms is not a pressure sensor ?

(A) Cantilever beam

(B) Bourden tube

(C) Diaphragm

(D) Bellows

53. The reference electrode in pH measurement is :

(A) Antimony electrode

(B) Glass electrode

(C) Hydrogen electrode

(D) Hg-calomel electrode

54. Maximum power is transmitted by an electrical transducer if the impedance of the external load

(A) is very high

(B) is very low

(C) matches with the internal impedance of the transducer

(D) increases from very low values to very high values

55. The longest wavelength that can be absorbed by silicon, which has the bandgap of 1.12 eV is 1.1 μm. If the longest wavelength that can be absorbed by another material is 0.87 μm, then the bandgap of this material is :

(A) 1.425 eV (B) 0.886 eV

(C) 0.854 eV (D) 0.706 eV

56. An X-ray machine working on 100 kVp potential and the maximum energy that an electron can acquire is 100 keV. Then the energy of an X-ray photon with wavelength of :

(A) 0.012 Å

(B) 0.024 Å

(C) 0.124 Å

(D) 0.246 Å

57. A 1 mA meter movement with an internal resistance of 100 Ω is to be converted into 0 – 100 mA. The shunt resistance required is :

(A) 2 Ω (B) 1.01 Ω

(C) 50 Ω (D) 100 Ω

Space For Rough Work

58. Which of the following is not the advantage of Fourier transform spectrometer ?
(A) S/N is high
(B) Information can be gathered on all frequencies
(C) Retrieval of data is possible
(D) Easy to maintain

59. When system noise is large and signal power is low in a telemetry system, what is the preferred form of modulation ?
(A) Pulse – width modulation
(B) Pulse – amplitude modulation
(C) Pulse – code modulation
(D) Pulse position modulation

60. A compensated wattmeter has its reading corrected for error due to which one of the following parameters ?
(A) Frequency
(B) Friction
(C) Power consumed in current coil
(D) Power consumed in pressure coil

61. The temperature co-efficient of resistance for a thermistor is
(A) low and negative
(B) low and positive
(C) high and positive
(D) high and negative

62. The dynamic characteristics of capacitive transducers are similar to those of a
(A) band-stop filter
(B) high-pass filter
(C) notch filter
(D) low-pass filter

63. If low pressure of the order of 10^{-6} mm of Hg is to be measured, the instrument of choice would be
(A) Compound pressure guage
(B) thermocouple vacuum guage
(C) Pirani guage
(D) ionization vacuum guage

64. The most useful transducer for displacement sensing with excellent sensitivity, linearity and resolution is :
(A) an incremental encoder
(B) an absolute encoder
(C) a LVDT
(D) a strain gauge

65. For measuring temperature below 20 K with high accuracy, the most useful instrument is :
(A) an optical pyrometer
(B) a thermistor based thermometer
(C) Ga As pn-junction diode thermometer
(D) Platinum resistance thermometer

Space For Rough Work

(SECTION – II)

Each question carries two marks. **(10 × 2 = 20)**

66. A 300 V full scale deflection voltmeter has an accuracy of ± 2% when it reads 222 V, the actual voltage

(A) lies between 217.56 V to 226.44 V
(B) lies between 217.4 and 226.6 V
(C) lies between 216 V and 228 V
(D) is exactly 222 V

67. A coil is tuned to resonance at 1 MHz with resonating capacitance of 72 pF. At 500 kHz, the resonance is obtained with a capacitance value of 360 pF. The self capacitance of the coil is :

(A) 12 pF (B) 24 pF
(C) 36 pF (D) 72 pF

68. Consider a multifunction board with an ADC that can operate at a sampling rate of 100 k samples/sec. When this ADC is used to sample 10 channels, what is the effective rate of scanning for each individual channel ?

(A) 10 k samples/sec
(B) 20 k samples/sec
(C) 1000 samples/sec
(D) 2000 samples/sec

69. The minimum number of 2 to 1 multiplexers required to realise a 4 to – 1 multiplexer is

(A) 1 (B) 2
(C) 3 (D) 4

70. An instrument needs an amplifier to amplify pulses of one microsecond duration. The amplifier must have a bandwidth atleast :

(A) 10 kHz (B) 10 MHz
(C) 1 kHz (D) 1 MHz

71. The power in the signal

$s(t) = 8 \cos (20\pi t - \frac{\pi}{2}) + 4 \sin (15\pi t)$

(A) 40 (B) 41
(C) 42 (D) 82

72. If the Laplace transform of a signal $y(t)$ is $y(s) = \frac{1}{S(S-1)}$ then its final value is

(A) –1 (B) 0
(C) 1 (D) unbounded

73. Determine the discrete time Fourier transform for the signal

$X(n) = [-2, -1, \underset{\uparrow}{0}, 1, 2]$

$n = 0$

(A) $2j (2 \sin 2\omega + \sin \omega)$
(B) $2 (2 \cos 2\omega + \cos \omega)$
(C) $-2j (2 \sin 2\omega + \sin \omega)$
(D) $-2 (2 \cos 2\omega - \cos \omega)$

74. An inductive pickup is used to measure speed of a shaft on which a 120 tooth wheel is attached. The number of pulses produced per second is 3000. What is the RPM of the shaft ?

(A) 1500 (B) 1800
(C) 3000 (D) 3600

75. A 24 mm long conductor has a resistance of 128 ohms. If the change in resistance is 13.3 ohms and the change in length is 1.6 mm under tension, then the gauge factor of the conductor will be approximately :

(A) 1.2 (B) 2.1
(C) 1.6 (D) 2.6

Space For Rough Work

Space For Rough Work