

## Research Aptitude Test - 2021

### Model Test Paper

**Maximum Marks 100**

**Instruction:**

- (a) The Question Paper consists of two Parts.
- (b) Part – I of Question Paper (based on research methodology and quantitative aptitude) consists of 50 objective types of questions each of one mark. Correct answer is to be clicked as **a, b, c** or **d**.
- (c) Part – II of Question Paper (based on domain specific) consists 2 sections. Section I consists 30 objective types of questions each of one mark. Correct answer is to be clicked as a, b, c or d. Section II consists descriptive type of questions each of 5 marks. The answers are to be written in the given space. Candidate are advised to attempt questions from only one domain.

### **PART -I**

**[Common for all Candidates]  
(Research Methodology and Quantitative Aptitude)**

1. Action-research can be understood as \_\_\_\_\_
  - a. A longitudinal Research
  - b. An applied Research
  - c. A kind of research being carried out to solve a specific problem
  - d. All of the above.
  
2. The process not needed in experimental research is
  - a. Controlling
  - b. Observation
  - c. Reference collection
  - d. Manipulation and replication
  
3. If FRIEND is coded as HUMJTK, how is CANDLE written in that code ?
  - a. EDRIRL
  - b. DCQHQB
  - c. ESJFME
  - d. DEQJQM
  
4. "Sampling Cases" can be defined as
  - a. Sampling using a sampling frame
  - b. Identifying people who are suitable for research
  - c. Literally the researcher's brief case
  - d. A sampling of people, newspapers, television programs etc.

5. Biped : Quadruped :: Ostrich : ?
- Cat
  - Kangaroo
  - Penguin
  - Duck
6. If you write down all the numbers from 1 to 100, then how many times do you write 3?
- 11
  - 18
  - 20
  - 21
7. What are the core elements of a dissertation?
- Introduction; Data Collection; Data Analysis; Conclusions and Recommendations
  - Executive Summary; Literature Review; Data Gathered; Conclusions; Bibliography
  - Research Plan; Research Data; Analysis; References
  - Introduction; Literature Review; Research Methodology; Results; Discussions and Conclusions
8. In a town of 500 people, 285 read Hindu and 212 read Indian Express and 127 read Times of India, 20 read Hindu and Times of India and 29 read Hindu and Indian Express and 35 read Times of India and Indian express. 50 read no newspaper. Then how many read only one paper?
- 123
  - 231
  - 312
  - 32
9. On what basis did Jean Piaget give his theory of cognitive development of humans?
- Evaluation Research
  - Fundamental Research
  - Applied Research
  - Action Research
10. Which one is called non-probability sampling?
- Quota sampling
  - Cluster sampling
  - Systematic sampling
  - Stratified random sampling

11. Authenticity of a research finding is its

- a. Validity
- b. Objectivity
- c. Originality
- d. All of the above.

12. Arrange the words given below in a meaningful sequence.

1.Presentation 2.Recommendation 3. Arrival 4.Discussion 5. Introduction

- a. 5, 3, 4, 1, 2
- b. 3, 5, 4, 2, 1
- c. 3, 5, 1, 4, 2
- d. 5, 3, 1, 2, 4

13.



a.



b.



c.



d.



14. Circle graphs are used to show

- a. How is one part related to other parts?
- b. How various sections share in the whole?
- c. How is one whole related to another whole?
- d. How are various parts related to the whole?

15. Pointing to a photograph, Vipul said, "She is the daughter of my grandfather's only son."  
How is Vipul related to the girl in the photograph?

- a. Father
- b. Brother
- c. Cousin
- d. Uncle

16. A research problem is feasible only when

- a. It has utility and relevance
- b. It is new and adds something to knowledge
- c. It is researchable
- d. All of the above

17. Which of the following is not the method of Research?

- a. Survey
- b. Historical
- c. Observation
- d. Philosophical

18. One morning after sunrise, Suresh was standing facing a pole. The shadow of the pole fell exactly to his right. To which direction was he facing?

- a. East
- b. West
- c. South
- d. Data is inadequate

19.



- a. 1
- b. 2
- c. 3
- d. 4

20.



- a. 1
- b. 2

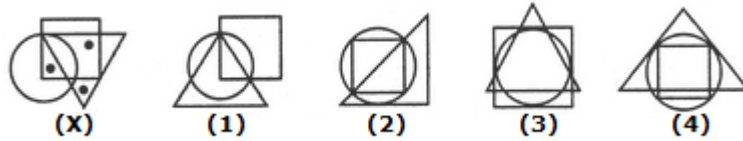
- c. 3
  - d. 4
21. Four usual dice are thrown on the ground. The total of numbers on the top faces of these four dice is 13 as the top faces showed 4, 3, 1 and 5 respectively. What is the total of the faces touching the ground?
- a. 12
  - b. 13
  - c. 15
  - d. Cannot be determined
22. How to judge the depth of any research?
- a. By research title
  - b. By research duration
  - c. By research objectives
  - d. By total expenditure on research
23. The conclusions/findings of which type of research cannot be generalized to other situations?
- a. Casual Comparative Research
  - b. Historical Research
  - c. Descriptive Research
  - d. Experimental Research
24. The main aim of the scientific method in the research field is to \_\_\_\_\_
- a. Improve data interpretation
  - b. Confirm triangulation
  - c. Introduce new variables
  - d. Eliminate spurious relations
25. Which of the following does not correspond to characteristics of research?
- a. Research is not passive
  - b. Research is systematic
  - c. Research is not a problem-oriented
  - d. Research is not a process
26. How many pairs of letters are there in the word 'NURSING' which have as many letters between them as in the alphabet?
- a. 1
  - b. 3
  - c. 5

d. 6

27. Assertion (A): Pakistan's national cricket team did not participate in the tournament.  
Reason (R): Pakistan does not have enough cricket players.

- a. Both (A) and (R) are true, and (R) is the correct explanation of (A).
- b. Both (A) and (R) are true, but (R) is not the correct explanation of (A).
- c. (A) is true, but (R) is false.
- d. (A) is false, but (R) is true.

28. Select the figure which satisfies the same conditions of placement of the dots as in Figure-X.



- a. 1
- b. 2
- c. 3
- d. 4

29. Evaluation Research is concerned with \_\_\_\_\_

- a. How well are we doing?
- b. Why are we doing?
- c. What are we doing?
- d. None of the above

30. What does the longitudinal research approach actually deal with?

- a. Long-term research
- b. Short-term research
- c. Horizontal research
- d. None of the above

31. Find the 11th letter to the left of 20th letter from left in the English alphabet.

- a. D
- b. J
- c. K
- d. I

32. AZ, CX, FU, ?

- a. IR
- b. IV

- c. JQ
  - d. KP
33. Assertion (A): The Steam engine was invented by James Watt.  
Reason (R): There was a problem of taking out water from flooded mines.
- a. Both A and R are true and R is the correct explanation of A.
  - b. Both A and R are true but R is NOT the correct explanation of A
  - c. A is true but R is false.
  - d. A is false but R is true.
34. Which one among the following statements is false in the context of participatory research?
- a. It recognizes knowledge as power
  - b. It is a collective process of inquiry
  - c. It emphasizes people as experts
  - d. Its sole purpose is the production of knowledge
35. A research intends to explore the result of possible factors for the organization of effective mid-day meal interventions. Which research method will be most appropriate for this study?
- a. Descriptive survey method
  - b. Historical method
  - c. Ex-post facto method
  - d. Experimental method
36. How is random sampling helpful?
- a. Reasonably accurate
  - b. An economical method of data collection
  - c. Free from personal biases
  - d. All of the above
37. Which of the following features are considered as critical in qualitative research?
- a. Collecting data with the help of standardized research tools.
  - b. Design sampling with probability sample techniques.
  - c. Collecting data with bottom-up empirical evidence.
  - d. Gathering data with top-down schematic evidence.
38. What is the main role of research in education?
- a. To upsurge one's social status.
  - b. To increase one's job prospects.
  - c. To augment one's personal growth.
  - d. To help an applicant in becoming a renowned educationalist.

39. While going on a scooter, you find someone has been hurt by your vehicle, you would
- Try to run away from the spot immediately
  - stop your vehicle and say 'I am sorry'
  - Take him to doctor and arrange for his medical aid
  - pay compensation for the injury and in this way
40. In the following question, a number series is given with one term missing. Choose the correct alternative that will the same pattern and fill in the blank spaces.: 1, 4, 9, 16, 25, x
- 35
  - 36
  - 48
  - 49
41. 120, 99, 80, 63, 48, ?
- 35
  - 38
  - 39
  - 40
42. What is the major attribute of Correlation Analysis?
- Association among variables
  - Difference among variables
  - Regression among variables
  - Variations among variables
43. I. All flowers in the garden are red.  
II. Some of the flowers are roses.  
III. All roses in the garden are red.  
If the first two statements are true, the third statement is
- False
  - True
  - Uncertain
  - None of the above
44. If the word 'LION' is coded as LMGJ. How is 'MILK' written in that code?
- JKFL
  - KLIM
  - KILM
  - IJGK
45. \_\_\_\_\_ is a type of conclusive research which is especially formulated to give a description about a phenomena or group
- Longitudinal Research design
  - Exploratory Research design



- c. Descriptive Research design
  - d. Two- Tiered Research design
46. Which of the following is true about field experiment?
- a. High internal validity
  - b. High external validity
  - c. High internal and High external validity
  - d. None of the above
47. A is B's sister. C is B's mother. D is C's father. E is D's mother. Then, how is A related to D?
- a. Grandfather
  - b. Grandmother
  - c. Daughter
  - d. Granddaughter
48. A and B invest in a business in the ratio 3 : 2. If 5% of the total profit goes to charity and A's share is Rs. 855, the total profit is :
- a. 500
  - b. 1000
  - c. 1500
  - d. 2000
49. Who was the author of the book named "Methods in Social Research"?
- a. Kerlinger
  - b. CR Kothari
  - c. Goode and Hatt
  - d. Wilkinso
50. Statement 1: A is bigger than B but shorter than C  
Statement 2: D is smaller than C and bigger than A  
Statement 3: B is greater than D  
If statement 1 and statement 2 are true, statement 3 will be –
- a. True
  - b. false
  - c. uncertain
  - d. None of the above

# PART-II

## (Domain Specific)

(Computer Science & Engineering /Electronics & Communication Engineering /Management/Mathematics)

### Instructions:

Part – II of Question Paper (based on domain specific) consists 2 sections. Section I consists 30 objective types of questions each of one mark. Correct answer is to be clicked as a, b, c or d. Section II consists descriptive type of questions each of 5 marks. The answers are to be written in the given space. Candidate are advised to attempt questions from only one domain.

## Computer Science & Engineering

### Section I

1. Which of the following statements is true for TCP protocol?
  - a. TCP is a connection-less unreliable protocol.
  - b. TCP is a connection-less reliable protocol.
  - c. TCP is a connection-oriented reliable protocol.
  - d. TCP is a connection-oriented unreliable protocol.
2. The file space allocation of Unix Operating System is:
  - a. Linked
  - b. Single level indexed
  - c. Multi-level Indexed
  - d. Contiguous
3. Consider the following transaction involving two bank accounts x and y. read(x); x:= x – 50; write(x); read(y); y := y + 50; write(y) The constraint that the sum of the accounts x and y should remain constant is that of:
  - a. Atomicity
  - b. Consistency
  - c. Durability
  - d. Isolation
4. What is the worst case time complexity of inserting n elements into an empty linked list, if the linked list needs to be maintained in sorted order?
  - a. O(n)
  - b. O(n log n)
  - c. O(n<sup>2</sup>)
  - d. None of the above
5. Suppose we are given pointers to first and last nodes of a singly linked list containing n elements (where each node contains pointer to the next node). Which of the following operations cannot be performed in time independent on the length of the linked list?

- a. Insert a new element as the last element.
- b. Insert a new element as the first element.
- c. Delete the first element.
- d. Delete the last element.

6. A CPU has 32 bit address lines and 16 bit datalines. The maximum primary memory addressing capacity of the CPU is:

- a. 4 MB
- b. 2 GB
- c. 64 KB
- d. 4 GB

7. Which of the following inter-process communication mechanism is most efficient in an operating system?

- a. Semaphore
- b. Shared memory
- c. Message Passing
- d. Message queue

8. In a QAM Modulation scheme, the baud-rate is 4 kilobaud/second. The lowest carrier frequency is 102 KHz. The bandwidth of the channel is 1 MHz. The number of digital channels created would be:

- a. 300
- b. 250
- c. 200
- d. 225

9. To reduce thrashing in virtual memory, which of the following data structures is most suitable?

- a. Queue
- b. Array
- c. Hashing
- d. Stack

10. An Ethernet frame is 32 bytes long. How many extra bytes should be added to the frame before transmission?

- a. 32 bytes
- b. 48 bytes
- c. 64 bytes
- d. 4. 16 bytes

11. The number of 4 digit even numbers where all the digits are distinct is (Note that the most significant digit of these numbers cannot be zero).

- a. 2296
- b. 2240
- c. 2520

d. 2620

12. Networks that use different technologies can be connected by using

- a. Packets
- b. Switches
- c. Bridges
- d. Routers

13. The postfix expression  $AB + CD - *$  can be evaluated using a

- a. Stack
- b. Tree
- c. Queue
- d. Linked List

14. Both hosts and routers are TCP/IP protocol software. However, routers do not use protocol from all layers. The layer for which protocol software is not needed by a router is:

- a. Application
- b. Physical
- c. Internet
- d. Network Interface

15. The post order traversal of a binary tree is DEBFCA. Find out the preorder traversal.

- a. ABFCDE
- b. ADBFEC
- c. ABDECF
- d. None of the above

16. In multiuser database if two users wish to update the same record at the same time, they are prevented from doing so by

- a. Jamming
- b. Password
- c. Documentation
- d. Record Lock

17. The branch logic that provides making capabilities in the control unit is known as:

- a. Controlled Transfer
- b. Conditional Transfer
- c. Unconditional Transfer
- d. None of the above

18. A binary search tree is a binary tree:

- a. All items in the left subtree are less than root

- b. All items in the right subtree are greater than or equal to the root
- c. Each subtree is itself a binary search tree
- d. All of the above

19. The number of colours required to properly colour the vertices of every planer graph is:

- a. 2
- b. 3
- c. 4
- d. 5

20. Leaves of which of the following trees are at the same level?

- a. Binary Tree
- b. B- Tree
- c. AVL Tree
- d. Expression Tree

21. What deletes the entire file except the file structure?

- a. ERASE
- b. DELETE
- c. ZAP
- d. PACK

22. Which of the following TCP/IP Internet protocol is diskless machine uses to obtain its IP address from a server?

- a. RAP
- b. RIP
- c. ARP
- d. X.25

23. Which command is the fastest among the following?

- a. COPY TO
- b. COPY STRUCTURE TO
- c. COPY FILE
- d. COPY TO MFILE-DAT DELIMITED

24. Decryption and Encryption of data are the responsibility of which of the following layer?

- a. Physical Layer
- b. Data Link Layer
- c. Presentation Layer
- d. Session Layer

25. B+ tree are preferred to binary tree in Database because

- a. Disk capacities are greater than memory capacities
- b. Disk access is much slower than memory access
- c. Disk data transfer rates are much less than memory data transfer rate
- d. Disks are more reliable than memory

26. In which circuit switching, delivery of data is delayed because data must be stored and retrieved from RAM?

- a. Space Division
- b. Time Division
- c. Virtual
- d. Packet

27. With reference to cache memory, the hit ratio is defined as:

- a.  $\text{No. of hits} / (\text{No. of hits} + \text{No. of miss})$
- b.  $\text{No. of hits} / \text{No. of miss}$
- c.  $\text{No. of miss} / (\text{No. of hits} + \text{No. of miss})$
- d.  $\text{No. of miss} / \text{No. of hits}$

28. How many address/data lines are required to access 64k x 8 memory?

- a. 16/8
- b. 8/16
- c. 16/16
- d. 8/8

29. In a sliding window ARQ scheme, the transmitter's window size is N and the receiver's window size is M. The minimum number of distinct sequence numbers required to ensure correct operation of the ARQ scheme is:

- a.  $\max(M, N)$
- b.  $M + N$
- c.  $\min(M, N)$
- d.  $M * N$

30 Consider a disk pack with a seek time of 4 milliseconds and rotational speed of 10000 rotations per minute (RPM). It has 600 sectors per track and each sector can store 512 bytes of data. Consider a file stored in the disk. The file contains 2000 sectors. Assume that every sector access necessitates a seek, and the average rotational latency for accessing each sector is half of the time for one complete rotation. The total time (in milliseconds) needed to read the entire file is\_.

- a. 4020
- b. 14200
- c. 14400
- d. 14040

## Section II

### ***Instructions:***

1. Write your name, application number and email ID at the space provided in this form

2. *Use A4 size white papers for answers*
3. *Marks are indicated against each question*
4. *Attempt all questions*
5. *Credit will be given to brief and precise answers*
6. *Scan all your answer sheets and create a single PDF file for each question separately*
7. *Upload the PDF files in this form question wise.*

Q1 Explain partial dependency and transitive dependency. **(5 Marks)**

Q2 Explain thrashing in memory management. **(5 Marks)**

Q3 Explain PGP encryption system. **(5 Marks)**

Q4 What is the difference between arrays and linked list? Explain with example. **(5 Marks)**

## PART-II

(Domain Specific)

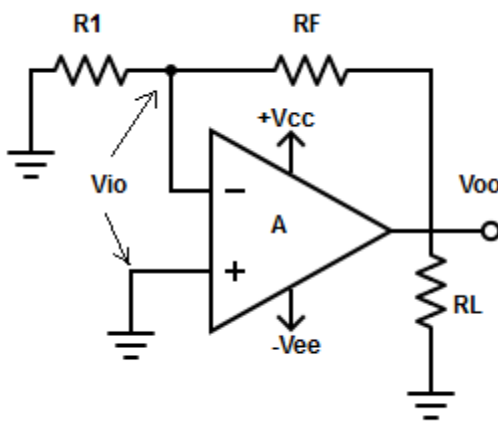
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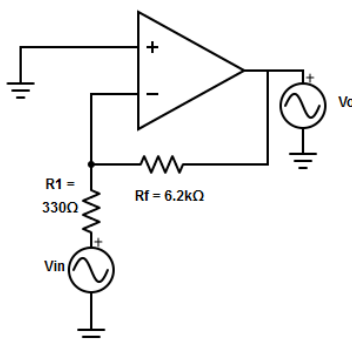
## Electronics & Communication Engineering

### Section I

1. What happens if  $R_1 \gg R_F$  in the circuit



- a. 1.1  
b. 1.6  
c. 1.2  
d. 2.2
2. Voltage shunt feedback amplifier forms
- a. A Positive feedback  
b. A negative feedback  
c. Both positive and negative  
d. None of the mentioned
3. Specification of op-amp 741c is given below:  
 $A=200000$ ;  $R_i=2M\Omega$ ;  $R_o=75\Omega$ ; Supply voltages=  $\pm 15v$ ; output voltage swing =  $\pm 13v$ ;



$f_o=5hz.$



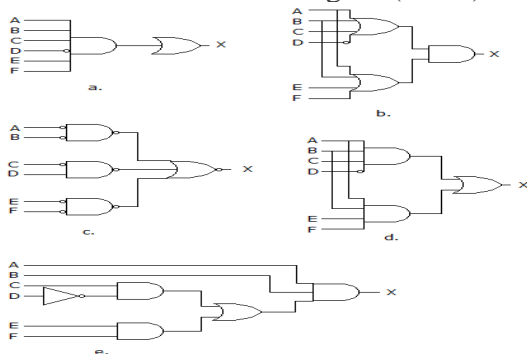
Compute the value of output resistance, bandwidth and closed loop voltage gain for the circuit shown.

- a.  $R_{OF}=8.6\text{m}\Omega$  ,  $f_F= 53005\text{hz}$  and  $A_F=-9.36$
  - b.  $R_{OF}=4.12\text{m}\Omega$  ,  $f_F= 53005\text{hz}$  and  $A_F=-11.78$
  - c.  $R_{OF}=7.1\text{m}\Omega$  ,  $f_F = 53005\text{hz}$  and  $A_F=-16.95$
  - d.  $R_{OF}=1.9\text{m}\Omega$  ,  $f_F= 53005\text{hz}$  and  $A_F=-10$
4. Write the formula for closed loop voltage gain of inverting amplifier with feedback using open loop voltage gain and gain of feedback circuit
- a.  $A_F= A/(1+AB)$
  - b.  $A_F= -A/(1+AB)$
  - c.  $A_F= -B/(1+AB)$
  - d. None of the mentioned
5. What are the types of MOSFET devices available?
- a. P-type enhancement type MOSFET
  - b. N-type enhancement type MOSFET
  - c. Depletion type MOSFET
  - d. All of the mentioned
6. Expression for characteristic impedance  $Z_o$  of a transmission line in terms of L and C the transmission line is:
- a.  $\sqrt{C/L}$
  - b.  $\sqrt{CL}$
  - c.  $\sqrt{L/C}$
  - d.  $1/\sqrt{LC}$
7. For any mode of propagation in a rectangular waveguide, propagation occurs
- a. Above the cut off frequency
  - b. Below the cut off frequency
  - c. Only at the cut-off frequency
  - d. Depends on the dimension of the waveguide
8. In a two wire transmission line, if the distance between the lines is 20 mm and the radii is 5 mm then the inductance of the line is:
- a.  $0.1 \mu\text{H}$
  - b.  $0.526 \mu\text{H}$
  - c.  $0.9 \mu\text{H}$
  - d.  $1 \mu\text{H}$
9. If the outer and the inner diameter of a coaxial transmission line are 20 mm and 10 mm respectively, then the inductance /m of the transmission line is:
- a.  $0.13 \mu\text{H}$
  - b.  $0.2 \mu\text{H}$
  - c.  $0.3 \mu\text{H}$
  - d.  $0.1 \mu\text{H}$
10. The lowest mode of TE mode propagation in a circular waveguide is:
- a. TE<sub>10</sub> mode
  - b. TE<sub>00</sub> mode
  - c. TE<sub>01</sub> mode
  - d. TE<sub>11</sub> mode
11. If the wavelength of a signal is 10 mm, then the wavenumber of the material when a waveguide is filled with that material is

- a. 628
  - b. 345
  - c. 123
  - d. None of the mentioned
12. The basic requirements of transmitting antennas are:
- a. High efficiency
  - b. Low side lobes
  - c. Large signal to noise ratio
  - d. None of the mentioned
13. . In which of the following semiconductor, the concentration of the holes and electrons is equal?
- a. Intrinsic
  - b. Extrinsic
  - c. Compound
  - d. Elemental
14. An AM signal is represented by  $x(t) = (20 + 4\sin(500\pi t)) \cos(2\pi \times 10^5 t)$  V. The modulation index is
- a. 20
  - b. 4
  - c. 0.2
  - d. 10
15. An AM signal is represented by  $x(t) = (20 + 4\sin(500\pi t)) \cos(2\pi \times 10^5 t)$  V. Total sideband power is
- a. 8W
  - b. 4 W
  - c. 2 W
  - d. 16 W
16. A carrier is simultaneously modulated by two sine waves with modulation indices of 0.4 and 0.3. The resultant modulation index will be
- a. 1
  - b. 0.7
  - c. 0.5
  - d. 0.35
17. If the positive terminal of the battery is connected to the anode of the diode, then it is known as
- a. Schottky barrier
  - b. Equilibrium
  - c. Reverse biased
  - d. Forward biased
18. Which of the following is a characteristic of digital signal?
- a. It takes quantized value
  - b. Its waveform is a continuous function
  - c. The maximum number of signals that can be produced by N bits is  $2^{N-1}$
  - d. There is no loss of value after converting an analog signal to digital signal
19. Consider an N-bits ADC (Analog to Digital Converter) whose analog input varies from 0 to  $V_{max}$ , then which of the following is not true?
- a. The least significant bit correspond to a change of  $V_{max}/2^N - 1$  in the analog signal

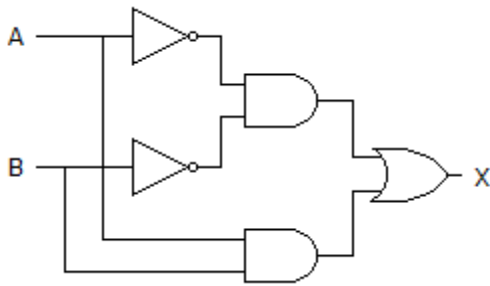
- b. The resolution of the ADC is  $V_{\max}/2^N - 1$
  - c. The maximum error in the conversion (or quantization error) is  $V_{\max}/2(2^N - 1)$
  - d. None of the mentioned
20. Assuming that the signal is quantized to satisfy the condition of previous question and assuming the approximate bandwidth of the signal is  $W$ . The minimum required bandwidth for transmission of a binary PCM signal based on this quantization scheme will be
- a.  $5W$
  - b.  $10W$
  - c.  $20W$
  - d. None of the mentioned
21. In PCM system, if the quantization levels are increased from 2 to 8, the relative bandwidth requirement will
- a. Remain same
  - b. Be doubled
  - c. Be tripled
  - d. Become four times
22. In an NPN transistor, the arrow is pointed towards \_\_\_\_\_
- a. the collector
  - b. the base
  - c. depends on the configuration
  - d. the emitter
23. Which of the following are true for a PNP transistor?
- a. the emitter current is less than the collector current
  - b. the collector current is less than the emitter current
  - c. the electrons are majority charge carriers
  - d. the holes are the minority charge carriers
24. In the saturated region, the transistor acts like a \_\_\_\_\_
- a. poor transistor
  - b. amplifier
  - c. open switch
  - d. closed switch

25. Which of the circuits in figure (a to d) is the sum-of-products implementation of figure (e)?



- a. a
- b. b
- c. c
- d. d

26. Which of the following logic expressions represents the logic diagram shown?



- a.  $X=AB'+A'B$
- b.  $X=(AB)'+AB$
- c.  $X=(AB)'+AB$
- d.  $X=A'B'+AB$

27. A latch is an example of a \_\_\_\_\_

- a. Monostable multivibrator
- b. Astable multivibrator
- c. Bistable multivibrator
- d. 555 timer

28. The number of cars arriving at ICICI bank drive-in window during 10-min period is Poisson random variable X with  $\lambda=2$ . The probability that more than 3 cars will arrive during any 10 min period is

- a. 0.249
- b. 0.143
- c. 0.345
- d. 0.5688

29. The number of cars arriving at ICICI bank drive-in window during 10-min period is Poisson random variable X with  $\lambda=2$ . The probability that no car will arrive is

- a. 0.516
- b. 0.459
- c. 0.777
- d. 0.135

30. For NMOS transistor which of the following is not true?

- a. The substrate is of p-type semiconductor
- b. Inversion layer or induced channel is of n type
- c. Threshold voltage is negative
- d. None of the mentioned

## Section II

### Instructions:

1. Write your name, application number and email ID at the space provided in this form
2. Use A4 size white papers for answers
3. Marks are indicated against each question
4. Attempt all questions
5. Credit will be given to brief and precise answers
6. Scan all your answer sheets and create a single PDF file for each question separately
7. Upload the PDF files in this form question wise.

Q1. Define state table & state diagram. Draw state diagram of a state 07 2 machine with state table as given in Table-1. The state machine contains input variable X and output variable Y and two flip-flops P & Q.

Table-1

Present State PQ	Next State AB PQ		Output Y 1	
	X=0	X=1	X=0	X=1
00	11	00	10	01
01	10	11	00	10
10	01	00	11	10
11	01	10	10	00

(5 Marks)

Q2. Explain MOS technology families. How is CMOS different from NMOS?

(5 Marks)

Q3 Explain with the help of diagram, a method of generating and demodulating phase shift keying signals.

(5 Marks)

Q4 What is Travelling Wave Tube? Explain the principle of operation and construction of T.W.T. Also write its limitations.

(5 Marks)

# PART-II

(Domain Specific)

## Instructions:

*Part – II of Question Paper (based on domain specific) consists 2 sections. Section I consists 30 objective types of questions each of one mark. Correct answer is to be clicked as a, b, c or d. Section II consists descriptive type of questions each of 5 marks. The answers are to be written in the given space. Candidate are advised to attempt questions from only one domain.*

## Management

### Section I

1. Technology that assists companies to alteration in business by allowing them to use new methods is named as:
  - a. Data Processing
  - b. Information Systems
  - c. Information Technology
  - d. Virtualization
2. Which of the following is not an example of a way in which technology is changing business and its relationship with employees?
  - a. Technology Cuts Waste
  - b. Technology Cuts Development Cycles
  - c. Technology Eliminates Layers of Management
  - d. Technology Is Breaking Down Corporate Barriers
3. A company-wide network, closed to public access, which uses Internet-type technology is called:
  - a. A. Intranet
  - b. B. Internet
  - c. C. Extranet
  - d. D. All of the above
4. The most dynamic change in business technology in recent years is:
  - a. The speed of the printers
  - b. The move away from mainframe computers toward network systems
  - c. The cost of computers
  - d. None of the above
5. The computer program that is used to handle anything from a note to a multi chapter book is called a(n)
  - a. Data base program
  - b. Spreadsheet
  - c. Accounting program
  - d. Word processing program
6. Delta Co. wants to calculate the Breakeven Point for a product. Which of the following programs would he use?
  - a. Database
  - b. Spreadsheet
  - c. Word processor
  - d. None of the above
7. Computer programs that make it possible for different brands of computers to transfer data to each other are called:

- a. Message centre software
  - b. Data base software
  - c. Communication software
  - d. All of the above
8. Which of the following statements about marketing is true?
- a. It is of little importance when products are standardized.
  - b. It can help create jobs in the economy by increasing demand for goods and services.
  - c. It is more important for bigger organizations than smaller ones.
  - d. It is seldom used by non-profit organizations.
9. \_\_\_\_\_ management is the art and science of choosing target markets and getting, keeping, and growing customers through creating, delivering, and communicating superior customer value.
- a. Marketing
  - b. Knowledge
  - c. Operations
  - d. Strategic
10. A social definition of marketing says \_\_\_\_\_.
- a. Effective marketing requires companies to remove intermediaries to achieve a closer connection with direct consumers
  - b. A company should focus exclusively on achieving high production efficiency, low costs, and mass distribution to facilitate the broadest possible access to the company's products
  - c. Marketing is the process by which individuals and groups obtain what they need and want through creating, offering, and freely exchanging products and services of value with others
  - d. Marketing is the process of extracting the maximum value from consumers to facilitate corporate growth
11. As economies advance, a growing proportion of the economy's activities focuses on the production of \_\_\_\_\_.
- a. Products
  - b. Events
  - c. Luxury goods
  - d. Services
12. Soccer's World Cup is promoted aggressively to both companies and fans. This is an example of marketing a(n) \_\_\_\_\_.
- a. Idea
  - b. Place
  - c. Luxury item
  - d. Event
13. In Walt Disney's Magic Kingdom, customers can visit a fairy kingdom, a pirate ship, or even a haunted house. Disney is marketing a(n) \_\_\_\_\_.
- a. Experience
  - b. Service
  - c. Event
  - d. Organization
14. Sales of woollen clothing usually increase during the winter season and decline thereafter. This is an example of \_\_\_\_\_ demand.
- a. Seasonal
  - b. Declining
  - c. Impulse
  - d. Latent

15. Young people in emerging countries today are becoming increasingly health conscious and are seeking healthy food choices. As a result, demand for health foods is rising steadily, creating an opportunity for marketers to exploit this \_\_\_\_\_ market.
- Demographic
  - Business
  - Need
  - Geographic
16. When demand is \_\_\_\_\_, it implies that more customers would like to buy the product than can be satisfied.
- Latent
  - Irregular
  - Overfull
  - full
17. A financial instrument is
- A type of asset
  - A type of liability
  - A type of a contract
  - A type of asset or liability
18. Debenture securities carry
- Voting rights and dividends
  - Interest and voting rights
  - Interest and dividend
  - Only interest
19. A critical assumption of the net operating income (NOI) approach to valuation is:
- that debt and equity levels remain unchanged.
  - that dividends increase at a constant rate.
  - that  $k_0$  remains constant regardless of changes in leverage.
  - that interest expense and taxes are included in the calculation.
20. Cost of capital is the minimum rate of return expected by its investors.
- Given statement is false
  - Given statement is true
  - Given statement is true in some cases
  - Given statement is unreasonable
21. Which of the following statement is not true for capital budgeting?
- Capital budgeting decisions are irreversible in nature.
  - Capital budgeting decisions affect the future stability of the firm.
  - Business expansion decision in a capital expenditure decision.
  - Sunk cost is a relevant cost in capital budgeting.
22. Gross working capital is based on
- Accrual Concept
  - Money Measurement Concept
  - Going Concern Concept
  - Realization Concept
23. An alternative to \_\_\_\_ is the objective of wealth maximization.
- Profit minimization
  - Market maximization
  - Quality maximization
  - Profit maximization
24. Fredrick Winslow Taylor's Principles of Scientific Management suggested the use of scientific methods to define:
- The easiest way of doing a job
  - The most complex way of doing a job
  - The best way of doing a job



- d. None of these
25. The perspective that Managers are directly responsible for an organization's success is known as:
- Omnipotent view of management
  - Management orientation
  - Autocratic management
  - None of these
26. The internal environment factor(s) that influence management is (are)
- Place
  - Machine
  - Labour
  - All the above
27. A person directly involved in operation and accomplishment of main objective of the firm is called
- line manager
  - Close line manager first line manager
  - staff manager
  - Line and staff manager
28. \_\_\_\_\_ Studied 5 chief executives at work and identify 10 managerial roles.
- Max Weber
  - Henry Fayol
  - Henry Mintzberg
  - F.W. Taylor
29. Control should be placed
- where they are cost effective
  - in problem area of operations
  - on the single most important area
  - on all the activities
30. The key to motivating today's diverse workforce lies in
- Innovation
  - Creativity
  - Goal Setting
  - Adaptability

## Section II

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- Upload the PDF files in this form question wise.*

Q1. A company is manufacturing and selling a non-durable consumer product for the last 15 years. The market for the product is spread over the country. The management has divided the market into several regions. Every year, the management sets sales targets for different regions. A marketing manager of a particular region has been observing that he is not able to achieve his sales targets. He wants to find the reasons for this and initiates a study of the market. What type of study will he take up? Explain briefly. **(5 Marks)**

Q2 Organizational behavior(OB) is Art and Science. Discuss. What are the various models of OB? **(5 Marks)**

Q3. Imagine you are a research scholar with a rating agency. You have been entrusted to formulate a research design relating to unearthing the under current in the Indian economy to address the following key issues:

1. Understanding misleading GDP number vis-à-vis disguised employment.
2. Allocation for social security vis-à-vis economic development.

**(5 Marks)**

Q4. Mr. Jagdish & Mr. Kalpesh (J & K) are two enterprising youth. They are MBA degree holders from a reputed university. They want other people to work under them rather than they working under other people. So, they will launch fresh vegetable in Indian Markets. Having learnt of future conventional foods, they decided to venture into cultivation of mushrooms. Mushrooms are known to be the best alternative food for vegetarians. For Jagdish and Kalpesh, fund raising was a serious handicap for mass production. However, the first trial batch of mushrooms that they produced was brought by star hotels in Metro City. Further, the hotel started placing orders for supply of 40 kgs every day.

Now the Mushroom Industry is run by small entrepreneurs. Another big player M/s Jashmine Mushrooms, equipped with cold storage facility was more interested in export market. J & K have set their sight high now. They aim to sell mushrooms in a very big way, all over the country. Mushrooms have a great market potential and is a perishable food.

Questions:

- (a) In what ways can a J & K mushroom seek to gain better understanding of its marketing environment?
- (b) What will you advise J & K, as how to increase the Indian Consumers awareness about this new food product?

**(5 Marks)**

## PART-II

(Domain Specific)

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## Mathematics

### Section I

1.  $\log_{n \rightarrow \infty} \frac{1 - \cos(x)}{x^2} =$

- a.  $\frac{1}{4}$
- b.  $\frac{1}{2}$
- c. 1
- d. 2

2.  $\frac{d^2y}{dy^2} + x^2 \cdot \left(\frac{dy}{dx}\right)^3 + \sin^2 x = 0.$

The above differential equation is

- a. Second order, linear, homogenous
- b. third order, non-linear, homogenous
- c. third order, linear, Non-homogenous
- d. Second order, Non-linear, Non-homogenous

3. The minimum value of function  $y = x^2$  in the interval  $[1, 5]$  is

- a. 0
- b. 1
- c. 25
- d. Undefined

4. Eigen values of a real symmetric matrix are always

- a. Positive
- b. Negative
- c. Real
- d. Complex

5.  $\frac{d^2y}{dy^2} + 4\frac{dy}{dx} + 3y = \sin 2x$

The particular integral for the differential equation is:

- a.  $\frac{1}{7}\sin 2x$
- b.  $-\frac{1}{65}(8\cos 2x + \sin 2x)$
- c.  $-\frac{1}{7}(2\cos 2x + \sin 2x)$
- d.  $-\frac{1}{65}(4\cos 2x + \sin 2x)$

6. At  $x = 0$ , the function  $f(x) = x^3 + 1$  has

- a. A maximum value
- b. A minimum value
- c. A singularity
- d. A point of inflection

7. The partial differential equation  $\frac{\partial u}{\partial t} + u \frac{\partial u}{\partial x} = \frac{\partial^2 u}{\partial x^2}$  is a

- a. Linear equation of order 2
- b. Non-linear equation of order 1
- c. Linear equation of order 1
- d. Non-linear equation of order 2

8. Given that the determinant of the matrix  $A = \begin{vmatrix} 1 & 3 & 0 \\ 2 & 4 & 6 \\ -1 & 0 & 2 \end{vmatrix}$  is -12, then the determinant of the

matrix  $\begin{vmatrix} 2 & 6 & 0 \\ 4 & 8 & 12 \\ -2 & 0 & 4 \end{vmatrix}$  is

- a. -96
- b. -24
- c. 24
- d. 96

9. For a given set of linear equations,

$$\begin{aligned}x + 3y - z &= 4 \\ 2x + y + 2z &= 10 \\ 3x - y + bz &= a\end{aligned}$$

The value of  $a$  and  $b$  for the equation to have a unique solution will be respectively.

- a. Any value of  $a$ ,  $b \neq 5$
- b.  $a \neq 16$ , or  $b \neq 3a - 16$ , or  $b \neq 3$
- c.  $a \neq 10$ , or  $b \neq 2$
- d.  $a \neq 10$ , or  $b = 5$

10. The argument of the complex number  $z = \frac{1+i}{1-i}$

- a.  $\pi$
- b.  $\pi/2$
- c.  $-\pi/2$
- d.  $2\pi$

11. The condition for which the eigenvalues of the matrix  $A = \begin{vmatrix} 2 & 1 \\ 1 & k \end{vmatrix}$  are positive

- a.  $k > 1/2$
- b.  $k > -2$
- c.  $k > 0$
- d.  $k < -1/2$

12. The value of the integral  $\int_{-\infty}^{\infty} \frac{\sin(x)}{x^2 + 2x + 1} dx$

- a.  $-\pi \sin(1)/e$
- b.  $-\pi \cos(1)/e$
- c.  $\sin(1)/e$
- d.  $\cos(1)/e$

13. Let  $z$  be a complex variable. For a counter-clockwise integration around a unit circle  $C$ , centred at origin,  $\oint \frac{1}{5z-4} dz = A\pi i$ , then value of  $A$  is
- $2/5$
  - $1/2$
  - $2$
  - $4/5$
14. Consider a function  $u$  which depends on position  $x$  and time  $t$ . The partial differential Equation  $\frac{\partial u}{\partial t} = \frac{\partial^2 u}{\partial x^2}$  is known as the:
- Wave equation
  - Heat Equation
  - Laplace Equation
  - Elasticity Equation
15. A parametric curve defined by  $x = \cos\left(\frac{\pi y}{2}\right)$ ,  $y = \sin\left(\frac{\pi y}{2}\right)$ , in the range of  $0 \leq u \leq 1$  is rotated about the  $X -$  axis by  $360$  degrees. Area of the surface generated is
- $\pi$
  - $\frac{\pi}{2}$
  - $2\pi$
  - $4\pi$
16. Divergence of the vector field  $x^2z\hat{i} + xy\hat{j} - yz^2\hat{k}$  at  $(1,-1,1)$  is
- $0$
  - $3$
  - $5$
  - $6$
17.  $\lim_{n \rightarrow \infty} \frac{x - \sin(x)}{1 - \cos(x)} =$
- $0$
  - $1$
  - $3$
  - Not defined
18. Evaluate  $\oint \frac{2z}{(z+1)^4} dz$ , where  $C$  is a circle with centre at origin,  $|z| = 3$ .
- $\frac{8}{3}\pi i \cdot e^{-2}$
  - $\frac{4}{3}\pi i \cdot e^{-2}$
  - $2\pi i \cdot e^{-2}$
  - $2\pi i \cdot e^2$
19. Find the directional derivative of  $f(x, y) = e^x \cdot \sin(y)$  at the point  $P(0, \pi/4)$  in the direction  $v = (1, -1)$
- $0$
  - $1$
  - $2$
  - $\sqrt{2}$
20. The product of two complex numbers  $1 + i$  and  $2 - 5i$  is
- $7 - 3i$
  - $3 - 4i$
  - $-3 - 4i$

d.  $7 + 3i$

21. Evaluate the following integral  $\oint \frac{\cos(\pi z)}{(z-1)} dz$ , where C is the circle  $|z|=3$

- a.  $2\pi i$
- b.  $-2\pi i$
- c.  $6\pi^2 i$
- d.  $-6\pi^2 i$

22. A series expansion for the function  $\sin x$  is

- a.  $1 - \frac{x^2}{2!} + \frac{x^4}{4!} + \dots$
- b.  $x - \frac{x^3}{3!} + \frac{x^5}{5!} + \dots$
- c.  $1 + x + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots$
- d.  $x + \frac{x^3}{3!} + \frac{x^5}{5!} + \dots$

23. A factory produces 15% defective items from a batch. Find the probability that exactly 2 of the chosen items are defective out of the 10 picked.

- a. 0.022
- b. 0.335
- c. 0.276
- d. 0.428

24. The Blasius equation,  $\frac{\partial^3 f}{\partial n^3} + \frac{f}{2} \frac{\partial^2 f}{\partial n^2} = 0$  is a

- a. Second order nonlinear ordinary differential equation
- b. Third order nonlinear ordinary differential equation
- c. Third order linear ordinary differential equation
- d. Mixed order nonlinear ordinary differential equation

25. An anti-aircraft gun can take a maximum of 4 shots at an enemy plane moving away from it. The probabilities of hitting the plane at the first, second, third and fourth shot are 0.4, 0.3, 0.2 and 0.1 respectively. The probability that the gun hits the plane is

- a. 0.76
- b. 0.4096
- c. 0.6976
- d. None of these

26. The value of  $\oint x^2 y \, dx - xy^2 \, dy$ , where C is the  $x^2 + y^2 = 4$  going counter-clockwise

- a.  $2\pi$
- b.  $-4\pi$
- c.  $-8\pi$
- d.  $\pi$

27. For what value of x, the function  $y = \frac{x}{1+x \tan x}$  has maximum value at

- a.  $\tan x$
- b. 0
- c.  $\cot x$
- d.  $\cos x$

28. A variable has Poisson distribution with mean m. The probability that the variable takes any of the values 0 or 2 is

- a.  $e^{-m} \left( 1 + m + \frac{m^2}{2!} \right)$

- b.  $e^m(1+m)^{-\frac{3}{2}}$
- c.  $e^{3/2}(1+m^2)^{-\frac{1}{2}}$
- d.  $e^m(1+\frac{m^2}{2!})$

29. Let  $\gamma$  be the correlation coefficient between  $x$  and  $y$  and  $b_{yx}, b_{xy}$  be the regression coefficients of  $y$  on  $x$  and  $x$  on  $y$  respectively then

- a.  $\gamma = b_{xy} + b_{yx}$
- b.  $\gamma = b_{xy} \times b_{yx}$
- c.  $\gamma = \sqrt{b_{xy} \times b_{yx}}$
- d.  $\gamma = \frac{1}{2}(b_{xy} + b_{yx})$

30. For the function of a complex variable  $W = \ln Z$  (where,  $W = u + iv$  and  $Z = x + iy$ ), the  $u = \text{constant}$ , lines get mapped in  $Z$ -plane as

- a. Set of confocal hyperbolas
- b. Set of confocal ellipses
- c. Set of radial straight lines
- d. Set of concentric circles

31. A jar contains black and white marbles. Two marbles are chosen without replacement. The probability of selecting a black marble and then a white marble is 0.34, and the probability of selecting a black marble on the first draw is 0.47. What is the probability of selecting a white marble on the second draw, given that the first marble drawn was black?

- a. 72%
- b. 28%
- c. 36%
- d. 40%

32. In a binomial distribution, the mean is 4 and variance is 3. Then the mode is

- a. 5
- b. 6
- c. 4
- d. None

33. Let the eigen values of  $A$  be 1, -1, 1. Then what is the determinant of  $A^{99} + I$  if  $A$  is diagonal matrix

- a. 2
- b. 6
- c. 100
- d. 0

34. The value of  $\frac{1}{2\pi i} \int \frac{\cos \pi z}{z^2 - 1} dz$  around a rectangle with vertices at  $2 \pm i, -2 \pm i$  is

- a. 6
- b.  $2ie$
- c. 8
- d. 0

35. The eigen values of symmetric matrix are all

- a. Complex with non-zero positive imaginary part
- b. Complex with non-zero negative imaginary part
- c. Real
- d. Pure imaginary

36. Find the value of  $\log_{n \rightarrow 1} \frac{\sin\left(\frac{1}{1-\frac{1}{x}}\right)}{x} (x - 1)$  is
- 1
  - 0
  - $\frac{1}{2}$
  - Not defined
37. If  $f'(x) = \frac{1}{2-x^2}$ , then what would be sum of lower and upper bound of  $f(1)$ , if  $f(0) = 1$  and  $f(x)$  be defined for  $[0,1]$
- 1
  - 2
  - 0
  - 3.5
38. The distance between origin & a point nearest to the curve  $z^2 = 5 - xy$
- 2
  - 1
  - $\sqrt{5}$
  - $\sqrt{3}$
39. The partial differential equation  $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} + \frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} = 0$
- Degree 1 order 2
  - Degree 1 order 1
  - Degree 1 order 1
  - Degree 2 order 2
40. The integral  $\int_1^3 \frac{1}{x} dx$  is evaluated using Simpson rule on two equal intervals with length 1.
- 1
  - 1.2
  - 1.11
  - 1.21
41. A calculator has accuracy up to 8 digits after decimal place. The value of  $\int_1^3 \sin(x) dx$  when evaluated using this calculator by trapezoidal method with 8 equal intervals, to 5 significant digits is
- 0.00000
  - 1.00000
  - 0.00500
  - 0.00025
42. Let X and Y be two independent random variables. Which one of the relations between expectation (E), variance (Var) and covariance (Cov) given below is FALSE?
- $E(XY) = E(X) E(Y)$
  - $\text{Cov}(X, Y) = 0$
  - $\text{Var}(X + Y) = \text{Var}(X) + \text{Var}(Y)$
  - $E(X^2 Y^2) = (E(X))^2 (E(Y))^2$
43. Consider the function  $f(x) = |x|$  in the interval  $-1 \leq x \leq 1$ . At the point  $x = 0$ ,  $f(x)$  is
- Continuous and differentiable
  - Non – continuous and differentiable
  - Continuous and non – differentiable
  - Neither continuous nor differentiable



44. Which of the following integrals is unbounded ?
- $\int_0^{\pi/4} \tan(x) dx$
  - $\int_0^{\infty} \frac{1}{1+x^2} dx$
  - $\int_0^{\infty} xe^{-x} dx$
  - $\int_0^1 \frac{1}{1-x} dx$
45. If  $A = \begin{bmatrix} 8 & 4 \\ -2 & 2 \end{bmatrix}$  then the value of  $A^4 - 2A^2 + 76I$  is
- $50A - 170I$
  - $500A - 1776I$
  - $300A - 470I$
  - None of these
46. A Binomial probability distribution is characterized by  $B(4, 1/4)$  then what is the value of  $P(x \geq 2)$
- $67/256$
  - $33/128$
  - $13/356$
  - None of these
47. If  $u = \sinh x \cos y$  then the analytic function  $f(z) = u + vi$
- $\cosh^{-1} z + iC$
  - $\cosh z + iC$
  - $\sinh z + iC$
  - $\sinh^{-1} z + iC$
48. The minimum value of the function  $x^3 + y^3 + z^3$  such that  $x^2 + y^2 + z^2 = 3$  is
- 3
  - 3
  - 1/3
  - 1/3
49. The solution of Differential Equation  $y'' - 2y' + 5y = 4\delta(t)$ , where  $\delta(t)$ , is a unit impulse function  $y(0)=0, y'(0)=0$
- $2e^t \cos 2t$
  - $2e^t \sin 2t$
  - $4e^t \sin t$
  - $4e^t \cos t$
50. The length of the curve  $y = \log(\cos(x))$  between  $x = \frac{-\pi}{4}$  to  $\frac{\pi}{4}$ .
- $\log \sqrt{2}$
  - $2 \log \sqrt{2}$
  - $\log(2.419)$
  - $2 \log(2.419)$

## Section II

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Q1. Prove that the function  $u(x, y) = e^{-x}(x \sin y - y \cos y)$  is harmonic. Also, find its conjugate harmonic. **(5 Marks)**

Q2. Let  $T: \mathbb{R}^4 \rightarrow \mathbb{R}^4$  be defined by  $T(x, y, z, w) = (x + y + 5w, x + 2y + w, -z + 2w, 5x + y + 2z)$ . Find the dimension of the Eigen space of T. **(5 Marks)**

Q3. Find the general solution of the differential equation  $y'' - 7y' + 12y = 8 \sin(x) + e^{3x}$ .

**(5 Marks)**

Q4. State and prove Bolzano Weierstrass theorem.

**(5 Marks)**

# Answer Keys

## PART (A)

### (Research Methodology and Quantitative Aptitude)

1	c	11	b	21	c	31	d	41	a
2	b	12	c	22	c	32	c	42	a
3	a	13	c	23	b	33	a	43	b
4	d	14	d	24	d	34	d	44	d
5	a	15	b	25	d	35	c	45	c
6	c	16	d	26	b	36	d	46	b
7	d	17	c	27	c	37	c	47	d
8	d	18	c	28	c	38	d	48	c
9	b	19	c	29	a	39	c	49	c
10	a	20	a	30	a	40	b	50	b

## **PART (B)**

### **Section-I**

#### **Computer Science & Engineering**

1	c	11	a	21	c
2	c	12	d	22	c
3	b	13	a	23	b
4	c	14	a	24	c
5	d	15	c	25	b
6	d	16	d	26	b
7	b	17	a	27	a
8	d	18	d	28	a
9	d	19	d	29	b
10	a	20	b	30	a

#### **Electronics & Communication Engineering**

1	a	11	a	21	c
2	b	12	a	22	d
3	c	13	a	23	b
4	c	14	c	24	d
5	d	15	b	25	d
6	c	16	c	26	d
7	a	17	d	27	d
8	b	18	a	28	b
9	a	19	d	29	d
10	c	20	b	30	c

## Management

1	c	11	d	21	d
2	c	12	d	22	c
3	a	13	a	23	d
4	b	14	a	24	c
5	d	15	a	25	a
6	b	16	c	26	d
7	c	17	c	27	a
8	b	18	d	28	c
9	a	19	c	29	d
10	c	20	b	30	c

## Mathematics

1	b	11	a	21	b
2	d	12	a	22	b
3	b	13	a	23	c
4	c	14	b	24	b
5	b	15	c	25	c
6	d	16	c	26	c
7	d	17	a	27	a
8	a	18	a	28	c
9	a	19	a	29	c
10	c	20	a	30	d