



SRI JAGADGURU MURUGHARAJENDRA UNIVERSITY

(Established under SJM University Act 2020)

Instructions:

1. Entrance test question paper consists of multiple choice questions for 100 Marks and it is Classified as Part-A, Part-B & Part- C
2. Entrance Test Duration shall be 3 hours
3. Part-A shall be Subject specific for 50 Marks.
Part – B shall be General Aptitude for 30 Marks
Part – C shall be Mathematics for 20 Marks

Part – A

Subject Specific (Engineering Discipline)

Computer Science & Engineering

SYLLABUS FOR Ph.D. ENTRANCE EXAMINATION

The syllabus for the basic test will be as follows:

1. Programming and Data Structure

Programming in C: Structure of C program, input and output statement, functions, control structures, recursion, files, strings, structures and unions.

Linear Data structures: Arrays, stacks, queues, linked lists, Doubly Linked Lists, Circular Lists, and Application of Linked Lists.

Non-linear data structures: Trees, binary search trees, binary heaps, graphs, Traversals, Shortest Path algorithms, Spanning Trees

2. Algorithms and Analysis

Analysis of algorithms: Time and space complexity, Asymptotic notations, Recursion and its systematic removal.

Sorting and searching algorithms: Bubble sort, Selection sort, Insertion sort, Shell sort, Quick sort, Radix sort, Merge sort. Linear and Binary search.

Design of Algorithms: Divide and Conquer, Greedy method, Dynamic programming, Back tracking, Branch and Bound. NP-hard and NP-complete problems.

3. Operating Systems

Process Synchronization – Concurrent Processing: Mutual exclusion, Critical regions, Semaphores, Critical-Section problem, Peterson's Solution, Synchronization Hardware.

Scheduling: CPU scheduling, I/O scheduling, resource scheduling.

Memory Management: Memory allocation And Segmentation - Swapping, Contiguous memory allocation, Virtual memory, paging, fragmentation, Caching and TLBs, Caching and Demand Paging- Demand paging, copy-on-write, page replacement, Allocation of Frames, Thrashing
Deadlocks: Model, Handling Deadlocks, Prevention, Avoidance, Detection Recovery.

4. Data Communication and Computer Networks

Data Communication: simplex, half-duplex and full-duplex mode of data transmission, packet switching and circuit switching, Analog and Digital Signals; Noiseless and Noisy Channels; Digital and Analog Transmission; Data Encoding and Modulation Techniques; switching; Flow and error control techniques

Computer Networks: Network Hardware, LAN, MAN, WAN, OSI Reference Model, - Protocol IPv4/IPv6, routers and routing algorithms (distance vector, link state); TCP/UDP and sockets, congestion control. Application layer protocols (DNS, SMTP, POP, FTP, HTTP). Network Security: authentication, basics of public key and private key cryptography

5. Software Engineering

Software Engineering: The Waterfall Model, Incremental Process Models Evolutionary Process Models, Concurrent Models. Agility and the Cost of Change, Agile Process, Extreme Programming (XP), Adaptive Software Development (ASD), Scrum; Requirements Modelling: Requirements Analysis, Scenario-Based Modelling, UML Models, Design Concepts: The Design Process, Design Concepts, the Design Model, Architectural design, and component-level design. Quality management

References

1. YeshwanthKanitkar, Let us C
2. Programming in ANSI C, Balaguruswamy, McGraw Hill Education.
3. Data Structures Using C and C++ by YedidyahLangsam and Moshe J. Augenstein and Aaron M Tenanbanum, 2nd Edition, Pearson Education Asia, 2002.
4. Introduction to the Design and Analysis of Algorithms, AnanyLevitin:, 2rd Edition, 2009. Pearson
5. Computer Algorithms/C++, Ellis Horowitz, SatrajSahni and Rajasekaran, 2nd Edition, 2014, Universities PressSilberschatz, Galvin, Operating Systems concepts, John Wiley and Sons, Seventh Edition, 2002.
6. Computer Networks: "Computer Networking: A top-down approach" by Kurose-Ross. Pearson Education
7. "Computer Networks" by Tanenbaum, Prentice Hall
8. Roger S Pressman, "Software Engineering- A Practitioners Approach", Sixth Edition, McGraw Hill publishers.

Part - B

General Aptitude Test Syllabus (Weightage 30%)

Common to all branches

1. Arithmetical Ability
2. Data Interpretation
3. Verbal Ability
4. Numerical Analysis Quantitative ability
5. Reading Comprehension data Sufficiency
6. Logical Reasoning, computer awareness

Reference Books:

1. Quantitative Aptitude by R S Agarwal
2. Fast Track Objective Arithmetic by Rajesh Verma

Part –C

Mathematics Entrance Test Syllabus for Ph.D-20 Marks Common to all branches

Linear Transformations:The algebra of Linear Transformation, singular and non-singular transformations, characteristic polynomials, minimal polynomials, Rank and Nullity, Eigen values and Eigen vectors.

Solutions of Linear System of Equations : Introduction to Direct Methods via., Gauss Elimination method, Gauss-Jordan method. Iteration Methods: Gauss Jordan methods, Gauss-Seidel method, Successive Over relaxation method and problems on each method.

Fourier Series : Dirichlet's conditions, Expansions of Periodic functions into Fourier series, Half range Fourier series.

Laplace Transforms: Properties of Laplace transformation, Unit step function, Convolution theorem, Solution of differential equation using Laplace transformation.

Statistical method :Curve fitting by the method of least squares – Fitting the curve of the form $y = ax + b$, $y = ax^2 + bx + c$ and $y = ax^b$. Correlation and regression.

Differential Calculus: polar curves, angle between polar curves, Curvature and radius of curvature, Taylor's and Maclaurin's expansion for a function of single variable.

Differential Equations: Ordinary Differential Equations (ODEs): Existence and Uniqueness of Solutions of initial value problems for first order ordinary differential equations, singular solutions of first order ODEs, system of first order ODEs.

Numerical methods : Solution of ODE of first order : Taylor's series method , Modified Euler's method, RK - 4th method, Milne's method , Newton forward- backward method, interpolation method.

References:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.
3. H.K.Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S.Chand Publication (2014).
4. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.



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Part – A

Subject Specific (Engineering Discipline)

Computer Science and Engineering

Model Question Paper-50Marks

1. In the C language, the constant is defined _____.
 - a) Before main
 - b) After main
 - c) Anywhere, but starting on a new line.
 - d) None of the these.
1. Which one of the following is a loop construct that will always be executed once?
 - a) For
 - b) while
 - c) switch
 - d) do while
2. What is a pointer?
 - a) A keyword used to create variables
 - b) A variable used to store address of an instruction
 - c) A variable used to store address of other variable
 - d) A variable used to store address of a structure
4. Who is the father of C language?
 - a) Steve Jobs
 - b) James Gosling
 - c) Dennis Ritchie
 - d) Rasmus Lerdorf
5. Which one of the following is the process of inserting an element in the stack?
 - a) Insert
 - b) Push
 - c) Add
 - d) None of the above

6. Which of the following highly uses the concept of an array?
- a) Binary Search tree
 - b) Caching
 - c) Spatial locality
 - d) Scheduling of Processes
7. The necessary condition to be checked before deletion from the Queue is_____
- a) Underflow
 - b) Front value
 - c) Overflow
 - d) Rear value
8. Which of the following is a Divide and Conquer algorithm?
- a) Merge Sort
 - b) Heap Sort
 - c) Selection Sort
 - d) Bubble Short
9. A graph is a tree if and only if graph is
- a) Directed graph
 - b) Contains no cycles
 - c) Planar
 - d) Completely connected
10. Which of the following options is not true about the Binary Search tree?
- a) The value of the left child should be less than the root node
 - b) The value of the right child should be greater than the root node.
 - c) The left and right sub trees should also be a binary search tree
 - d) None of the above
11. Operating systems_____
- (a) enables the programmer to draw a flow chart
 - (b) provides a layer, user friendly interface
 - (c) links a program with subroutine it references
 - (d) all of these
12. Which one of the following is a real time operating system?
- (a) RTLinux
 - (b) VxWorks
 - (c) Windows CE
 - (d) All of the mentioned

13. The interval from the time of submission of a process to the time of completion is termed as _____
- a) waiting time
 - b) turnaround time
 - c) response time
 - d) throughput
14. In priority scheduling algorithm _____
- a) CPU is allocated to the process with highest priority
 - b) CPU is allocated to the process with lowest priority
 - c) Equal priority processes can not be scheduled
 - d) None of the mentioned
15. What is a reusable resource?
- a) that can be used by one process at a time and is not depleted by that use
 - b) that can be used by more than one process at a time
 - c) that can be shared between various threads
 - d) none of the mentioned
16. Which of the following condition is required for a deadlock to be possible?
- a) mutual exclusion
 - b) a process may hold allocated resources while awaiting assignment of other resources
 - c) no resource can be forcibly removed from a process holding it
 - d) all of the mentioned
17. Which process can be affected by other processes executing in the system?
- a) cooperating process
 - b) child process
 - c) parent process
 - d) init process
18. When several processes access the same data concurrently and the outcome of the execution depends on the particular order in which the access takes place is called _____
- a) dynamic condition
 - b) race condition
 - c) essential condition
 - d) critical condition

19. A memory buffer used to accommodate a speed differential is called _____
- a) stack pointer
 - b) cache
 - c) accumulator
 - d) disk buffer
20. Which one of the following is the address generated by CPU?
- a) physical address
 - b) absolute address
 - c) logical address
 - d) none of the mentioned
21. Which one is not belongs to internal sort?
- A. insertion sort
 - B. bubble sort
 - C. heap sort
 - D. merge sort
22. Define the value of r in a circular queue?
- A. $r=r+1$
 - B. $r=(r+1)\%[QUEUE_SIZE-1]$
 - C. $r=(r+1)\% QUEUE_SIZE$
 - D. $r=(r-1)\% QUEUE_SIZE$
23. Divide and conquer approaches steps.
- A. divide, conquer and combine
 - B. conquer, divide and combine
 - C. combine, divide and conquer
 - D. none of these
24. In the binary search algorithm the complexity of searching for an element from a set of n elements.
- A. $O(n \log n)$
 - B. $O(\log n)$
 - C. $O(n^2)$
 - D. $O(n)$

25. ___ of an algorithm is the amount of time required for it to execute.
- Time complexity
 - Space complexity
 - Compiling time
 - Best case
26. ___ is the maximum amount of time an algorithm takes to execute a specific set of inputs.
- Running time
 - Average case time complexity
 - Worst case time complexity
 - Best case time complexity
27. ___ are node-based data structures used in many system programming applications for managing dynamic sets.
- Stack
 - Queue
 - Binary search trees
 - List
28. Which method is practical to perform a single search in an unsorted list of elements?
- Sequential search
 - Bubble sort
 - Horspool's method of string matching
 - Brute force method of string matching
29. In ___, one begins at the root of the tree and then explores along each branch.
- Topological sorting
 - Breadth-first search
 - Depth-first search
 - Insertion Sort
30. What is the mode for the following set numbers? 10,12,8,4,10, 6, 10,11,11,10,12
- 11
 - 12
 - 10
 - 9

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- a) 11
 - b) 12
 - c) 10
 - d) 9
41. The software life cycle can be said to consist of a series of phases. The classical model is referred to as the waterfall model. Which phase defined as "The concept is explored and refined, and the client's requirements are elicited?"
- a) Requirements
 - b) Specification
 - c) Design
 - d) Implementation
42. In the maintenance phase the product must be tested against previous test cases. This is known as _____ testing.
- a) Unit
 - b) Integration
 - c) Regression
 - d) Module

43. Who is the father of Software Engineering?
- a) Margaret Hamilton
 - b) Watts S. Humphrey
 - c) Alan Turing
 - d) Boris Beizer
44. What are the features of Software Code?
- a) Simplicity
 - b) Accessibility
 - c) Modularity
 - d) All of the above
45. Who proposed the spiral model?
- a) Barry Boehm
 - b) Pressman
 - c) Royce
 - d) IBM
46. Which is not a step of Requirement Engineering?
- a) Requirements elicitation
 - b) Requirements analysis
 - c) Requirements design
 - d) Requirements documentation
47. FAST stands for _____ .
- a) Functional Application Specification Technique
 - b) Fast Application Specification Technique
 - c) Facilitated Application Specification Technique
 - d) None of the above
48. The level at which the software uses scarce resources is _____ .
- a) Reliability
 - b) Efficiency
 - c) Portability
 - d) All of the above
49. Modifying the software to match changes in the ever changing environment is called _____
- a) Adaptive maintenance
 - b) Corrective maintenance

c) Perfective maintenance

d) Preventive maintenance

50. One of the fault base testing techniques is _____ .

a) Unit Testing

b) Beta Testing

c) Stress Testing

d) Mutation Testing

Part –B

**General Aptitude Entrance Test Question paper for Ph.D. - 30 Marks
Common to all Branches**

1. In how many different ways can the letters of the word 'LEADING' be arranged in such a way that the vowels always come together?
(A) 720 (B) 520
(C) 420 (D) 630
2. There are 7 non-collinear points. How many triangles can be drawn by joining these points?
(A)45 (B)85 (C) 35 (D) 25
3. A is 3 years older to B and 3 years younger to C, while B and D are twins. How many years older is C and D?
(A)7 (B) 5
(C) 6 (D) 8
4. The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 kms in 4 hours, then the speed of the first train is:
(A)78.5 km/hr (B)52 km/hr
(C) 60 km/hr (D) 87.5 km/hr
5. Two numbers are respectively 20% and 50% more than a third number. The ratio of the two numbers is:
(A) 4:5 (B)5:4
(C)6:5 (D) 2:5
6. Three unbiased coins are tossed. What is the probability of getting at most two heads?
(A) 5/7 (B) 5/4
(C) 7/8 (D) 3/6
7. If an angle is its own complementary angle, then its measure is
(A)45⁰ (B)55⁰
(C)60⁰ (D)70⁰
8. The digit in unit's place of the product
(A)2 (B)1
(C)0 (D)4

9. When he is

P : did not know

Q : he was nervous and

R : heard the hue and cry at midnight

S : what to do

The Proper sequence should be:

(A)RQPS (B)PQRS

(C)SPQR (D) QPRS

10. Correct the sentence “He was very tired as he is working since 6’0 clock in the morning”.

(A)he was working (B)he had been working

(C)he has been working (D)he will be working

11. Pain : sedative

(A)Day: Night (B)Dengue: Mosquito

(C)Malaria: Water (D)Grief: Consolation

12. Find the missing term of the given expression: $18.834 + 818.34 - ? = 618.43$

(A)217.644 (B)218.744

(C)217.744 (D)217.844

13. The amount of uncertainty in a system of the symbol is called.

(A)bandwidth (B)Entropy

(C)loss (D)quantum

14. Buffering is....

(A)The process of temporarily storing the data to allow for small variation in device speeds.

(B)a method to reduce cross-talks

(C)storage of data within the transmitting medium until the receiver is ready to receive

(D)a method to reduce the routing overhead

15. What is the name of the virus that fool a user into downloading and executing them by pretending to be useful applications ?

(A)Trojan Horses (B)keylogger

(C)worm (D)ransomware

16. Which among the following is NOT a web browser?

(A)SpaceTim (B)NeoP

(C)Sputnik (D)MeeGo

17. Which of the following comprise the software components of a computer?
(A) Programs
(B) Keyboard
(C) BIOS
(D) Memory
18. Which of the following are the features of a Spreadsheet?
(A) Layers and Lines (B) Rows and Columns
(C) Layers and Planes (D) Height and Width
19. Which of these IEEE standards represent wireless local area network?
(A) 802.11 (B) 802.3
(C) 802.12 (D) 802.1
20. Which of these protocols is used by TFTP for data transport?
(A) TCP (B) UDP
(C) Both A & B (D) None of the Above
21. The last Sunday of March, 2006 fell on which date ?
Statements: I. The first Sunday of that month fell on 5th. II. The last day of that month was Friday.
(A) I alone is sufficient while II alone is not sufficient
(B) II alone is sufficient while I alone is not sufficient
(C) Either I or II is sufficient
(D) Neither I nor II is sufficient
22. Five persons - A, B, C, D and E are sitting in a row. Who is sitting in the middle?
Statements: I. B is between E and C. II. B is to the right of E III. D is between A and E.
(A) Only I and II
(B) Only II and III
(C) Only I and III
(D) All I, II and III
23. All the trees in the park are flowering trees. Some of the trees in the park are dogwoods. All dogwoods in the park are flowering trees. If the first two statements are true, the third statement is
(A) True
(B) False
(C) Uncertain
(D) None of the above
24. $5 : 150 :: 8 : \underline{\quad}$
(A) 576 (B) 567
(C) 512 (D) 520

25. Find the number of parallelograms.



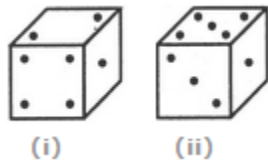
- (A) 8 (B) 10
(C) 15 (D) None Of These

26. How many triangles are there in the following figure?



- (A) 2
(B) 3
(C) 4
(D) More than 4

27. Two positions of a cube are shown below. When the number 4 will be at the bottom, then which number will be at the top?

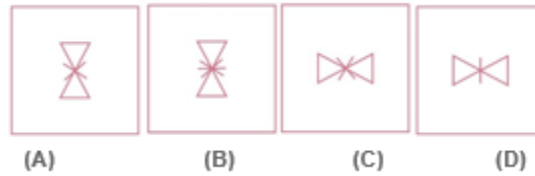


- (A) 3
(B) 5
(C) 6
(D) None of these

28. Questions Figures



Answer figures



- (A)A
- (B)C
- (C)D
- (D)B

29. A man is facing west. He turns 45 degrees in the clockwise direction and then another 180 degrees in the same direction and then 270 degrees in the anticlockwise direction. Find which direction he is facing now?

- (A)South
- (B)West
- (C)South West
- (D)East

30. Statement 1: Pens cost more than pencils. Statement 2: Pens cost less than erasers. Statement 3: Erasers cost more than pencils and pens. If the first two statements are true, the third Statement is

- (A)True
- (B)False
- (C)Uncertain
- (D)Cannot be determ

Part -C

Mathematics Entrance Test Question paper for Ph.D.-20 Marks Common to all Branches

- For the linear transformation, $X = \begin{bmatrix} 2 & 1 & 1 \\ 1 & 1 & 2 \\ 1 & 0 & -2 \end{bmatrix} Y$, find the Y co-ordinates for (1, 2, -1) in X.
 - (0, -2, 0)
 - (-1, 3, 1)
 - (-1, -2, 0)
 - (-1, 3, 0)
- Which of the following statements is true about the regression line?
 - A regression line is also known as the line of the average relationship
 - A regression line is also known as the estimating equation
 - A regression line is also known as the prediction equation
 - All of the above
- If the values of two variables move in the same direction, _____
 - The correlation is said to be non-linear
 - The correlation is said to be linear
 - The correlation is said to be negative
 - The correlation is said to be positive
- Which of the following are types of correlation?
 - Positive and Negative
 - Simple, Partial and Multiple
 - Linear and Nonlinear
 - All of the above
- A is 5×5 matrix, all of whose entries are 1, then
 - A is not diagonalizable
 - A is idempotent
 - A is nilpotent
 - The minimal polynomial and the characteristics polynomial of A are not equal.
- $T : R^3 \rightarrow R^3$ such that $T(a, b, c) = (0, a, b)$, for $(a, b, c) \in R^3$. Then $T + I$ is a zero of the polynomial:

- a) t
- b) t^2
- c) t^3
- d) none of above

7. $T : P_2(\mathbb{R}) \rightarrow P_3(\mathbb{R})$ such that $T(f(x)) = 2f'(x) + 3 \int_0^x f(t)dt$. Then rank of T is

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

$$\begin{pmatrix} 2 & 1 & 0 & 0 \\ 0 & 2 & 0 & 0 \\ 0 & 0 & 2 & 0 \\ 0 & 0 & 0 & 5 \end{pmatrix}$$

8. The minimal polynomial of

- a) $(x - 2)$
- b) $(x - 2)(x - 5)$
- c) $(x - 2)^2(x - 5)$
- d) $(x - 2)^3(x - 5)$

$$\begin{pmatrix} 2 & 2 & 0 & 0 \\ 2 & 1 & 0 & 0 \\ 0 & 0 & 3 & 0 \\ 0 & 0 & 1 & 4 \end{pmatrix}$$

9. Number of linearly independent Eigen vectors of

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

10. A is a 4-square matrix and $A^5 = 0$. Then

- a) $A^4 = I$
- b) $A^4 = A$
- c) $A^4 = 0$
- d) $A^4 = -I$

11. Solve the following equations by Gauss Elimination Method.

$$x+4y-z = -5, \quad x+y-6z = -12, \quad 3x-y-z = 4$$

- a) $x = 1.64791, y = 1.14085, z = 2.08451$
- b) $x = 1.65791, y = 1.14185, z = 2.08441$
- c) $x = 1.64691, y = 1.14095, z = 2.08461$
- d) $x = 1.64491, y = 1.15085, z = 2.09451$

12. Find the values of x, y, z in the following system of equations by Gauss Elimination Method.

$$2x + y - 3z = -10, \quad -2y + z = -2, \quad z = 6$$

- a) 2, 4, 6
- b) 2, 7, 6
- b) 3, 4, 6
- d) 2, 4, 5

13. In Gauss Jordan method which of the following transformations are allowed?
- a) Diagonal transformation
 - b) Column transformation
 - c) Row transformation
 - d) Square transformation
14. Solve the equations using Gauss Jordan method.
- $$x + 2y + 6z = 15, \quad 3x + 4y + z = 16, \quad 6x - y - z = 20$$
- a) $x = 3.735, y = 0.795, z = 1.612$
 - b) $x = 3.735, y = 3.735, z = 1.612$
 - c) $x = 3.735, y = 1.612, z = 3.735$
 - d) $x = 1.612, y = 0.795, z = 3.735$
15. Gauss Seidal method is also termed as a method of _____
- a) Successive displacement
 - b) Eliminations
 - c) False positions
 - d) Iterations
16. Which of the following is not Dirichlet's condition for the Fourier series expansion?
- a) $f(x)$ is periodic, single valued, finite
 - b) $f(x)$ has finite number of discontinuities in only one period
 - c) $f(x)$ has finite number of maxima and minima
 - d) $f(x)$ is a periodic, single valued, finite
17. If the function $f(x)$ is odd, then which of the only coefficient is present?
- a) a_n
 - b) b_n
 - c) a_0
 - d) everything is present
18. Find b_n if the function $f(x) = x^2$.
- a) finite value
 - b) infinite value
 - c) zero
 - d) can't be found

19. What is the coefficient of x^{101729} in the series expansion of $\cos(\sin(x))$?

- a) 0 b) $\frac{1}{101729!}$ c) $-\frac{1}{101729!}$ d) 1

20. The angle between Radius vector $r=a(1-\cos^2\theta)$ and tangent to the curve is ϕ given by

- a) $\phi=\pi/2$ b) $\phi=\pi$
c) $\phi=-\pi/2$ d) $\phi=0$