BIRLA INSTITUTE OF TECHNOLOGY
MESRA – 835215, RANCHI, INDIA

UG

Name: …… Roll No.: ……..

Branch: …… Signature of Invigilator: ……

Semester: VIth Date: 29/04/2022 (MORNING)

Subject with Code: **CS360 NATURE INSPIRED COMPUTING**

Marks Obtained	Section A (30)	Section B (20)	Total Marks (50)

INSTRUCTION TO CANDIDATE

1. The booklet (question paper cum answer sheet) consists of two sections. First section consists of MCQs of 30 marks. Candidates may mark the correct answer in the space provided / may also write answers in the answer sheet provided. The Second section of question paper consists of subjective questions of 20 marks. The candidates may write the answers for these questions in the answer sheets provided with the question booklet.
2. The booklet will be distributed to the candidates before 05 minutes of the examination. **Candidates should write their roll no. in each page of the booklet.**
3. Place the Student ID card, Registration Slip and No Dues Clearance (if applicable) on your desk. All the entries on the cover page must be filled at the specified space.
4. Carrying or using of mobile phone / any electronic gadgets (except regular scientific calculator)/chits are strictly prohibited inside the examination hall as it comes under the category of unfair means.
5. No candidate should be allowed to enter the examination hall later than 10 minutes after the commencement of examination. Candidates are not allowed to go out of the examination hall/room during the first 30 minutes and last 10 minutes of the examination.
6. Write on both side of the leaf and use pens with same ink.
7. The medium of examination is English. Answer book written in language other than English is liable to be rejected.
8. All attached sheets such as graph papers, drawing sheets etc. should be properly folded to the size of the answer book and tagged with the answer book by the candidate at least 05 minutes before the end of examination.
9. The door of examination hall will be closed 10 minutes before the end of examination. Do not leave the examination hall until the invigilators instruct you to do so.
10. Always maintain the highest level of integrity. Remember you are a BITian.
11. Candidates need to **submit the question paper cum answer sheets before leaving the examination hall**.

BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: CSE **SEMESTER : VI**
BRANCH: CSE **SESSION : SP/22**

SUBJECT: CS 360 Nature Inspired Computing(set-1)

TIME: 2 Hrs **FULL MARKS: 50**

INSTRUCTIONS:

1. **The question paper section-A contains 30 Objective (MCQ) questions each of 1 mark and section-B contains 4 subjective (descriptive) questions each of 5 marks.**
2. **Candidate has to attempt all 34 (30+4) questions maximum of 50 marks.**
3. **The missing data, if any, may be assumed suitably.**
4. **Before attempting the question paper, be sure that you have got the correct question paper.**
5. **No Tables/Data hand book/Graph paper etc. is required.**

Section-A: Objective (MCQ) Questions:

1. Which algorithm is not based on initial population of solution?
   a) Honey bee mating optimization algorithm
   b) Gradient Descent based optimization algorithm
   c) Harmony Search optimization algorithm
   d) Ant Colony optimization algorithm

2. General problems solving heuristic based approach is known as
   a) Meta heuristic based approach
   b) Hyper heuristic based approach
   c) Both b and c
   d) None of the above

3. For a linear optimization problem both minimization and maximization can be found In case of

   a) Unbounded decision space of the problem
   b) Bounded decision space of the problem
   c) Both a and b possible
   d) None of the above.

4. Mostly natured inspired optimization problems solving approach can be classified in
   a) Initial Single solution based
   b) Population based
   c) Initial two solutions based
   d) a and c

5. 2D linear optimization problem can be solved
   a) Using graphical method
   b) Simplex method
   c) Both a and b

d) None of the above

6. 0/1 knapsack optimization problem is
   a) Linear optimization
   b) Non linear optimization
   c) Both a and b
   d) None of the above

7. A nature inspired algorithm for solving optimization problem provides
   a) local optimum solution
   b) Near local optimum solution
   c) Both a and b may be possible
   d) None of the above

8. Random Sampling grid approach of meta heuristic algorithm needs
   a) The whole decision space of the problem be searched precisely
   b) the evaluation of any new possible solution is done independently of previously tested solutions.
   c) the evaluation of any new possible solution is dependent of previously tested solutions.
   d) a and c
   e) a and b

9. Which one is true among the following?
   a) State variables are independent variables whose values changes so, the decision variables change their values.
   b) State variables are dependent variables whose values change as the decision variables change their values
   c) Both state variables and decision variables separate from each other and do not make any effect on each other.
   d) None of the above

10. By default, Gradient descent approach can be used to
    a) solve the minimization problem of optimization
    b) solve the maximization problem of optimization
    c) solve both a and b
    d) None of the above

11. Can a solution be feasible if
    a) It optimizes the objective function but not satisfies the constraints
    b) It optimizes the objective function and also satisfies the constraints
    c) Not optimizes the objective function but satisfies the constraints
    d) Both b and c
12. Which one is true among following?

a) Nature inspired meta heuristic approach is derivative free approach to solve the optimization problem
b) Nature inspired meta heuristic approach is derivative based approach to solve the optimization problem
c) Both a and b possible
d) None of the above

13. Genetic algorithm is
a) First Derivation based technique
b) Second Derivation technique
c) both a and b can be possible.
d) None of the above

14. Which one is true in genetic algorithm:
a) Selection of the solutions according to their fitness value
b) Creating new off-springs using mutation
c) Crossover technique is used to discard low fitness valued solutions.
d) a and c
e) a and b

15. The role of population diversity in GA is
a) To avoid the selective pressure
b) To avoid the premature convergence of Genetic algorithm
c) To increase the rate of convergence of genetic algorithm
d) a and b
e) a and c

16. The purpose of low mutation rate in genetic algorithm is
a) To avoid the accumulation of more deleterious mutations overall, which can result in higher fitness.
b) To avoid the accumulation of more deleterious mutations overall, which can result in lower fitness.
c) To keep the accumulation of more deleterious mutations overall, which can result in higher fitness.
d) None of the above

17. Ant Colony optimization technique is based on
a) Concentration of pheromone depositions on the path
b) Visibility or desirability of the path
c) Both a and b
d) None of the above

18. Ant colony optimization technique can be applied mainly
a) To solve the discrete optimization problem
b) To solve the continuous optimization problem
c) solve the both a and b
d) None of the above

19. Travelling salesman problem is
    a) Discrete optimization problem
    b) Continuous optimization problem
    c) Both a and b can be possible
    d) None of the above

20. Global best in the PSO technique shows
    a) Personal behaviors of the particles
    b) Social behaviors of the particles
    c) Both personal and social behaviors of the particles.
    d) None of the above

21. In Particle swarm optimization technique position of the particles are updated using
    a) previous position and previous velocity
    b) previous position and current velocity
    c) previous position only
    d) Previous velocity only

22. Honey Bee mating optimization technique is
    a) improved version of particle swarm optimization
    b) improved version of genetic algorithm
    b) improved version of ant colony optimization
    d) None of the above

23. BAT Algorithm is inspired by the
    a) Visibility capability of the BAT
    b) Echolocation capability of the BAT
    c) Flying capability of the BAT
    d) None of the above

24. The crossover operation in honey bee optimization technique is applied
    a) In between drones and workers
    b) In between queen and drones
    c) In between drones
    d) In between workers

25. In honey bee optimization technique, the solution of the optimization problem is
    a) Based on the fitness of the queen
    b) Based on the fitness of the workers
    c) Based on the fitness of the drones
    d) None of the above

26. In BAT algorithm the frequency is used to

a) Adjust the position
b) Adjust the Velocity
c) Both position and velocity
d) None of the above

27. The termination criteria is decided in BAT algorithm as
    a) Number of BATs
    b) Number of Movements of the BATs
    c) Both a and b can be taken
    d) None of the above

28. The Music improvisation is the basis or inspiration for
    a) Harmony Search technique to solve the optimization problem.
    b) Honey bee optimization technique to solve the optimization problem
    c) BAT algorithm to solve the optimization problem
    d) None of the above.

29. In Harmony Search algorithm if Harmony memory consideration rate (HMCR) is 0.5 and pitch adjustment rate is 0.4 then, effective rate of pitch adjustment rate is:
    a) 0.1
    b) 0.9
    c) .20
    d) 0.4

30. In Harmony search algorithm the purpose of HMCR is
    a) To provide the probability for the selection of solution from the harmony memory
    b) To provide the probability for the selection of solution randomly generated.
    c) To provide the probability to adjust the harmony selected from the harmony memory
    d) None of the above

Section-B: Subjective (Descriptive) questions

Q.No.1:

a) Explain the basis for classification of Meta-Heuristic and Evolutionary Algorithms. [2]

b) Explain, how we evaluate the performance of the meta-heuristic algorithms. [3]

Q.No.2:

a) Explain the various features of genetic algorithm. [2]

b) Six strings have the following fitness function values: 5,10,15,25,50,100. Under Ranking selection, calculate the expected number of copies of each string in the mating pool of the constant population size, n=6, is maintained. [3]

Q.No.3:

a) Explain the method to compute the probability of selecting a path in Ant colony optimization based on pheromone and visibility criteria. How can we control these criteria? [2]

b) Write the algorithm for particle swarm optimization technique. Explain the controlling factors of this algorithm. [3]

Q.No.4:

a) Write down the harmony search optimization algorithm. By applying the harmony search algorithm compute the first iteration result for the optimization of the following problem

maximize $z = x^3 - 60x^2 + 900x + 100$

where decision variable x is subject to

$0 <= x <= 31$

Assume the suitable parameters and initial population of the feasible solution. [3]

b) Explain the algorithm of honey bee mating optimization technique using flowchart. [2]

********** End of Question Paper **********