28. a.	Explain the stages of conjugate gradient method and Quasi-Newton method of Multi-variable optimization.	10	3	3	2,3
	(OR)				
b.	Minimize using Penalty function method for a function $f(x)=-x_1x_2$ subject to $g(x)=x_1+2x_2-4\le 0$	10	3	3	2,3
29. a.	Explain the simulated annealing method of optimization. How the cross over and mutation operator work in GA?	10	3	4	2,3
	(OR)				
b.	State schema theorem. Explain how it works in different stages in genetic Algorithm.	10	3	4	2,3
30. a.	A steel bar is to be Machined on a CNC late using P20 carbide tool. The lathe has a 10 kW motor and a transmission efficiency of 75%. A maximum allowable cutting force of 5000 N is applied. The operation will remove 219, 912 mm^3 of material. The step time during which tool does not cut have been assumed as 0.15, 0.2 and 0.05 mins respectively. The objectives are minimization of operation time and used tool life. Formulate the problem as a multi-objective optimization problem.	10	4	5	2,3
	(OR)				
b.	Draw a 2 dimensional dynamic model of a car suspension system considering sprung mass supported on two axles by means of suspension coil spring and shock absorber. Each axle contains some unsprung mass supported by the tyre. List the design parameters and formulate the objective function to minimize the transmissibility factor based on bouncing amplitude of the spring mass and road excitation Amplitude.	10	4	5	2,3

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Reg. No.														

B.Tech. DEGREE EXAMINATION, MAY 2022

Sixth and Seventh Semester

18MEE402T – OPTIMIZATION IN ENGINEERING DESIGN

(For the candidates admitted from the academic year 2018-2019 to 2019-2020)

Note:

(i) **Part - A** should be answered in OMR sheet within first 40 minutes and OMR sheet should be handed over to hall invigilator at the end of 40th minute.

(ii) **Part - B** should be answered in answer booklet.

Time: 2½ Hours Max. Marks: 75

PART – A (25 × 1 = 25 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
1.	The techniques for selecting a new point depends upon (A) Scope of the problem (B) Nature of the problem (C) Range of the problem (D) Analysis of the problem	1	1	1	2,3
2.	A "≤" type constraint expressed in the standard form is active at a design point if it has (A) Zero value (B) More than zero (C) Less than zero (D) Infinite value	1	1	1	2,3
3.	The degrees of freedom for an optimization problem that has four design variables is (A) 1/4 (B) 4 (C) $\sqrt[4]{4}$ (D) 2	1	1	1	1,3
4.	The function $f(x)=3x^2+2x+5$ has (A) Minimum at $x=\frac{1}{3}$ (B) Maximum at $x=\frac{1}{3}$ (C) Minimum at $x=\frac{-1}{3}$ (D) Maximum at $x=\frac{-1}{3}$	1	1	1	1,3
5.	The variables in the design process are called _____. (A) Constraints (B) Free points (C) Pre-assigned parameters (D) Decision variables	1	1	1	1,3
6.	The direct search methods require only the objective function values but not the partial derivatives of the function is given by (A) Non-gradient methods (B) Gradient methods (C) Newton's method (D) Pattern search method	1	1	2	2,3
7.	For what value of 'x', is the function x^2-2x-6 be minimized? (A) 0 (B) 1 (C) 5 (D) 3	1	2	2	2,3
8.	In solving an unconstrained minimization problem, find out the method which doesn't belongs to an unconstrained minimization? (A) Univariate method (B) Newton's method (C) Pattern search method (D) Tabu search method	1	1	2	2,3

9.	The _____ method is used on generating a sequence of improved approximations to the minimum each derived from preceding approximation. (A) Random search (B) Random walk (C) Random jump (D) Grid search	1	1	2	2,3	
10.	Choose one of the following which is not a one dimensional minimization method. (A) Unrestricted search method (B) Fibonacci method (C) Golden section method (D) Penalty function method	1	1	2	2,3	
11.	In unconstrained optimization technique, which one is not a direct method? (A) Random search method (B) Complex method (C) Fibonacci method (D) Transformation of variable technique	1	1	3	2,3	
12.	_____ method coupled with powell method of unconstrained minimization and cubic interpolation of one dimensional search is used to solve a problem. (A) Exterior penalty function (B) Interior penalty function (C) Explicit function (D) Quasi-Newton	1	1	3	2,3	
13.	In geometric programming the emphasis is on (A) Optimal distribution (B) Single distribution (C) Variable distribution (D) Linear distribution	1	1	3	2,3	
14.	When we solve a problem using conjugate gradient method, it can be simplified in 'n' iterations if it is robust and _____. (A) Diverges (B) Converges (C) Symmetric (D) Non-symmetric	1	1	3	2,3	
15.	In unconstrained optimization techniques, which is not a indirect method? (A) Interior penalty function (B) Exterior penalty function (C) Larange multiplier method (D) Sequential quadratic programming	1	1	3	2,3	
16.	The basic feature of genetic algorithm is a _____. (A) Deterministic mutation (B) Fitness based selection (C) Hill climbing search selection (D) Random selection	1	1	4	2,3	
17.	Parameters space to be searched (A) Chromosomes (B) Population (C) Generation (D) Colony	1	1	4	2,3	
18.	Which chemical is released by ants to keep track of their path? (A) De oxyribonucleic acid (DNA) (B) Pheromone (C) H_2O (D) Citric acid	1	1	4	2,3	
19.	The cooling strategy in simulated annealing does not determine the (A) Selection of successor state (B) Temperature-decrease steps (C) Number of iterations for each step (D) Maximum number of iterations in search process	1	1	4	2,3	

20.	Large changes in the parameter vector dependent on other parameter vectors is applicable in _____. (A) Mutation (B) Selection (C) Macro-mutation (D) Cross over	1	1	4	2,3	
21.	For analyzing a two bar truss element, the analysis functions that is used? (A) Height of truss (B) Weight (C) Modulus of elasticity (D) Thickness	1	1	5	2,3	
22.	_____ models are based on the underlying principles that govern any design problems. (A) Physical (B) Experimental (C) Numerical (D) Analytical	1	1	5	2,3	
23.	To design a shaft with ultimate strength, the following constraints can be rewritten as $4 \leq$ diameter ratio ≤ 16. (A) Diameter ratio ≤ 16 Diameter ratio ≥ 4 (B) Diameter ratio ≥ 16 Diameter ratio ≤ 4 (C) Diameter ratio ≤ 4 Diameter ratio ≤ 16 (D) Diameter ratio ≥ 4 Diameter ratio ≥ 16	1	2	5	2,3	
24.	Most engineering designs represented a compromise among _____. (A) Similar objectives (B) Conflicting objectives (C) Single dependent objectives (D) Multiple dependent objectives	1	1	5	2,3	
25.	In order to design a robust spring element, the relative size of wire dia and coil dia should be _____. (A) Restrained (B) Neglected (C) Minimized (D) Maximized	1	2	5	2,3	

PART – B (5 × 10 = 50 Marks)

Answer **ALL** Questions

		Marks	BL	CO	PO
26. a.	What are the differences between static and dynamic optimization problem? Explain with example, How non-traditional optimization method is better for searching the global optima?	10	3	1	2,3
	(OR)				
b.	How adequate and optimum design differ? What are the objectives of optimum design? What is a multi-objective optimization problem?	10	3	1	2,3
27. a.	Minimize $f(x) = 0.65 - \frac{0.75}{1+x^2} - 0.65x\tan^{-1}\left(\frac{1}{x}\right)$ in the interval (0,3) using Fibonacci method for n = 6.	10	4	2	2,3
	(OR)				
b.	Find the minimum value of $f = x(x-1.5)$ in the interval of (0,1) within 10% of the exact value using internal halving method.	10	4	2	2,3