



STEM Careers Project



STEM Careers Project is a joint venture of the Higher Education Commission and Pakistan Atomic Energy Commission, for grooming talented students for careers in Science, Technology; Engineering & Mathematics (STEM).

Screening TEST: Mathematics NSTC-22, June 28, 2025

Maximum Marks: 100

Maximum Time: 3 hours

Check List: Before attempting this question paper please make sure that:

- i) Paper contains 6 pages including this page and no page is torn or missing
- ii) Part I consists of 20 multiple choice questions, Part II contain 50 multiple choice questions and Part III contains descriptive questions
- iii) Answer Sheet for MCQs of Part-I & II, and Answer Booklet for Part III

1. Part I has 5 multiple-choice questions (MCQs) from each of the subjects of Biology, Computer, Chemistry, Mathematics and Physics. There is a choice between Biology or Computer only, rest of the three subjects are compulsory for every candidate. For Biology or Computer one must blacken the corresponding circle in the answer sheet.
2. Part I has 20 MCQs and carries 20 marks. The MCQ portion of the relevant subject of Part II carries 50 Marks. Correct answer carries +1 mark; 1/3 mark will be deducted for each incorrect answer.
3. In Part I and Part II, there are four choices (a, b, c, d) corresponding to each multiple-choice question. Blacken one of these choices, which in your opinion is correct. Rough work may be done in the Answer Booklet for Part III by clearly specifying 'Rough Work'.
4. The descriptive question(s) of Part III should be solved in the Answer Booklet for Part III. This part carries 30 Marks.
5. You are recommended to give frank opinion about the test, including pointing out possible mistakes and legibility problems on the last page of the Answer Booklet. It is meant to motivate you to carefully read the question paper before attempting it. It may be used to discriminate between candidates having similar scores.
6. Recommended time for Part I is about 30 minutes and for Parts II and III is about one hour each. The rest of the time is for carefully reading the paper and commenting on it.
7. No leaf from the question paper or Answer Booklet is to be torn out as all these must be handed over to the examiner, even if no question has been attempted. Anyone found using unfair means would be disqualified.
8. You may use non-programmable calculators.
9. No questions will be entertained and no clarification will be made during the test. In case of doubt, please write down your remarks/comments on the last page of the Answer Booklet.
10. You must attempt all Parts of the paper. To qualify screening test one should pass both Parts I and the portion of Parts II and III that are relevant to the discipline in which you have applied to appear.
11. The term 'estimate' if used in the descriptive portion of Part II means that only an approximate answer is expected from the students. Similarly the term 'sketch' in Part III means drawing a rough graph, which looks like what you might expect from more careful considerations.
12. **Possession of CELL PHONE or any IMAGING DEVICE in the Examination Hall will be treated as an offence under unfair mean rules.**
13. Please put your pen down as soon as you hear the announcement of 'stop writing'.

Students will be short-listed for a one-week Training Camp on the basis of their performance on this Screening Test. Results will be posted on NSTC web page: www.stem.edu.pk. Successful candidates will also be informed about their result in about two months after the exam. Please make sure that we have your correct phone/fax number and e-mail address.

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PART-I

[CANDIDATE MUST ATTEMPT THIS PART]

[It contains 20 MCQs, 5 from each biology/computer, chemistry, mathematics, and physics,
for selection to the next phase]

Choose either Biology or Computer and must blacken the correct option in the answer sheet.

BIOLOGY

1. Which gas is filled in an electric bulb?
a) Argon b) Helium c) Nitrogen d) All of these
2. Cancer is disease of:
a) Simple cell b) Uncontrolled cell c) Controlled cell division d) Accelerated cell division
division division division division
3. Which of the following is a list of entirely abiotic factors?
a) Soil, temperature, b) viral infection, c) Sunlight, soil pH, d) Temperature, soil
viral infection, pH of predators, competition number of species, pH, oxygen, light
soil, predators for resources Plant canopy
4. Malaria is an infectious disease caused by a single-celled eukaryotic organism, carried by female mosquitoes. The mosquito is the:
a) Pathogen b) Vector c) Agent d) Virus
5. Cellular digestion is associated with which organelle?
a) Lysosomes b) Mitochondria c) Golgi bodies d) Plastids

OR

COMPUTER

1. When _____ is encountered inside any loop, control automatically passes to the first statement after loop.
a) Continue b) Goto c) Return d) Break
2. The speed of the laser printer is measured in.
a) Lines per minute b) Page per minutes c) Characters per sound d) Word per minutes
3. Which unit in the CPU is responsible for fetching instructions from memory?
a) ALU (Arithmetic Logic Unit) b) Register c) Cache Memory d) Control Unit
4. When a collection of various computers appears as a single coherent system to its clients, what is this called?
a) mail system b) distributed system c) networking system d) computer network
5. In a hierarchical database model, data is organized in a:
a) Tree-like structure b) Mesh structure c) Circular structure d) Linear structure

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CHEMISTRY

6. A mole of any substance is related to
a) Number of particles b) Volume of gaseous substance c) Mass of a substance d) All of these
7. A drop of liquid acquires a spherical shape because of
a) its tendency to maximize its surface area b) its tendency to acquire minimum surface area
c) its viscous nature d) none of these
8. Some people add sodium chloride to water while boiling eggs. This is to
a) decrease the boiling point of water b) increase the boiling point of water
c) prevent breaking of eggs d) make egg tasty
9. A variety of water which contains soluble salts of Ca and Mg is known as
a) Soft water b) Heavy water (c) Conductivity water d) Hard water
10. Milk is a colloid in which
a) Liquid is dispersed in liquid b) Gas is dispersed in liquid c) Sugar is dispersed in water d) Solid is dispersed in liquid

MATHEMATICS

11. If $x + 1/x = 3$, then the value of $x^2 + 1/x^2$ is:
a) 5 b) 7 c) 9 d) 3
12. Find the degree of the polynomial $5x^4y^2 + 3xy^5 + 7$
a) 4 b) 6 c) 7 d) 5
13. Number of real roots of $x^2 + 4x + 5 = 0$ is:
a) 2 b) 0 c) 1 d) infinite
14. If $x^2 - 6x + 9 = 0$, the $x =$
a) 0 b) 3 c) 9 d) ± 3
15. The set of all points, in a plane equidistant from a fixed point $A = (x, y)$, forms a
a) Line b) Circle c) Sphere d) None of these

PHYSICS

16. A 1,200-kilogram car traveling at 10 meters per second hits a tree and is brought to rest in 0.10 second. What is the magnitude of the average force acting on the car to bring it to rest?
a) 1.2×10^2 N b) 1.2×10^4 N c) 1.2×10^3 N d) 1.2×10^5 N
17. A spring scale reads 20 newtons as it pulls a 5.0-kilogram mass across a table. What is the magnitude of the force exerted by the mass on the spring scale?
a) 49 N b) 20 N c) 5 N d) 4 N
18. When a neutral metal sphere is charged by contact with a positively charged glass rod, the sphere
a) loses electrons b) gains electrons c) loses protons d) gains protons
19. A motor is used to produce 4.0 waves each second in a string. What is the frequency of the waves?
a) 0.25 Hz, b) 25 Hz, c) 15 Hz, d) 4 Hz
20. One watt is equivalent to one
a) N•m b) N/m c) J•s d) J/s

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PART II – MATHEMATICS

21	If $x = \sqrt{5} + 2$, find the value of $x - 1/x$:						
(a)	3	(b)	$\sqrt{5}$	(c)	4	(d)	2
22	If one root of the equation $(k + 2)x^2 + 3x + 2 = 0$ is -1 , then the value of k is						
(a)	-1	(b)	-2	(c)	0	(d)	1
23	The function $f: R \rightarrow R$ defined by $f(x) = 3x^2 + 2x + 5$, is						
(a)	only onto	(b)	only one-one	(c)	both one-one and onto	(d)	neither one-one nor onto
24	Which of the following is a rational number?						
(a)	$\sqrt{2} + \sqrt{3}$	(b)	$2\sqrt{3}/3$	(c)	$\frac{(\sqrt{5} - \sqrt{2})(\sqrt{5} + \sqrt{2})}{\sqrt{2}}$	(d)	$\sqrt{2} \times \sqrt{3}$
25	Consider the points in a plane with coordinates $A = (0, -1)$, $B = (3, -1)$, $C = (3, 4)$. Then ABC is a						
(a)	Parallelogram	(b)	Line	(c)	Right Triangle	(d)	None of these
26	Consider triangle ABC , $AB = AC$. If angle $B = x^\circ$, then angle C is						
(a)	$2x^\circ$	(b)	x°	(c)	$180^\circ - 2x^\circ$	(d)	Can't be determined.
27	Let the central angle subtended by two points on a circle is 140° . Then the inscribed angle subtended by those points is						
(a)	140°	(b)	40°	(c)	180°	(d)	None of these.
28	Consider the triangle in a plane with vertices $A = (0, -1)$, $B = (3, -1)$, $C = (3, 4)$. The perimeter of triangle ABC is						
(a)	12	(b)	5	(c)	7	(d)	None of these.
29	Consider 3 circles, all are tangent to each other. Exactly, at how many points they meet?						
(a)	1	(b)	2	(c)	3	(d)	6
30	Two non-congruent circles can intersect maximum at _____ points.						
(a)	2	(b)	1	(c)	0	(d)	Infinite
31	The distance between x -axis and the point $(-2, 5)$ is						
(a)	-2	(b)	5	(c)	3	(d)	None of these
32	Consider a triangle ABC with $\angle A = 50^\circ$ and $\angle B = 80^\circ$. What is the type of $\triangle ABC$?						
(a)	Right Angle	(b)	Isosceles	(c)	Equilateral	(d)	Obtuse
33	Consider a cylinder with radius 2 cm and height 6 cm. What is the surface area of the given cylinder?						
(a)	$24\pi \text{ cm}^2$	(b)	$32\pi \text{ cm}^2$	(c)	$48\pi \text{ cm}^2$	(d)	None of these.
34	Haniya had to multiply two positive integers. Instead of taking 35 as one of the multipliers, she incorrectly took 53. As a result, the product went up by 540. What is the new product?						
(a)	1590	(b)	1050	(c)	540	(d)	1440
35	If two fractions, each of which has a value between 0 and 1, are multiplied together, the product will be						
(a)	always greater than either of the original fractions	(b)	sometimes greater and sometimes less than either of the original fractions	(c)	always less than either of the original fractions	(d)	remains the same
36	If x, y, z are chosen from the three numbers, $-3, \frac{1}{2}$ and 2, what is the largest possible value of the expression $\left(\frac{x}{y}\right)z^2$?						
(a)	36	(b)	16	(c)	24	(d)	54
37	There are 35 steps in a building. By the time Ahsan comes down two steps, Arham goes up one step. If they start simultaneously and keep their speed uniform, then at which step from the bottom will they meet?						
(a)	9th step	(b)	12th step	(c)	13th step	(d)	8th step
38	Let x, y and z be distinct integers. x and y are odd and positive, and z is even and positive. Which one of the following statements cannot be true?						
(a)	$(x - z)y^2$ is odd	(b)	$(x - z)y$ is odd	(c)	$(x - z)^2y$ is even	(d)	$(x - y)^2z$ is even

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39	The sum of the first 100 natural numbers, 1 to 100 is divisible by						
(a)	2, 4 and 8	(b)	2 and 4	(c) 100	(d) 2		
40	Find the G.C.D of $12x^2y^3z^2$, $18x^3y^2z^4$, and $24xy^4z^3$						
(a)	$6x^3y^4z^3$	(b)	$6xy^3z^2$	(c) $24xy^3z^2$	(d) $18x^2y^2z^3$		
41	If a, b, c, and d are four different positive integers selected from 1 to 25, then the highest possible value of $\frac{(a+b)(c+d)}{(a+b)(c-d)}$ is						
(a)	4	(b)	49	(c) 96	(d) 51		
42	The value of $6ab^2c^3 \cdot 4b^2c^3d$ is						
(a)	24ad	(b)	6a	(c) 4b	(d) 4d		
43	The sum of two different prime numbers is a						
(a)	Prime number	(b)	Composite number	(c) Either Prime or Composite	(d) None of the mentioned		
44	What is the smallest positive integer n for which n! is divisible by 1000?						
(a)	15	(b)	22	(c) 29	(d) 45		
45	If $\gcd(a,b)=6$ and $\text{lcm}(a,b)=72$, what is the product $a \times b$?						
(a)	432	(b)	864	(c) 560	(d) 720		
46	How many pairs of positive integers (x, y) satisfy $x^2 - y^2 = 72$?						
(a)	2	(b)	3	(c) 4	(d) 6		
47	Find the smallest number that when divided by 5, 6, and 8 leaves a remainder of 3 each time.						
(a)	99	(b)	145	(c) 180	(d) 123		
48	A bag contains coins worth either \$3 or \$5. The total value is a two-digit number with identical digits (e.g., \$33). How many possible amounts exist?						
(a)	2	(b)	3	(c) 4	(d) 5		
49	A father's age is the product of two primes that are consecutive in the sequence of prime numbers. His son's age is the sum of these two primes. If the son is 18 years old, how old is the father?						
(a)	35	(b)	55	(c) 77	(d) 85		
50	If there are 18 boys and 12 girls in a class, how many ways are there of selecting 1 student, either a boy or a girl, as a class representative?						
(a)	30	(b)	15	(c) 306	(d) 153		
51	How many numbers in the range 1000 - 9999 have no repeated digits?						
(a)	6561	(b)	4536	(c) 3024	(d) 4032		
52	How many diagonals exist in a convex polygon with n sides?						
(a)	$\binom{n}{2}$	(b)	$\binom{n}{k-1}$	(c)	$\frac{n(n-3)}{2}$	(d)	$\binom{n+1}{2}$
53	How many positions of eight rooks are there on a chess board in which no two of them attack each other?						
(a)	40320	(b)	20160	(c) 28	(d) 56		
54	How many subsets does $A = \{a_1, a_2, \dots, a_{n-1}\}$ have?						
(a)	4^n	(b)	2^{n-1}	(c)	2^n	(d)	n
55	Let $S = \{1, 2, \dots, 500\}$, the number of integers in S which are divisible by 2, 3, or 5 are						
(a)	516	(b)	500	(c) 416	(d) 366		
56	Determine the 4 th term in the expansion of $(x - 2y)^5$						
(a)	$-80x^2y^3$	(b)	$-40x^3y^2$	(c)	$40x^3y^2$	(d)	$80x^2y^3$
57	A student can choose a professor in ___ ways if there are 8 female professors and 5 male professors teaching DAA?						
(a)	5	(b)	18	(c) 13	(d) 40		
58	Find the number of triangles which can be formed by joining the angular points of polygon of 8 sides as vertices.						
(a)	56	(b)	24	(c) 16	(d) 12		
59	If the n th term of an arithmetic progression is $3n - 4$, then the $(n + 1)^{\text{th}}$ term of an A.P is?						
(a)	$3n - 1$	(b)	$3n + 4$	(c)	$3n + 1$	(d)	$3n + 3$

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60	Suppose that a robot is placed on the Cartesian plane. At each step it is allowed to move either one unit up or one unit right, i.e., if it is at (i, j) then it can move to either $(i + 1, j)$ or $(i, j + 1)$. How many distinct paths are there for the robot to reach the point $(10, 10)$ starting from the initial position $(0, 0)$						
(a)	2^{20}	(b)	$\binom{20}{10}$	(c)	2^{10}	(d)	10^2
61	In how many ways can 10 books be divided into 2 piles of 4 and 6 books, respectively, if the order within piles doesn't matter and the piles are labeled?						
(a)	$\binom{10}{5}$	(b)	$\binom{10}{6} \times 2$	(c)	$\binom{10}{4} \cdot \binom{6}{6}$	(d)	$\binom{10}{4}$
62	The sum of squares of two numbers is 58 and their product is 15. What is the sum of the numbers?						
(a)	11	(b)	13	(c)	15	(d)	17
63	Solve the inequality: $x^2 - 4x + 3 < 0$						
(a)	$x < 1$ or $x > 3$	(b)	$1 < x < 3$	(c)	$x > 1$	(d)	$x < 3$
64	The length of a rectangular garden is 4 meters longer than it's width. If the perimeter is 64 meters, what is the length of the garden?						
(a)	16	(b)	20	(c)	18	(d)	22
65	If the ratio of boys to girls in a class is 3:4 and there are 21 boys, how many girls are there?						
(a)	24	(b)	25	(c)	28	(d)	30
66	A student scored 72 marks in an exam. If this was 80% of the total marks, what were the maximum marks						
(a)	85	(b)	88	(c)	90	(d)	95
67	The sum of three consecutive integers is 3 times the smallest one. What is the smallest integer?						
(a)	0	(b)	-1	(c)	2	(d)	3
68	A man invests a sum of money at compound interest. The interest for the second year is Rs 528 and for the third year is Rs 580.80 at the same rate. Find the rate of interest per annum.						
(a)	8%	(b)	9%	(c)	10%	(d)	12%
69	A car travels from A to B at a speed of 60 km/h and returns at a speed of 40 km/h. What is the average speed for the entire journey?						
(a)	50 km/h	(b)	100 km/h	(c)	45 km/h	(d)	55 km/h
70	Solve for θ (in degrees): $2\sin^2(\theta) = 1$ where $0 \leq \theta \leq 180^\circ$						
(a)	30°	(b)	45°	(c)	60°	(d)	90°

Part III: Mathematics-Descriptive Questions

[30 Marks]

Question No 1: In triangle ABC , angle A is a right angle. A point D lies on line segment AB in such a way that the angles ACD and BCD are equal. Moreover, $|AD| = 2$ and $|BD| = 3$. What is the length of line segment CD ?

Question No 2: Let a, b and c be real numbers such that, $a + b + c = 0$ and $a^2 + b^2 + c^2 = 12$. Find the value of $a^3 + b^3 + c^3$.

----End of paper----

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