భారతీయ సాంకేతిక విజ్ఞాన సంస్థ హైదరాబాద్
भारतीय प्रौद्योगिकी संस्थान हैदराबाद
Indian Institute of Technology Hyderabad

Application Number of the Candidate

Name of the Post: Junior Technical Superintendent   **Pay Level:**

Date & Time of the Exam: 15/12/2023   **Duration: 01 hr. 30 min**

Scheme of the Exam:

Topic	Number of Question	Marks
English Communication	15	30
Basic Mathematics	15	30
Work Related Topics	20	40

Instructions to fill the responses in the OMR answer sheet:

1. Candidate must write his/her **application number** in the designated box on the top of OMR answer sheet.
2. Candidates must write the post code and Question paper code in the designated boxes on the top of OMR answer sheet.
3. Candidates must sign in the box provided in the OMR answer sheet.
4. Each answer sheet must be signed by the invigilator in the space printed in the OMR answer sheet.
5. Only one response to be selected & marked. In case more than one response is marked for a single question or no response is marked for a question, no marks will be awarded for that question.
6. Partially filled circles shall not be considered as responses.
7. Erasing or changing of answer is not allowed.
8. No negative marking
9. Candidate must use Blue/Black ball point pen to fill his/her responses.
10. Rough work should not be done on the OMR answer sheet.
11. Candidates can use the designated page(s) of the question booklet for the purpose of rough work.

Answer **all** questions. Pick the most appropriate answer from the choices given. Each correct answer carries 2 marks.
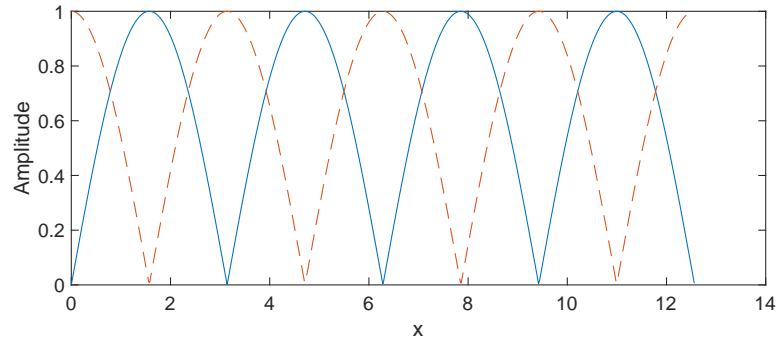
1 English Communication

1. Frame the correct wh-question: _____ time can I see you today?

   (A) When
   (B) What
   (C) How
   (D) Where

2. Fill in the blanks with *a* or *an* or both: _____ car was seen at the gate with _____ expired registration.

   (A) a, a
   (B) an, an
   (C) an, a
   (D) a, an

3. Fill in the blanks with the correct tense: I _____ to be a singer, but now I _____ a teacher.

   (A) am, used
   (B) am, was
   (C) used, am
   (D) was, will

4. Use the correct form of adjective given in the bracket: The sun is _____ (bright) than yesterday.

   (A) bright
   (B) brighter
   (C) brightest
   (D) none of the above

5. Use the correct prepositions in the following sentence: The man _____ the bus stop has been waiting _____ an hour.

   (A) at, for
   (B) in, that
   (C) that, for
   (D) for, the

6. Use the correct punctuation: Hurray India is in the semifinal

   (A) Hurray: India is in the semifinal.
   (B) Hurray! India is in the semifinal.
   (C) Hurray. India is in the semifinal.
   (D) Hurray, India is in the semifinal!

7. Correct the following jumbled sentence with proper punctuation: Jungle I saw a tiger I was where in the

   (A) In the jungle I was where I saw tiger.
   (B) I was in the jungle where a tiger I saw
   (C) I was in the jungle. where I saw a tiger.
   (D) I was in the jungle, where I saw a tiger.

8. Use antonyms in the following sentence: I _____ (love) the rain but I need to _____ (sell) grocery.

   (A) loved, sold
   (B) hated, sell
   (C) hate, buy
   (D) like, bought

9. Use synonyms in the following sentence: The elephant is _____ (large) but the mouse is _____ (tiny).

   (A) huge, small
   (B) expensive, small
   (C) old, new
   (D) heavy, huge

10. Correct the mistakes in the sentence: I bought two cakes with one stone when I got shoes and socks from the same shop.

    (A) I bought two birds with one stone, when I got shoes and socks from the same shop.
    (B) I hit two cakes with one stone when I got shoes and socks from the same shop.
    (C) I hit twice birds with one stone when I got shoes and socks from the same shop.
    (D) I hit two birds with one stone, when I got shoes and socks from the same shop.

11. Select the misspelled word:

    (A) Concise
    (B) Conscience
    (C) Conscious
    (D) Consrue

12. Correct the sentence: "Each of the students were given a textbook."

    (A) Each of the student is given a textbook.
    (B) Each of the students are given textbooks.
    (C) Each of the students was given a textbook.
    (D) Each of the students were given textbook.

13. Choose the correct conjunction: "She is talented _____ hardworking."

    (A) but
    (B) for
    (C) nor
    (D) so

14. Identify the correct plural form of 'mouse':

    (A) Mousees
    (B) Mice
    (C) Mices
    (D) Mouses

15. Choose the correct preposition to complete sentence: "She is interested _____ learning Spanish."

    (A) for
    (B) at
    (C) to
    (D) in

2 Basic Mathematics

16. Which of the following plots (solid line, dashed line) in the following figure shows $|\sin x|$?

(A) Solid line

(B) Dashed line

(C) Neither

(D) Need more information

17. The rank of the square matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 9 \end{bmatrix}$ is

(A) 3

(B) 2

(C) 1

(D) 0

18. The area under the curve $y = 4x^3$ from $x = 0$ to $x = 3$ is

(A) 36

(B) 9

(C) 81

(D) 27

19. One of the solutions of the differential equation $\frac{d^2 y}{dx^2} + y = 0$ is

(A) 0

(B) 1

(C) x

(D) x^2

20. A cylinder whose height is twice its radius is inscribed in a sphere of radius R. What is the volume of the cylinder?

(A) $\pi R^3 / \sqrt{2}$

(B) $4\pi R^3 / 3$

(C) $2\pi R^3$

(D) $2\sqrt{2}\pi R^3$

21. If the points $A(1, -1, -3)$, $B(\lambda, 1, -2)$, and $C(0, -3, -4)$ are collinear, what should λ be?

(A) 0

(B) 1

3

(C) 2

(D) -1

22. If the points $A(0,0,0)$, $B(1,1,0)$, and $C(0,0,1)$ lie on the same plane, which one of the following vectors is normal to the plane?

(A) $-2\hat{i} + 2\hat{j} + \hat{k}$

(B) $-\hat{i} + \frac{1}{\sqrt{2}}\hat{j}$

(C) $2\hat{i} - 2\hat{j}$

(D) $-\hat{k}$

23. Derivative of $\frac{\sin(x)}{x}$ with respect to x is

(A) $\cos(x)\log_e x$

(B) $-\frac{\sin(x)}{x} + \frac{\cos(x)}{x^2}$

(C) $-\cos(x)\log_e x$

(D) $-\frac{\sin(x)}{x^2} + \frac{\cos(x)}{x}$

24. The eigenvalues of the matrix $A = \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$ are

(A) 0, 2

(B) -1, 1

(C) 2, -2

(D) -2, 0

25. Two lines given by equations $2x + 3y = 1$ and $4x + 3y = 2$ intersect at

(A) $(1/2, 2)$

(B) $(0, 1/3)$

(C) $(1/2, 0)$

(D) $(0, -1/3)$

26. The number of roots of the equation $x^6 - 1 = 0$ is

(A) 6

(B) 1

(C) ± 1

(D) -1

27. Find the derivative of the function $f(x) = e^{x^2}\sin x$.

(A) $e^{x^2}\cos x - 2xe^{x^2}\sin x$

(B) $e^{x^2}\cos x + 2xe^{x^2}\sin x$

(C) $e^{x^2}\sin x - 2xe^{x^2}\cos x$

(D) $e^{x^2}\cos x$

28. Evaluate the integral $\int \frac{\cosh\sqrt{x}}{\sqrt{x}}dx$.

(A) $-2\sinh\sqrt{x} + c$

(B) $\sqrt{x} + c$

(C) 0

(D) $2\sinh\sqrt{x} + c$

29. If the determinant of the matrix $A = \begin{bmatrix} 1 & c \\ 2c & 4 \end{bmatrix}$ is zero, find c.

(A) $-\sqrt{2}$

(B) ± 1.4

(C) 4

(D) 0

30. Solve for x in the equation $\log_2 x = 3$.

(A) 2

(B) 4

(C) 6

(D) 8

3 Work Related

31. In a DC circuit consisting of a DC voltage source of 9V and two resistors in series, one of the resistors is attached to a substrate whose strain needs to be measured. What combination of resistances achieves 5V output across any of the two resistors?

(A) 1 kΩ, 5 kΩ

(B) 23 kΩ, 69 kΩ

(C) 69 kΩ, 23 kΩ

(D) 12 kΩ, 15 kΩ

32. A piezoelectric transducer is usually used along with the

(A) current amplifier

(B) charge amplifier

(C) resistance amplifier

(D) None of the above

33. Which principle do ultrasonic distance transducers use to measure distance?

(A) They emit ultrasonic waves and measure the change in frequency of the echo.

(B) They emit ultrasonic waves and measure the time taken for the echo to return.

(C) They emit ultrasonic waves and measure the speed of the echo.

(D) They emit ultrasonic waves and measure the amplitude of the echo.

34. What is the sensor shown in the following picture?

(A) Force-sensitive resistor (FSR)

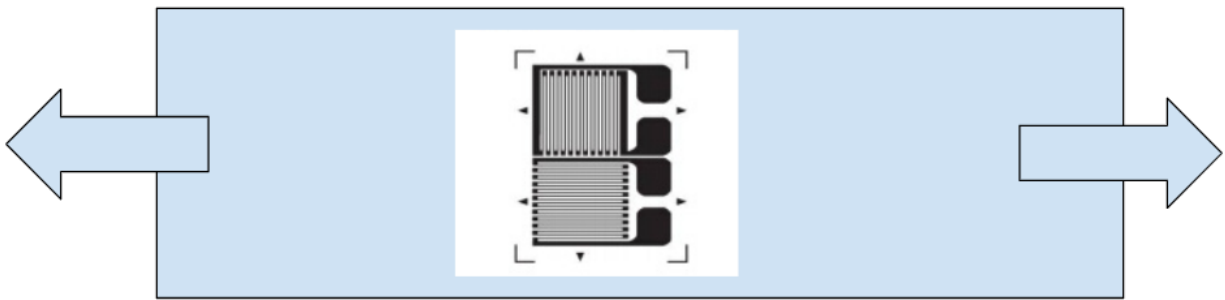(B) Light dependent resistor (LDR)

(C) Strain gauge

(D) Colour sensor

35. When used with appropriate instrumentation, a strain gauge can convert which one of the following:

(A) electrical load to mechanical load

(B) electrical energy to mechanical energy

(C) mechanical energy to thermal energy

(D) mechanical force to electrical signal

36. Which principle is commonly used in thermocouples for temperature measurement?

(A) The change in resistance of a material with temperature.

(B) The generation of an electrical charge in response to thermal stress.

(C) The production of an electrical voltage when two dissimilar metals are joined and subjected to temperature differences.

(D) The change in color of a material at different temperatures.

37. The below arrangement of strain gauges is made on a plate that is subjected to a tensile load. How many channels should a strain meter have so that Poisson's ratio of the plate material can be calculated using the below arrangement?

(A) 1

(B) 2

(C) 3

(D) 4

38. A sphygmomanometer is used by healthcare professionals to measure:

(A) Blood pressure

(B) Blood glucose levels

(C) Oxygen saturation

(D) Body temperature

39. Which device is commonly used in fluid dynamics to measure the velocity of a fluid?

(A) Manometer

(B) Pitot tube

(C) Thermocouple

(D) Barometer

40. What does a hot-wire anemometer measure?

(A) Change in pressure exerted by a moving fluid.

(B) Velocity based on sound waves in the fluid.

(C) Rate of rotation of cups or vanes moved by the fluid.

(D) Change in fluid temperature to infer velocity.

41. In a Doppler radar system used for velocity measurement, what characteristic of the wave is primarily utilized to determine the speed of an object?

(A) The amplitude change of the reflected wave

(B) The change in the polarization of the reflected wave

(C) The alteration in the phase of the reflected wave

(D) The frequency shift of the reflected wave

42. In an engineering drawing, a line that is used to represent an edge that is not directly visible is known as:

(A) a center line

(B) a dimension line

(C) a hidden line

(D) a construction line

43. In engineering drawing, what is the purpose of a "section view"?

(A) To show an object's appearance from the outside.

(B) To display the internal features of an object by cutting through it.

(C) To represent the object's motion and operation.

(D) To indicate the type of material used in the object.

44. At what temperature a thermometer shows the same number for Centigrade and Fahrenheit?

(A) 0 deg C

(B) -32 deg F

(C) 212 deg F

(D) -40 deg C

45. Gauge factor in a strain gauge refers to the ratio of

(A) size of wire used to prepare the strain gauge

(B) fractional change in electrical resistance to fractional change in length

(C) amplification of the electrical signal

(D) fractional change in strain to fractional change in electrical resistance

46. In a balanced Wheatstone bridge, what is the voltage across the bridge?

(A) Equal to the supply voltage

(B) Half of the supply voltage

(C) Zero

(D) Cannot be due to floating voltage

47. An electric furnace operating in a workshop has a rated power capacity of 9000 w. If the furnace is operated for twenty minutes, what is the energy consumed?

(A) 5 kWh

(B) 9 kWh

(C) 3 kWh

(D) 18 kWh

48. Which type of fit is characterized by a gap between the hole and shaft?

(A) Interference fit

(B) Transition fit

(C) Clearance fit

(D) Snug fit

49. What does the R_a parameter represent in surface finish measured by a profilometer?

(A) Average roughness

(B) Maximum roughness height

(C) Surface waviness

(D) Surface hardness

50. Which type of current is typically used in Gas Tungsten Arc Welding?

(A) Direct Current (DC)

(B) Alternating Current (AC)

(C) Either AC or DC

(D) No electricity is used