



ਪੰਜਾਬ ਟੈਕਨੀਕਲ ਯੂਨੀਵਰਸਿਟੀ ਜਲੰਧਰ
PUNJAB TECHNICAL UNIVERSITY JALANDHAR

Max. Marks: 90

Time: 90 Mins.

Entrance Test for Enrollment in Ph.D. Programme

Important Instructions

- Fill all the information in various columns, in capital letters, with blue/black ball point pen.
- Use of calculators is not allowed.
- All questions are compulsory. No negative marking for wrong answers.
- Each question has only one right answer.
- Questions attempted with two or more options/answers will not be evaluated.

Stream (Engg./Arch./Pharm./Mgmt./App. Sci./Life Sci.)

Applied Sciences

Discipline / Branch

Physics

Name

Father's Name

Roll No.

Date

Signature of Candidate

Signature of Invigilator

Q. 1 Which of the following is false?

- (a) A symmetric matrix is one for which the transpose of the matrix is the same as the original matrix.
- (b) Diagonal elements of an antisymmetric matrix are all zeros.
- (c) An anti symmetric matrix is one for which the transpose of the matrix is the negative of the original matrix.
- (d) The inverse of a matrix and inverse of its transpose are the same.

Q. 2 The Laplace transform of the function t^n , ($n = 1, 2, \dots$) is

- (a) $\frac{n!}{s^{n+1}}$
- (b) $\frac{n!}{s^n}$
- (c) $\frac{n!}{s^{n-1}}$
- (d) $\frac{n}{s^{n+1}}$

Q. 3 Which of the following is true?

- (a) Two non zero vectors are orthogonal if and only if their inner product is non zero.
- (b) The vector addition may or may not be commutative.
- (c) The dot product of two vectors will be zero only if both vectors are zero.
- (d) Dot product of vectors is commutative.

Q. 4 The number of different combinations of n different things, k at a time, without repetitions, is

- (a) $\frac{n!}{k!(n-k)!}$
- (b) $\frac{n!}{k!(n+k)!}$
- (c) $\frac{n!}{(n-k)!}$
- (d) $\frac{n!k!}{(n+k)!}$

Q. 5 For a normal random variable X

- (a) about $\frac{2}{3}$ of its values will lie between $\mu-\sigma$ and $\mu+\sigma$
- (b) about half of its values will lie between $\mu-\sigma$ and $\mu+\sigma$
- (c) about 90% of its values will lie between $\mu-\sigma$ and $\mu+\sigma$
- (d) about 95% of its values will lie between $\mu-\sigma$ and $\mu+\sigma$

Q. 6 A function $f(x,y)$ is harmonic if

- (a) $\frac{\partial f}{\partial x} + \frac{\partial f}{\partial y} = 0$
- (b) $\frac{\partial f}{\partial x} - \frac{\partial f}{\partial y} = 0$
- (c) $\frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2} = 0$
- (d) $\frac{\partial^2 f}{\partial x^2} - \frac{\partial^2 f}{\partial y^2} = 0$

Q. 7 If G is a group of even order, then

- (a) $a^2=e$ for all $a \in G$
- (b) $a^2=e$ for at least one $a \in G$
- (c) $a^2=a$ for all $a \in G$
- (d) none of above

Q. 8 The set $G = \begin{bmatrix} a & 0 \\ 0 & b \end{bmatrix}$ such that $a, b \in \mathbb{R}$ under matrix multiplication, forms

- (a) Abelian group
- (b) Non - Abelian group
- (c) Cyclic group
- (d) none of above

Q. 9 A three dimensional length element $dl = dx\hat{i} + dy\hat{j} + dz\hat{k}$ in Cartesian coordinates (x, y, z) may be expressed in spherical polar coordinates (r, θ, ϕ) as

(a) $dl = dr\hat{e}_r + d\theta\hat{e}_\theta + d\phi\hat{e}_\phi$

(b) $dl = dr\hat{e}_r + rd\theta\hat{e}_\theta + rd\phi\hat{e}_\phi$

(c) $dl = dr\hat{e}_r + rd\theta\hat{e}_\theta + r\sin\theta d\phi\hat{e}_\phi$

(d) $dl = dr\hat{e}_r + d\theta\hat{e}_\theta + r\sin\theta d\phi\hat{e}_\phi$

Q. 10 In an extrinsic semiconductor, the conduction process becomes intrinsic, when

(a) Temperature is low

(b) Temperature is high

(c) $T \rightarrow 0K$

(d) The conduction process never becomes intrinsic.

Q. 11 Voltage variable capacitances (VVCs) or Varactors are

(a) Reverse biased diodes

(b) Forward biased diodes

(c) Piezoelectric crystals

(d) Vacuum triodes

Q. 12 In a transistor amplifier, the d.c load line locates

(a) values for collector current i_C and collector-emitter voltage V_{CE} for series circuit comprised of transistor and load R_L , at constant V_{CC}

(b) values for emitter current i_E and emitter-base voltage V_{BE} for series circuit comprised of transistor and load R_L , at constant V_{CC}

(c) values for base current i_B and emitter-base voltage V_{BE} for series circuit comprised of transistor and load R_L , at constant V_{CE}

(d) values for base current i_B and collector current i_C for series circuit comprised of transistor and load R_L , at constant V_{CE}

Q. 13 An FET (Field Effect Transistor) differs from BJT (Bipolar Junction Transistor) primarily because of

(a) it is very low input resistance in comparison to BJT

(b) it is low gain in comparison to BJT

(c) it is very high input resistance in comparison to BJT

(d) none of above

Q. 14 The amplifier band width is defined as difference between two frequencies at which the power is

(a) $1/4$ of midfrequency power

(b) 33% of midfrequency power

(c) Half of midfrequency power

(d) 67% of midfrequency power

Q. 15 The Barkhausen criterion for an amplifier to behave as an oscillator is

(a) $|a\beta| = 1$

(b) $|a\beta| > 1$

(c) Phase shift around the loop must be $(n + 1/2)\pi$

(d) both (a) and (c)

Q. 16 Which of the following is a true cell?

- (a) photoemissive cell
- (b) photoconductive cell
- (c) photovoltaic cell
- (d) both (b) and (c)

Q. 17 For getting an output from XNOR gate, both inputs must be

- (a) high
- (b) low
- (c) at the same logic level
- (d) at the opposite logic level

Q. 18 Only one IC is active at a time to avoid a bus conflict caused by two ICs writing different data to the same bus, is ensured by

- (a) control bus
- (b) control instructions
- (c) address decoder
- (d) CPU

Q. 19 The register in the 8085A that is used to keep track of the memory address of the next op-code to be run in the program is the

- (a) stack pointer
- (b) program counter
- (c) instruction pointer
- (d) accumulator

Q. 20 Constraints that can be expressed as equations of coordinates and time, i.e., by an expression of the form $f(r_1, r_2, r_3, \dots, t) = 0$, are said to be

- (a) holonomic
- (b) non holonomic
- (c) scleronomous
- (d) non scleronomous

Q. 21 Scleronomous constraints have:

- (a) explicit time dependence
- (b) no explicit time dependence
- (c) no time dependence at all
- (d) may or may not have a time dependence

Q. 22 Hamilton's principle is an example of a

- (a) consevation law
- (b) continuity equation
- (c) variational principle
- (d) both (b) and (c)

Q. 23 If the Lagrangian is cyclic in q_j then,

- (a) p_j is not conserved
- (b) p_j is ~~not~~ conserved
- (c) q_j appears in the Lagrangian
- (d) the Lagrangian is circular

Q. 24 Canonical transformations can often be conveniently found or verified by using

- (a) rotational matrix
- (b) generating function
- (c) degeneration function
- (d) separation tensor