



# 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.

1. Eigen vectors of a real symmetric matrix corresponding to different eigen values are
  - (a) Singular
  - (b) Orthogonal
  - (c) Non-singular
  - (d) None of these
2. If  $A^T = A^{-1}$ , where A is a real matrix, then A is
  - (a) Normal
  - (b) Symmetric
  - (c) Hermitian
  - (d) Orthogonal
3.  $X^{1/x}$  is a decreasing function if
  - (a)  $X < e$
  - (b)  $X > e$
  - (c)  $X = e$
  - (d)  $X > 1/e$
4. Which of the following is false?
  - (a)  $f(a)$  is an extreme value of  $f(x)$  if  $f'(a) = 0$
  - (b) if  $f(a)$  is an extreme value of  $f(x)$ , then  $f'(a) = 0$
  - (c) if  $f'(a) = 0$ , then  $f(a)$  is an extreme value of  $f(x)$
  - (d) None of these
5. The minimum value of  $|x^2 - 5x + 21|$  is
  - (a) -5
  - (b) 0
  - (c) -1
  - (d) -2
6. What is the derivative of  $f(x) = |x|$  at  $x = 0$ ?
  - (a) 0
  - (b) 1
  - (c) -1
  - (d) Does not exist
7. The differential equation  $y'' + (s^3 \sin x)^5 y' + y = \cos x^3$  is
  - (a) Homogenous
  - (b) Nonlinear
  - (c) 2<sup>nd</sup> order linear
  - (d) Non-homogeneous with constant coefficients
8. The value of  $\int dl$  along a circle of radius 2 units is
  - (a) Zero
  - (b)  $2\pi$
  - (c)  $4\pi$
  - (d)  $8\pi$
9. The equation  $x(1 + y^2) dx + \tan^{-1} y dy = 0$  is satisfied by
  - (a)  $y = \tan^{-1} \sqrt{c - x^2}$
  - (b)  $(\tan^{-1} y)^2 + 2x^2 = c$
  - (c)  $\tan^{-1} y = x^2 + c$
  - (d)  $\tan^{-1} y - 2x^2 = c$

10. If median = (mode + 2 mean) $\mu$ , then  $\mu$  is equal to
- $\sqrt{\frac{2}{3}}$
  - $\sqrt{\frac{3}{2}}$
  - $\sqrt{\frac{1}{6}}$
  - None of these
11. If two variables X and Y are connected by the relation  $ax + by + c = 0$  where  $ab < 0$ , then  $\rho(X, Y)$  is equal to
- 1
  - 1
  - a/b
  - b/a
12. Two girls have picked 10 roses, 15 sunflowers and 14 daffodils. What is the number of ways they can divide the flowers amongst themselves?
- 1638
  - 2100
  - 2640
  - 6240
13. A fair coin is tossed three times in succession. If the first toss produces a head, then the probability of getting exactly two heads in three tosses is
- 1/2
  - 1/8
  - 3/8
  - $\frac{3}{4}$
14. The value of  $\int_1^2 \left(\frac{1}{x}\right) dx$  computed using Simpson's rule with a step size of  $h = 0.25$  is
- 0.69325
  - 0.69385
  - 0.69415
  - 0.69430
15. For a Gaussian distribution, the probability error is r. This means that
- Area under the curve between  $\pm r$  limits is 0.5
  - Half of observed values lies between  $\pm r$  limits
  - Chances that an additional observation will lies between  $\pm r$  limits are 50%
  - All of the above
16. Errors which may be variable both in magnitude and nature (+ve or -ve) are classified as
- Hysteresis error
  - Random error
  - Systematic error
  - Interaction error
17. What represents the departure of the observed readings from the arithmetic mean of the group of reading
- Dispersion
  - Deviation
  - Variance
  - Median
18. For  $|z| = 1$ ,  $\int_C \frac{z-3}{z^2+2z+5} dz$ , where C is the circle
- 0
  - 1
  - 2
  - None of these
19. In CRO, if the voltage applied to Y plates is V, the vertical deflection of the beam is proportional to:
- $V^2$
  - $\sqrt{V}$
  - $V^{1.5}$
  - V
20. In a permanent magnet moving coil ammeter the deflection of the pointer is proportional to product of flux density of magnetic field produced by the permanent magnet and the current in the moving coil. If the strength of the permanent magnet becomes 95% of the original, the meter gives erroneous reading resulting into error. This error can be classified as
- Gross error
  - Random error
  - Systematic error
  - Human error
21. BJT is said to be operating in the saturation region if
- Base-emitter junction is reverse biased and base-collector junction is forward biased
  - Base-emitter junction is reverse biased and base-collector junction is reverse-biased
  - Both junctions are reverse biased
  - Both junctions are forward biased
22. Silicon diode is less suitable for low voltage rectifier operation because its
- Cut-in voltage is high
  - Reverse saturation current is low
  - Break down voltage is high
  - Can withstand high temperature

23. Permanent magnet used in instruments are hard core materials because
- They have broad hysteresis loop
  - Their energy density is high
  - They have a high  $(BH)_{\max}$  product
  - All of the above
24. An aquadag is used in a CRO to collect
- Primary electrons
  - Secondary emission electrons
  - Both primary and secondary emission electrons
  - None of the above
25. In measurement systems, which of the following static characteristics are desirable
- Accuracy
  - Reproducibility
  - Sensitivity
  - All of the above
26. A Reading Is Recorded As  $23.90^{\circ}\text{C}$ . The Reading Has \_\_\_\_\_ Significant Figures.
- Two
  - Three
  - Four
  - Five
27. Input resistance of a CRO is of the order of
- Tens of ohm
  - Megohm
  - $\text{K}\Omega$
  - Fraction of an ohm
28. Fourier transform of a Gaussian time pulse is
- Gaussian
  - Rayleigh
  - Uniform
  - A pair of impulse
29. Which of the following represent a stable system?
- Impulse response of the system decreases exponentially
  - Area within the impulse response is finite
  - Eigen value of the system are positive and real
  - Roots of the characteristic equation of the system are real and negative
30. In a parallel RC circuit, the equivalent admittance of the circuit is
- $R^{-1} + j\omega C$
  - $R^{-1} - j\omega C$
  - $R + (1/j\omega C)$
  - $R + j\omega C$
31. The power consumed in a pure inductor circuit is
- Zero
  - $V_{\max} I_{\max} / 2$
  - $VI$
  - $I^2 L$
32. Heat loss in any electrical device like generator, motor etc. are dependent on
- Voltage
  - Current
  - Power factor
  - All of these
33. In impedance transfer function for LC network, when the degree of numerator polynomial is one greater than degree of denominator polynomial then
- LC ladder network has inductor in series and capacitor in parallel.
  - LC ladder network has capacitor in series and inductor in parallel.
  - Ladder network is converted to T network
  - Ladder network will have inductor and capacitor in series
34. In a parallel RLC circuit, under the conditions of resonance, which of the following are applicable?
- Conductance is maximum
  - Current is maximum
  - Current is in phase with voltage
  - All of these
35. A circuit component that opposes the change in circuit voltage is
- Resistance
  - Capacitance
  - Inductance
  - Permeability
36. The dual of a loop is
- Mesh
  - Node pair
  - Twig
  - Link

- 37 For one port network,  $Z_{in} = (s^2 + 3s + 2)/(s^4 + 3s^2 + 4s + 3)$  is
- Not possible
  - Possible
  - Possible under certain conditions
  - None of these
- 38 Thevenin's and Norton's networks are equivalent at
- No frequency
  - All frequencies
  - Resonant frequencies
  - Only one frequency at which these are computed
- 39 A  $20\mu\text{A}$ ,  $200\text{mV}$  meter movement is used to make a  $25\text{V}$  voltmeter. What is the sensitivity of meter?
- $100\text{kohm/volt}$
  - $75\text{kohm/volt}$
  - $50\text{kohm/volt}$
  - $25\text{kohm/volt}$
- 40 Using an AC voltmeter, the potential difference in the electrical line in a house is read to be  $234\text{ volt}$ . If the line frequency is  $50\text{Hz}$ , the instantaneous voltage is given by
- $V = 165 \sin(100t)$
  - $V = 331 \sin(314t)$
  - $V = 234 \sin(314t)$
  - $V = 468 \sin(314t)$
- 41 The instruction 'XCHG' of 8085 microprocessor instruction set performs the following operation
- Exchange the contents of HL and DE register pairs
  - Exchange the contents of register C and register B
  - Exchange the contents of HL and accumulator
  - Exchange the contents of program counter and stack pointer
- 42 Megger is provided with terminals as
- Line, neutral and ground
  - Line, earth and ground
  - Line, neutral, earth
  - Three line and ground
- 43 An integrated circuit USART stands for
- Universal Synchronous asynchronous Receiver Transmitter
  - Unique serial adder transfer
  - Universal serial auxiliary Receiver Transmitter
  - Universal Synchronous auxiliary Receiver Transmitter
- 44 The low power factor of an induction motor at low load results from
- High speed
  - Low magnetizing component of no load current
  - High magnetizing component of no load current
  - High working component of no load current
- 45 Synchronous induction motor are used mostly for driving
- Lathe machine
  - Cranes
  - Rotary compressor
  - None of these
- 46 In a large synchronous generator, dampers are provided to
- Increase stability
  - Eliminate harmonic effects
  - Reduce voltage fluctuation
  - Reduce frequency fluctuation
- 47 In a Q meter, the value of shunt resistance connected across the oscillator is typically of the order of
- $\Omega$
  - $\text{m}\Omega$
  - $\mu\Omega$
  - $\text{k}\Omega$
- 48 Buffer is an logic circuit that
- Convert analog signal to digital
  - Isolates two electric circuits
  - Amplifies current or power
  - Acts as input port
- 49 The programmable interrupt controller designed to operate with 8085/86 is
- 8259
  - 8155
  - 8253
  - 8051
- 50 The programmable registers in 8085 are
- A,B,C,D,E,H,L
  - B,C,D,E,H,L
  - Program counter and stack pointer only
  - A,B,C,D,E,H,L program counter and stack pointer

- 51 Which instruction is used to clear program counter?
- NOP
  - HLT
  - Reset
  - Wait
- 52 The contents of register A and register B are 55H and 66H respectively. After the execution of instructions CMP B and SUB B separately, the contents of register A will be
- 55 and EF
  - 66 and 11
  - EF and 11
  - EF and EF
- 53 How many parallel ports are in programmable peripheral chip 8255?
- Three
  - Four
  - Two
  - 256
- 54 The difference between ADD H and DAD H instructions with reference to 8085 is
- ADD H adds 8 bit data whereas DAD H adds 16 bit data
  - No difference and interchangeable as and when required
  - Carry flag is affected by ADD H whereas it remains unaffected by DAD H
  - ADD H adds binary data and DAD H adds decimal data
- 55 The non-weighted and cyclic code is
- ASCII
  - EBCDIC
  - Gray
  - Hamming
- 56 The Boolean function  $A+A'B+AB$  is equivalent to
- $A+B$
  - $AB$
  - $A'B$
  - $A'+B$
- 57 The following feature is not common in the instructions: POP PSW and SPHL
- Both are one byte instructions
  - Both affect status flag contents
  - Both instructions involve stack pointer
  - Both are data transfer instructions
- 58 The basic building block of asynchronous/synchronous counter is
- SR flip flop
  - D flip flop
  - T flip flop
  - Any flip flop
- 59 The number of squares in k map reduction technique is determined as
- $2^n$  number of squares for n variable logic function
  - Number of min terms
  - Number of max terms
  - Any of the above
- 60 If the field of a synchronous motor is under-excited then the power factor will be
- Unity
  - Lagging
  - Leading
  - More than unity
- 61 When a synchronous motor is running at synchronous speed, the damper winding produces
- No torque
  - Damping torque
  - Eddy current torque
  - Torque aiding the developed torque
- 62 Which of the following semiconductor device has maximum breakdown voltage rating?
- Thyristor
  - Insulated Gate Bipolar Transistor
  - Gate Turn Off Thyristor
  - Power MOSFET
- 63 During turn-on process of a thyristor, which sub interval of on-time period contributes maximum power losses in the circuit?
- Delay time
  - Spread time
  - Rise time
  - Recovery time
- 64 What is circuit turn off time for a two pulse bridge rectifier supplied with 200V, 50Hz and feeding purely inductive load with inductance of 300mH at firing angle of  $90^\circ$ ?
- 25 msec
  - 20 msec
  - 10 msec
  - 5 msec

- 65 Which of the following functions are performed by transformer connected at the input of AC-DC and AC-AC converters?
- It provides isolation
  - It provides voltage variation
  - It provides di/dt protection to device.
  - It supports the continuous current flow in the circuit.
- (a) i, ii  
 (b) i, ii, iii  
 (c) i, iii, iv  
 (d) i, ii, iii, iv

- 66 A three-phase to three-phase cyclo-converter requires \_\_\_\_\_ SCR's for three-pulse devices and \_\_\_\_\_ SCR's for 6-pulse device.
- (a) 18,36  
 (b) 9,18  
 (c) 6,12  
 (d) 3,6

- 67 Match the most appropriate converter from group B for the application in group A

| Group A                        | Group B                        |
|--------------------------------|--------------------------------|
| (u) Switched mode Power supply | (P) Phase Controlled Rectifier |
| (w) Induction heating          | (Q) AC Voltage Controller      |
| (x) Welding Circuit            | (R) Chopper                    |
| (y) Fluorescent Lighting       | (S) Inverter                   |

- (a) U-P, W-R, X-Q, Y-S  
 (b) U-R, W-S, X-P, Y-Q  
 (c) U-Q, W-S, X-P, Y-R  
 (d) U-S, W-Q, X-R, Y-P
- 68 Which of the following represent the correct loss coefficients for a two bus power system:
- (a)  $B_{11} = 0.02, B_{22} = 0.05, B_{12} = 0.01, B_{21} = 0.01$   
 (b)  $B_{11} = 0.03, B_{22} = 0.005, B_{12} = -0.01, B_{21} = 0.01$   
 (c)  $B_{11} = 0.03, B_{22} = 0.005, B_{12} = -0.001, B_{21} = -0.001$   
 (d)  $B_{11} = 0.02, B_{22} = 1.04, B_{12} = 0.01, B_{21} = 0.001$
- 69 For a two bus system, if the change in load at bus 2 is 5MW and the corresponding change in generation at bus 1 is 8MW, what is the penalty factor of bus 1?
- (a) 0.375  
 (b) 0.625  
 (c) 1.6  
 (d) 2.667
- 70 For a given power system network comprising three nodes, one reference node and six link elements in the network, the dimensions of Bus admittance matrix and primitive admittance matrix will be \_\_\_\_\_ and \_\_\_\_\_ respectively.
- (a) 3x3, 6x6  
 (b) 4x4, 6x6  
 (c) 6x6, 3x3  
 (d) 6x6, 10x10
- 71 Which of the following equipment has the lowest time constant?
- (a) Static Compensator  
 (b) Synchronous machine  
 (c) Transformer  
 (d) Transmission link
- 72 Which of the following statement is *false*?
- (a) Bus admittance matrix of a network represents the connectivity of network.  
 (b) A series fault is simply an unbalance of line impedance and does not involve ground.  
 (c) The presence of solidly grounded neutral of generator on the grounded star side of transformer makes three phase fault more severe than single line to ground fault.  
 (d) Contingency analysis determines the exact solution for bus voltages and line flows in case of switch-in/out operation.
- 73 The sag of a transmission line with 50m span is 1.0 m. What will be the sag if the height of transmission line is increased by 20%?
- (a) 1.0m  
 (b) 1.2 m  
 (c) 1.4m  
 (d) 1.44m
- 74 A suspension string has 3 units. Each unit can withstand maximum voltage of 11kV. The capacitance of each unit to metal work is 20% of the unit capacitance. What is the expected string efficiency?
- (a) 60.97%  
 (b) 63.8%  
 (c) 66%  
 (d) 78%

- 75 The series impedance of a single conductor of a three phase transmission line operating at 110kV is  $(15+j35)$  ohms and total shunt admittance between phase to neutral is  $300 \times 10^{-5}$  mho. Determine line constants A and B using nominal  $-\pi$  network.
- $(15+j35), j0.003$
  - $(0.9475+j0.0225), j0.003$
  - $(0.9475+j0.0225), (15+j35)$
  - $(15+j35), (0.9475+j0.0225)$
- 76 Which harmonics are the most troublesome on AC side of 12 pulse AC to DC converter?
- 3<sup>rd</sup> and 5<sup>th</sup>
  - 7<sup>th</sup> and 11<sup>th</sup>
  - 11<sup>th</sup> and 13<sup>th</sup>
  - 24<sup>th</sup> and 25<sup>th</sup>
- 77 A single phase 4 pole, 50Hz induction motor with only main winding when excited from single phase 50 Hz ac source, what will be the nature of magnetic field produced in the air gap?
- Rotating in air gap at speed 1500rpm
  - Stationary in space but pulsating at frequency 50 Hz
  - Stationary in air gap but constant
  - Constant but rotating at 1500rpm in air gap
- 78 Match the items in group A with items in group B based on the type of relay used for providing generator protection.
- |  |   |
|--|---|
| <p>Group A</p> <ol style="list-style-type: none"> <li>Differential Relay</li> <li>Reverse Power Relay</li> <li>Earth Fault Relay</li> <li>Negative Sequence Relay</li> </ol> | <p>Group B</p> <ol style="list-style-type: none"> <li>Failure of Prime-mover</li> <li>Unbalanced loading</li> <li>Phase fault protection</li> <li>Inter turn fault</li> </ol> |
|--|---|
- 1-P, 2-Q, 3-R, 4-S
  - 1-R, 2-P, 3-S, 4-Q
  - 1-S, 2-R, 3-P, 4-Q
  - 1-S, 2-R, 3-Q, 4-P
- 79 A three phase, 10 pole, 50 Hz synchronous machine has a star connected double layer winding with a coil span of  $150^\circ$  electrical. The number of slots per pole per phase is 2 and conductors per slot for winding are 6. What is the pitch factor of winding?
- 0.5
  - 0.85
  - 0.966
  - 1.0
- 80 What is the range of the speed of rotor of three phase, 4 pole, 400V, 50 Hz induction motor at no load?
- Between 1490 to 1510 rpm
  - Below 1450 rpm
  - Nearly 1510 rpm
  - Between 1480 to 1490 rpm
- 81 The open circuit and short circuit test on a 4kVA, 200/400V, 50 Hz single phase transformer gave the following results:
- Open circuit test on LV side: 200V, 1A, 100W  
Short circuit test on HV side: 15V, 10A, 85 W
- What are the ohmic losses, when transformer is operating at rated load and 0.8 pf lagging?
- 50W
  - 85W
  - 100W
  - 120W
- 82 The power input to the rotor of a 415V, 50 Hz, 6 pole, three phase induction motor is 75kW. The rotor electromotive force is observed to make 120 complete cycles per minute. What is the rotor loss?
- 1.0 kW
  - 2.5kW
  - 3.0kW
  - 7.2kW
- 83 Match the motors from group A with suitable test performed on motor from group B
- |  |  |
|--|--|
| <p><b>Group A</b></p> <ol style="list-style-type: none"> <li>Three phase Squirrel cage induction motor</li> <li>DC Shunt motor</li> <li>Salient pole Synchronous generator</li> <li>Three phase Slip Ring induction motor DC series motor</li> </ol> | <p><b>Group B</b></p> <ol style="list-style-type: none"> <li>Blocked Rotor Test</li> <li>Slip Test</li> <li>Rotor emf Injection</li> <li>Swinburne's test</li> </ol> |
|--|--|
- 1-Q, 2-P, 3-R, 4-S
  - 1-P, 2-S 3-Q, 4-R
  - 1-R, 2-S, 3-P, 4-Q
  - 1-S, 2-R, 3-P, 4-Q
- 84 Which of the harmonic component results in the flow of zero sequence current under unbalanced conditions?
- Fundamental component
  - Fundamental and third harmonic component
  - Third harmonic component
  - Fundamental, even and odd harmonic component

- 85 Increasing the natural damped frequency will \_\_\_\_\_ the rise time and - \_\_\_\_\_ delay time?
- (a) Increase, increase
  - (b) Increase, decrease
  - (c) Decrease, increase
  - (d) Decrease, decrease
- 86 When derivative controller is used in closed loop control system, the damping ratio will \_\_\_\_\_.
- (a) Increase
  - (b) Decreases
  - (c) Remains unchanged
  - (d) Depends upon type of input signal
- 87 Signal flow graph method is applied to
- (a) Linear but directed network
  - (b) Nonlinear system
  - (c) Closed loop system
  - (d) All the above
- 88 A parallel resonant circuit magnifies
- (a) Voltage
  - (b) Current
  - (c) Power
  - (d) Both voltage and current
- 89 For measurement of high direct voltage of the order of 10kV, which instrument will you select?
- (a) Permanent magnet moving coil
  - (b) Electrostatic
  - (c) Hot wire
  - (d) Moving iron
- 90 The impulse response of a filter, matched to a rectangular pulse is
- (a) An equalizer
  - (b) An attenuator
  - (c) A low pass filter
  - (d) A high pass filter