

Reg No.: \_\_\_\_\_

Name: \_\_\_\_\_

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**  
SIXTH SEMESTER B.TECH DEGREE COMPREHENSIVE EXAMINATION, MAY 2019

**Course Code: EC352**

**Course name: COMPREHENSIVE EXAM (EC)**

Max. Marks: 50

Duration: 1Hour

- Instructions:** (1) Each question carries one mark. No negative marks for wrong answers  
 (2) Total number of questions: 50  
 (3) All questions are to be answered. Each question will be followed by 4 possible answers of which only ONE is correct.  
 (4) If more than one option is chosen, it will not be considered for valuation.  
 (5) Calculators are not permitted

**PART A- COMMON COURSES**

1. The infinite series  $\sum_{n=1}^{\infty} \frac{1}{n^p}$ 
  - a) Converges if  $p < 1$
  - b) Converges if  $p > 1$
  - c) Converges if  $p = 1$
  - d) Diverges if  $p > 1$
2. The Wronskian of  $\cos x$  and  $\sin x$  is
  - a) 0
  - b)  $\cos^2 x - \sin^2 x$
  - c)  $2 \cos x \sin x$
  - d) 1
3. The equivalent stiffness of two springs of stiffness  $s_1$  and  $s_2$  joined in series is
  - a)  $s_1 s_2 / (s_1 + s_2)$
  - b)  $(s_1 / s_2) / (s_1 + s_2)$
  - c)  $s_1 + s_2$
  - d)  $s_1 s_2$
4. A bullet of mass 0.03kg moving with a speed of 400m/s penetrates 12cm into a fixed block of wood. The average force exerted by the wood on the bullet will be
  - a) 10kN
  - b) 20kN
  - c) 0kN
  - d) 15kN
5. Which among the following is not a Functional constraint?
  - a) Overall Geometry
  - b) Forces Involved
  - c) Quality control
  - d) Materials to be used
6. A structured planning method used to evaluate weakness, strength ,opportunities and threats of design:
  - a) SWOT analysis
  - b) Design analysis
  - c) WOST analysis
  - d) Matrix design
7. Eutrophication of water bodies is caused by the presence of
  - a) excessive dissolved oxygen
  - b) Excessive dissolved  $CO_2$
  - c) phosphorous and nitrogen nutrients
  - d) Algae
8. A major advantage of Pyrolysis in converting biomass to energy is
  - a) its heating to  $1000^0 F$
  - b) that Carbon Dioxide is not produced
  - c) the Oxygen generated as the by-product
  - d) the absorption  $CO_2$  during the process

9. When the projectors are parallel to each other and also perpendicular to the plane, the projection is called
- a) Perspective projection      b) Oblique projection      c) Isometric projection      d) Orthographic projection
10. In AutoCAD, to obtain parallel lines, concentric circles and parallel curves; \_\_\_\_\_ is used
- a) Array      b) Fillet      c) Copy      d) Offset

### PART B- CORE COURSES

11. A source of angular frequency of 1 rad/s has a source impedance consisting of a  $1\Omega$  resistance in series with a 1H inductance. The load that will obtain maximum power is
- a)  $1\Omega$  resistance      b)  $1\Omega$  resistance in parallel with 1H inductance      c)  $1\Omega$  resistance in parallel with 1F capacitance      d)  $1\Omega$  resistance in series with 1F capacitance
12. Laplace transform of the delayed unit impulse function  $\delta(t-1)$  is:
- a) 1      b) 0      c)  $e^{-s}$       d) infinity
13. An RC circuit has capacitance  $C=2\mu\text{F}$  in series with a resistance  $R = 1\text{M}\Omega$ . The time constant of the circuit (in seconds) is:
- a) 3      b) 0.5      c)  $1/3$       d) 2
14. As the poles of a network shift away from the x-axis, the response
- a) Remains constant      b) Becomes less oscillating      c) Becomes more oscillating      d) None of these
15. If a two port network has transmission parameters A,B,C & D, the impedance measured at input port with output open circuited is
- a)  $A/C$       b)  $B/D$       c)  $AD/BC$       d)  $AB/CD$
16. A series RLC circuit has a resonance frequency of 1kHz and a quality factor Q of 200. If each of R, L, and C is doubled from its original value, the new Q of the circuit is
- a) 25      b) 50      c) 100      d) 200
17. Find the value of x if the mutual inductance is 20H, the inductance of coil 1 is x H and the inductance of coil 2 is 8H. The coupling coefficient is 5.
- a) 2H      b) 4H      c) 6H      d) 8H
18. The odd part of  $x(t)=1+\sin^2(t)$  is
- a) 1      b)  $\sin^2(t)$       c)  $1+\sin^2(t)$       d) 0
19. A stable LTI system will have its impulse response,
- a) stable      b) causal      c) Finite for all times      d) Absolutely summable
20. A continuous time non-periodic signal is characterised with a
- a) Fourier series      b) Fourier transform      c) Z-transform      d) Discrete time fourier series
21. For an RC low pass filter the frequency response,  $H(s)$ , where  $s=j\omega$ , is
- a)  $1/(sCR+1)$       b)  $s/(sCR+1)$       c)  $R/(sCR+1)$       d)  $C/(sCR+1)$
22. If Z-transform of  $x(n)$  is  $X(z)$ , then Z-transform of  $a^n x(n)$  is
- a)  $a^z X(z)$       b)  $aX(z/a)$       c)  $X(z/a)$       d)  $a X(z)$
23. A stable and causal discrete system will have all its poles of its transfer function
- a) On the unit circle      b) Inside the unit circle      c) Outside the unit      d) Location of poles

- circle does not matter
24. The derivative of  $\delta(t)$ ,  $(d\delta(t)/dt)$  is  
 a) undefined                      b) 0                      c) 1                      d)  $u(t)$
25. The emitter bypass capacitor (capacitor across  $R_E$ ) is used in RC coupled amplifier to  
 a) Increase the O/P impedance of the transistor                      b) Avoid voltage gain drop                      c) Forward bias the transistor                      d) Reduce RC noise in amplifier
26. Multi stage amplifiers are also called  
 a) Cascode amplifiers                      b) Darlington pair                      c) Cascade amplifiers                      d) None of the above
27. If the feedback factor of an amplifier is 0.01, the gain with negative feedback is approximately  
 a) 100                      (b) 1                      c) 1000                      (d) 500
28. Which of the following improvements is (are) a result of the negative feedback in a circuit?  
 a) Lower output impedance                      (b) Reduced noise                      c) More linear operation                      (d) All of the above
29. Class D amplifiers differ from all other classes of amplifiers because  
 a) the output transistors are operated as switches                      (b) of their very low input capacitance                      c) of their high-frequency response capabilities                      (d) they employ dual MOSFETs.
30. The output impedance of a voltage regulator is  
 a) Very high                      (b) Equal to load voltage divided by load current                      c) Very Small                      (d) Equal to input voltage divided by output current
31. At channel pinch-off of MOSFET  
 a) The width of the induced channel become non linear                      (b) The width of the induced channel become very large                      c) Width is  $1/e$  times maximum possible width                      (d) Width of induced channel is zero and current saturates
32. A vector can be completely prescribed within a region by its  
 a) Curl & Gradient                      (b) Divergence & Curl                      c) Gradient, Divergence & Curl                      (d) Laplacian
33. In metals which of the following equation will hold good?  
 a)  $\text{Curl}(H) = J$                       (b)  $\text{Curl}(J) = dD/dt$                       c)  $\text{Curl}(H) = D$                       (d)  $\text{Curl}(J) = dB/dt$
34. The Brewster angle is expressed as  
 a)  $\tan^{-1}(n)$                       (b)  $\tan^{-1}(n_1/n_2)$                       c)  $\tan^{-1}(n_2/n_1)$                       (d)  $\tan(n)$
35. Which of the statements are true for Coaxial line  
 a) It supports TEM waves                      (b) Also supports other higher modes like TE, TM                      c) Power flow is confined in the region between the conductors                      (d) All of the above
36. The characteristic impedance of a line having open and short impedances of 20 and 5 respectively is  
 a) 100                      (b) 10                      c) 20                      d) 5
37. The dominant mode in waveguide is the mode which has  
 a) Highest frequency                      (b) Highest attenuation                      c) Lowest phase constant                      (d) Highest wavelength

38. Which is the incorrect expression  
a) Grad Div (b) Div Curl (c) Grad Curl (d) Curl Grad
39. The range of signed decimal numbers that can be represented by 6-bits 1's complement number is  
a) -31 to +31 (b) -63 to +63 (c) -64 to +63 (d) -32 to +32
40. A digital system is required to amplify a binary-encoded audio signal. The user should be able to control the gain of the amplifier from minimum to a maximum in 100 increment. The minimum number of bits required to encode, in straight binary, is  
a) 8 (b) 6 (c) 5 (d) 7
41. Choose the correct one from among the alternatives a, b, c, d after matching an item from Group 1 to the most appropriate item in Group 2.  
Group 1: Group 2:  
P. Shift register 1. Frequency division  
Q. Counter 2. Addressing in memory chips  
R. Decoder 3. Serial to parallel data conversion  
a) P-3, Q-2, R-1 (b) P-3, Q-1, R-2 (c) P-2, Q-1, R-3 (d) P-1, Q-2, R-2
42. A 4 bit ripple counter and synchronous counter are made using flip flops having a propagation delay of 10 ns each. If the worst case delay in the ripple counter and the synchronous counter be  $R$  and  $S$  respectively, then  
a)  $R = 10$  ns, (b)  $R = 40$  ns, (c)  $R = 10$  ns (d)  $R = 30$  ns,  
 $S = 40$  ns (e)  $S = 10$  ns (f)  $S = 30$  ns (g)  $S = 10$  ns
43. What is the modulus of 3-bit Ring counter?  
a) 3 (b) 8 (c) 6 (d) None of the above
44. Two states are said to be equal if they have exactly same  
a) inputs (b) Next state (c) Output (d) Both a and b
45. Which of the following is a low frequency noise?  
a) Thermal noise (b) Flicker noise (c) Shot noise (d) Partition noise
46. For AM, with 100% modulation, power in each sideband is \_\_\_\_\_ of that of carrier?  
a) 50% (b) 70% (c) 25% (d) 60%
47. Which of the following analog modulation scheme requires minimum transmitted power and minimum channel bandwidth?  
a) DSB-FC (b) VSB (c) DSB-SC (d) SSB
48. Super heterodyne principle provides selectivity at  
a) RF stage (b) IF stage (c) Demodulating stage (d) Audio stage
49. Armstrong method is used for the generation of  
a) Direct FM (b) Indirect FM (c) SSB-SC (d) DSB-SC
50. PSTN stands for  
a) Public Switched Telephone Network (b) Private Switched Telephone Network (c) Primary Service Telephone Network (d) Primary Service Telephone Numbers

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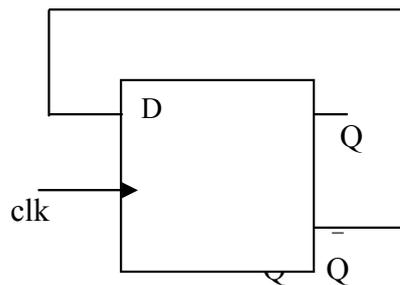
Duration: 1 hour

**Instructions:**

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- Maxwell's divergence equation for the magnetic field is given by
  - $\nabla \times B = 0$
  - $\nabla \cdot B = 0$
  - $\nabla \times B = \rho$
  - $\nabla \cdot B = \rho$
- Which of the following statements is correct with regard to the directions of  $E$  and  $H$  in TEM mode of propagation
  - Both  $E$  and  $H$  are entirely transverse to the direction of propagation.
  - $E$  is entirely transverse to  $H$  and  $H$  has component in the direction of propagation.
  - $E$  has a component in the direction of propagation.
  - Both  $E$  and  $H$  has a component in the direction of propagation.
- If VSWR is 3, then magnitude of reflection coefficient will be
  - 1/4
  - 1/3
  - 1/2
  - 1
- An air filter rectangular waveguide has dimensions 6 x 4 cm, the cutoff frequency for  $TE_{10}$  is
  - 2.5 GHz
  - 25 GHz
  - 25 MHz
  - 5 GHz
- Phase velocity  $V_p$  and group velocity  $V_g$  in a waveguide ( $C$  is velocity of light) are related as
  - $V_g V_p = C^2$
  - $V_g V_p = C$
  - $V_g / V_p = C$
  - $V_g V_p = \sqrt{C}$
- The dominant mode in TE wave
  - $TE_{11}$
  - $TE_{01}$
  - $TE_{10}$
  - $TE_{12}$

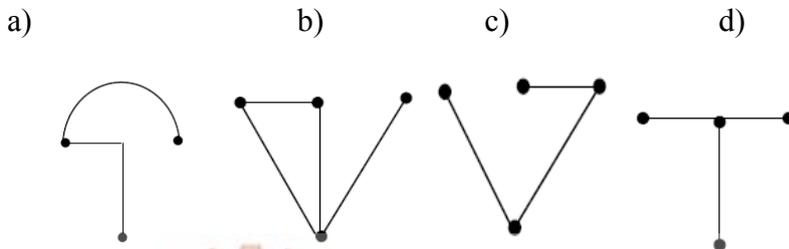
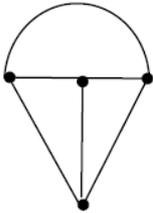
7. The depth of penetration of a wave in a lossy dielectric increases with increasing  
 a) Conductivity      b) Wavelength      c) Permeability      d) Permittivity
8. For a dominant mode in a rectangular waveguide with breadth 10 cm, guide wavelength for a signal of 2.5 GHz will be  
 a) 12 cm      b) 15 cm      c) 18 cm      d) 20 cm
9. The logic expression  $Y = A + \bar{A}B$  is equivalent to  
 a)  $Y = AB$       b)  $AB$       c)  $A + B$       d)  $A + B$
10. Minterms corresponding to decimal number 15 is  
 a)  $ABCD$       b)  $\bar{A}\bar{B}\bar{C}\bar{D}$       c)  $A+B+C+D$       d)  $\bar{A} + \bar{B} + \bar{C} + \bar{D}$
11. A carry look ahead adder is frequently used for addition because it is  
 a) Faster      b) more accurate      c) uses fewer gates      d) costs less
12. The output  $Q_n$  of a JK flipflop is zero. If it changes to 1 when a clock pulse is applied. Then the input  $J_n$  and  $K_n$  are respectively  
 a) 0 and X      b) 1 and X      c) X and 0      d) X and 1
13. How many flipflops are required to build a binary counter circuit from 0 to 1023?  
 a) 5      b) 6      c) 10      d) 12
14. For a circuit shown in figure below what is the frequency of the output Q



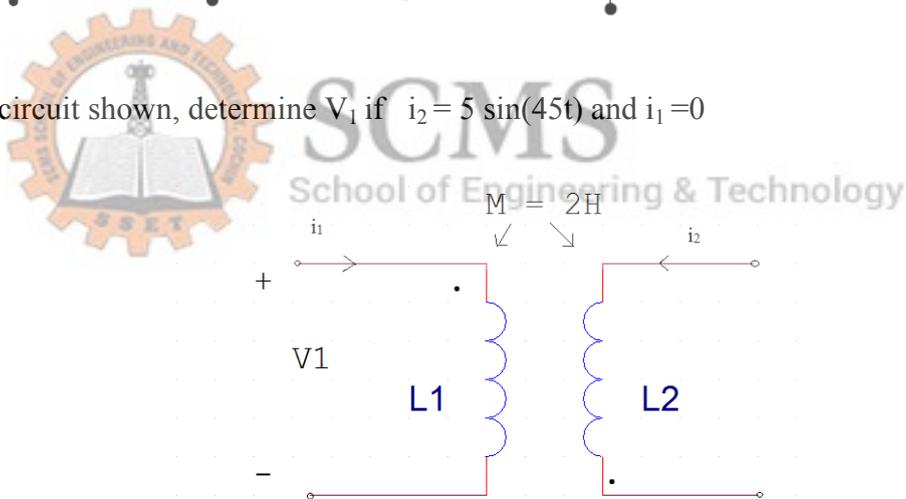
- a) Twice the input clock frequency.      b) Half the input clock frequency.  
 b) Same as the input clock frequency.      d) None of these.
15. In a sequential circuit the output at any instant of time depends on  
 a) Only on the inputs present at that instant of time  
 b) On the past output as well as present inputs  
 c) Only on past inputs  
 d) Only on present outputs

16. A pulse train can be delayed by a finite number of periods using clocks in
- a) PISO                      b) SIPO                      c) PIPO                      d) SISO
17. A 1000 KHz carrier is simultaneously modulated with 300 Hz and 200 Hz audio sine waves. The frequency which will not be present in output is
- a) 998 KHz                  b) 999.7 KHz                  c) 1000.3 KHz                  d) 700 KHz
18. If modulation index of AM wave is changed from 0 to 1, the transmitted power
- a) Increases by 50%                  b) Increases by 75%  
c) Increases by 100%                  d) Remains unaffected
19. In a superheterodyne receiver IF is 455KHz, if it is tuned to 1200KHz, the image frequency will be
- a) 1655 KHz    b) 745 KHz    c) 2110 KHz    d) 910 KHz
20. In the generation of a modulated signal, a varactor diode can be used for
- a) FM generation only.    b) AM generation only.  
c) PM generation only.    d) Both (b) and (c).
21. Which of the following statements is NOT correct regarding the signal  $x(t) = 5 \sin(2\pi \times 10^3 t) \sin(2\pi \times 10^6 t)$  ?
- a) Upper sideband frequency is 1001000.  
b) Lower sideband frequency is 999000.  
c)  $x(t)$  is a DSB-SC signal.  
d)  $x(t)$  is an AM signal.
22. If an angle modulated signal is given by  $f_a(t) = \cos(2 \times 10^8 \pi t + 75 \sin 2 \times 10^3 \pi t)$  then peak frequency deviation of the carrier is
- a) 1 KHz                  b) 7.5 KHz                  c) 75 KHz                  d) 100 MHz
23. The fundamental period of the signal  $e^{j\omega_0 t}$  is
- a)  $1/\omega_0$                   b)  $2\pi\omega_0$                   c)  $2\pi/\omega_0$                   d)  $\omega_0/2$
24. Energy of a signal  $A\delta[n] + A\delta[n-1]$  is
- a)  $2A^2$                   b)  $A^2/2$                   c)  $A^2/4$                   d)  $A^2$
25.  $\int_{-\infty}^{\infty} \sin(t)\delta(t)dt$  is equal to
- a)  $\infty$                   b)  $\pi/2$                   c) 0                  d)  $1/2$
26. The Nyquist sampling rate of the continuous time signal  $\text{Sinc}(500t)$  is
- a) 1000 Hz.                  b) 100 Hz.                  c) 500 Hz                  d) 250 Hz
27. If  $x(t)$  has the Fourier transform  $X(f)$ , the Fourier transform of  $x(-t)$  is
- a)  $X(f)$                   b)  $|X(f)|$                   c)  $-X(f)$                   d)  $X(-f)$

28. If  $x(t)$  is a real signal, then
- Magnitude response and phase response are even.
  - Magnitude response and phase response are odd.
  - Magnitude response is even and phase response is odd.
  - Magnitude response is odd and phase response is even.
29. Consider the network graph shown in the figure below. Which one of the following is 'NOT' a tree of the group?

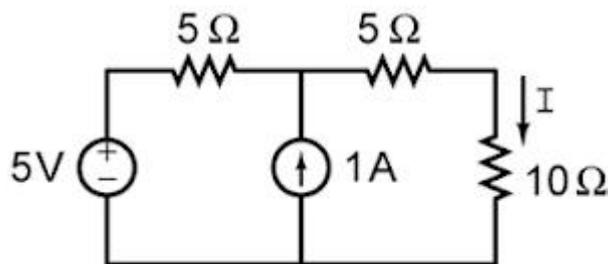


30. For the circuit shown, determine  $V_1$  if  $i_2 = 5 \sin(45t)$  and  $i_1 = 0$



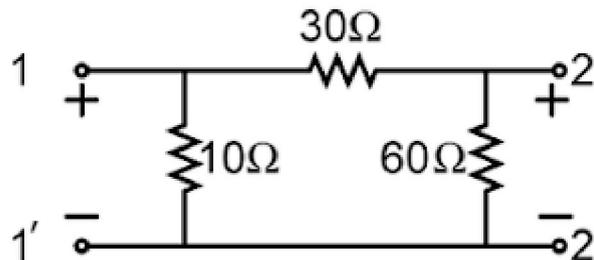
- a)  $450 \cos(45t)v$     b)  $450 \sin(45t)v$     c)  $-450 \cos(45t)v$     d)  $45 \sin(45t)v$

31. Find the current  $I$  (in amperes) in the following circuit



- a) 0.75A    b) 0.5A    c) 1A    d) 1.5A

32. The average power delivered to an impedance  $(4 - j3)\Omega$  by a current  $5 \cos(100\pi t + 100)$  A is
- a) 44.2 W                      b) 50 W                      c) 62.5 W                      d) 125 W
33. A two port device is defined by the following pair of equations  $i_1 = 2v_1 + v_2$  and  $i_2 = 2v_1 + v_2$ , its admittance parameters are  $(y_{11}, y_{12}, y_{21}, y_{22})$  are given by
- a) [2,1,2,1]                      b) [1,2,2,1]                      c) [2,1,1,1]                      d) [1,2,1,2]
34. For the two port network shown in the figure, the impedance ( $Z$ ) matrix (in  $\Omega$ ) is



- a)  $\begin{bmatrix} 6 & 24 \\ 42 & 9 \end{bmatrix}$                       b)  $\begin{bmatrix} 9 & 8 \\ 8 & 24 \end{bmatrix}$                       c)  $\begin{bmatrix} 9 & 6 \\ 6 & 24 \end{bmatrix}$                       d)  $\begin{bmatrix} 42 & 6 \\ 6 & 60 \end{bmatrix}$
35. An integrator circuit is
- a) Low pass filter                      b) high pass filter                      c) band pass filter                      d) all pass filter
36. If a transistor is in saturation
- a)  $I_C = \beta I_B$                       b)  $I_C > \beta I_B$                       c)  $I_C < \beta I_B$                       d)  $I_C = I_B$
37. Zener breakdown diodes have breakdown voltage which has
- a) Has positive temperature coefficient.                      b) Has negative temperature coefficient.  
c) Is independent of temperature                      d) None of the above.
38. The type of negative feedback in a RC coupled amplifier without bypass capacitor is
- a) Voltage series feedback.                      b) Current series feedback.  
c) Voltage shunt feedback.                      d) Current shunt feedback.
39. The phase shift produced by feedback network in a Weinbridge oscillator is
- a)  $180^\circ$                       b)  $0^\circ$                       c)  $90^\circ$                       d)  $270^\circ$
40. The dissipation at the collector is zero in the quiescent state and increases with excitation in the case of a
- a) Class A series fed amplifier                      b) Class A transistor coupled amplifier  
c) Class AB amplifier                      d) Class B amplifier
41. The total derivative of the function 'xy' is
- a)  $xdy + ydx$                       b)  $xdx + ydy$                       c)  $dx + dy$                       d)  $dxdy$

42. For the differential equation  $\frac{dy}{dt} + 5y=0$  with  $y(0) =1$  the general solution is  
a)  $e^{5t}$       b)  $e^{-5t}$       c)  $5e^{-5t}$       d) none of these
43. The radial component of velocity for a particle moving in a circular path is  
a) zero      b) radius itself      c) variable      d) none of the above
44. In which Quadrant the HP comes above XY line and VP comes below XY line for orthographic projection?  
a) First Quadrant      b) Second Quadrant      c) Third Quadrant      d) Fourth Quadrant
45. The force applied on a body of mass 100 kg to produce an acceleration of  $5 \text{ m/S}^2$  is  
a) 20 N      b) 100 N      c) 500 N      d) None of these
46. Which was the major green building rating system developed by TERI  
a) GRIHA      b) LEED      c) BREEAM      d) CASBEE
47. Which stage is directly responsible for the technical functioning of the product  
a) engineering function      b) research function      c) manufacturing function  
d) commercial function
48. The first full-scale and usually fully functional forms of a new design is called  
a) Model      b) prototype      c) rapid prototype      d) design attribute
49. The Air Pollution and Control Act, popularly known as the 'Air Act' was passed for the first time in US in  
a) 1955      b) 1999      c) 2004      d) 2015
50. Probability of a product successfully operation for a specific period of time is called  
a) reliability      b) durability      c) conformance      d) serviceability

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