2021 BATCH QUESTION BANK

SEMESTER 3, 2022-2023

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QUESTIONS COMPILED BY

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

VIDYA ACADEMY OF SCIENCE & TECHNOLOGY TECHNICAL CAMPUS, KILIMANOOR

INDEX

MAT 201
PARTIAL DIFFERENTIAL EQUATIONS AND COMPLEX ANALYSIS

Faculty – Mr. Dinesh Kumar S.

QUESTION BANK
THIRD SEMESTER (2020)
MAT201 PARTIAL DIFFERENTIAL EQUATIONS & COMPLEX ANALYSIS
(For EEE, ECE, CE & ME)

	MODULE I		
1	Solve $(y - z)p + (x - y)q = (z - x)$	3	KTU JULY 2017
2	Form the partial differential equation from $z = xg(x) + yf(x)$	3	KTU JULY 2017
3	Solve $(mz - ny)p + (nx - lz)q = ly - mx$	5	KTU JULY 2017
4	Find the partial differential equation representing the family of spheres whose Centre lies on z- axis	3	KTU JULY 2018
5	Find the general solution of $(y^2 + z^2)p - xyz\ q = -xz$	6	KTU JULY 2018
6	Find the partial differential equation z=x f(x) +y e^2	3	Model qp 2020
7	Solve 3z = xp + yq	3	Model qp 2020
8	Solve $(p^2 + q^2)$y = qz	7	Model qp 2020
9	Derive pde from the relation z = f(x + at) + g(x + at)	3	Model qp 2020
10	Use Charpit's methods to solve $q + xp = p^2$	7	Model qp 2020
11	Find the differential equation of all spheres of fixed radius having their centers in the xy plane.	7	Model qp 2020
12	Find the PDE by eliminating arbitrary function f and g from $z = f(x) + g(y)$	3	KTU Dec 2021
13	Solve $y^2 p - xyq = xz$	7	KTU Dec 2021
14	Find the complete integral of $px + qy = pq$ using Charpit's method	7	KTU Dec 2021
15	Form the PDE corresponding to family of sphere with centre on z-axis and radius a	7	KTU Dec 2021
16	Solve $\frac{\partial^2 z}{\partial x^2} = xy$	3	KTU Dec 2021
17	Solve by method of separation of variables $\frac{\partial u}{\partial x} + \frac{\partial u}{\partial y} = 0$, $u(x, 0) = 4e^{-3x}$	7	KTU Dec 2021
	MODULE 2		
1	Write any three assumptions involved in the derivation of the one dimensional wave equation.	3	KTU July 2018
2	A string of the length l fastened at both ends. The midpoint of the string is taken to a height h and the released from the rest in that position .Writethe boundary condition and the initial conditions of the string to find the displacement function y(x, t) satisfying the one dimensional wave equation.	3	KTU July 2018

3	Using method of separation of variables, solve $\frac{\partial u}{\partial x} = 2\frac{\partial u}{\partial t} - u$, $u(x,0) = 5e^{-3x}$	2	KTU July 2018
4	A tightly stretched string of length l fastened at both ends is initially in aposition given by y = kx, $0 < x < l$. If it is released from the rest from this position ,find the displacement y(x, t) at any time t and any distance x fromthe end x=0	5	KTU July 2018
5	Solve the one dimensional wave equation $\frac{\partial^2 u}{\partial t^2} = c^2 \frac{\partial^2 u}{\partial x^2}$ with boundary conditions $u(0,t) = 0$, $u(l, t) = 0$ for all t and the initial conditions $u(x,0) = f(x), \frac{\partial u}{\partial t}$	10	KTU July 2018
6	A string of length 20 cm fixed at both ends is displaced from its position of equilibrium position. Find the displacement $u(x,t)$ of this string if it is set vibrating by giving each of its points a velocity $v_0 \sin(\frac{\pi x}{a})$	10	KTU June 2016
7	A tightly stretched string of length 'a' with fixed ends is initially in equilibrium position. Find the displacement u(x, t) of the string if it is setvibrating by giving each of its points a velocity $v_0 \sin^3(\frac{\pi x}{a})$	10	KTU Aug 2016
8	A tightly stretched string of length L is fixed at both ends. Find thedisplacement u(x, t) if the string is given an initial displacement f(x) and an initial velocity g(x).	10	KTU Dec 2018
9	A string of length 20 cm fixed at both ends is displaced from its position of equilibrium, by each of its points an initial velocity given by $(x) = \begin{cases} x, & 0 \le x \le 10 \\ 20 - x, & 10 \le x \le 20 \end{cases}$, x being the distance from one end. Determine the displacement at any subsequent time.	10	KTU May 2017
10	A tightly stretched string with fixed endpoints x=0 and x=l is initially in aposition given by $u = v_0 \sin^3\left(\frac{\pi x}{a}\right), 0 \le x \le l$. If it is released from rest from this position, find the displacement function u(x, t).	10	KTU Dec 2018
11	Solve one dimensional heat equation when k > 0	3	KTU May 2017
12	Write down possible solutions of one dimensional heat equation	3	KTU May 2017
13	Derive one dimensional heat equation	10	KTU May 2017, Dec 2021
14	Find the temperature in a laterally insulated bar of length L whose endsare kept at temperature 0°C , assuming that the initial temperature is $f(x) = \begin{cases} x, & 0 < x < \frac{L}{2} \\ L - x, & \frac{L}{2} < x < L \end{cases}$	10	KTU May 2017
15	Write down the fundamental postulates used in the derivation of one dimensional heat equation.	3	KTU July 2018
16	Find the temperature distribution in a rod of length 3m whose end pointsare maintained at temperature zero and the initial temperature is $f(x) = 100(2x - x^2), 0 \le x \le 2$	7	KTU March 2017

17	Write the 3 possible solution of one dimensional wave equation	3	KTU Dec 2021
18	Write any 2 assumptions used in the derivation of one-dimensional heat equation	3	KTU Dec 2021
19	Solve the boundary value problem described by $u_{tt} - c^2 u_{xx} = 0, 0 \le x \le l, t \ge 0, u(0,t) = u(l,t) = 0, t \ge 0, u(x,0) = 10 \sin\left(\frac{\pi x}{l}\right), \frac{\partial u}{\partial t}(x,0) = 0$	7	KTU Dec 2021
20	Find the temperature $u(x,t)$ in a homogeneous bar heat conducting material of length l whose ends kept at $0°C$ and whose initial temperature is given by $u(x,0) = lx - x^2$	7	KTU Dec 2021
21	Derive the one dimensional wave equation	7	KTU Dec 2021
22	The ends A and B of a rod 10 cm in length are kept at temperature 0°C and 100°C until the steady state condition prevails. If B is suddenly reduced to 0°C and kept so. Find the temperature distribution in the rod at time t.	7	KTU Dec 2021

MODULE 3

1	Show that $u = y^3 - 3x^2 y$ is harmonic and hence find its harmonic conjugate.	8	KTU DEC 2016
2	Define an analytic function and prove that an analytic function of constant modulus is constant.	8	KTU DEC 2016

3	Check whether the following functions are analytic or not. Justify your answer
	   i) $f(z) = z + \bar{z}$
	   ii) $f(z) = |z|^2$
		4+4	KTU March 2017

4	Show that $f(z) = \sin z$ is analytic for all z. Find $f'(z)$	7	KTU March 2017
5	Show that $v = 3x^2 y - y^3$ is harmonic and find the corresponding analytic function	8	KTU March 2017
6	Let $(z) = u(x,y) + i\, v(x,y)$ be defined and continuous in some neighborhood of a point $z = x + iy$ and differentiable at z itself. Then prove that the first order partial derivatives of u and v exist and satisfy Cauchy- Riemann equations	7	KTU April 2018
7	Prove that $u = \sin x \cosh y$ is harmonic. Hence find its harmonic conjugate.	8	KTU April 2018
8	Check whether the function $f(z) = \begin{cases} \frac{Re(z^2)}{|z|^2}, & if\ z \ne 0 \\ 0, & if\ z = 0 \end{cases}$ is continuous at $z = 0$.	7	KTU April 2018
9	Let f (z) = u + iv is analytic, prove that u = constant, v = constant are families of curves cutting orthogonally	7	KTU July 2017
10	Prove that the function u(x, y) = $x^3 - 3xy^2 - 5y$ is harmonic everywhere. Also find the harmonic conjugate of u.	8	KTU July 2017

11	Find the points, if any in complex plane where the function $f(z) = 2x^2 + y + i(y^2 - x)$ is
	   (i) Differentiable
	   (ii) Analytic
		8	KTU July 2017

12	Find the analytic function whose imaginary part is $v(x, y) = \log(x^2 + y^2) + x - 2y$.	7	KTU May 2019
13	Find the image of $\left\|z - \frac{1}{2}\right\| \leq \frac{1}{2}$ under the transformation $w = \frac{1}{z}$, also find the fixed points of the transformations $w = \frac{1}{z}$	7	KTU Dec 2016
14	Find the image of the lines x = c and y = k where c and k are constants under the transformation w = $sin\, z$	7	KTU Dec 2016
15	Find the image of $0 < x < 1, \frac{1}{2} < y < 1$ under the mapping $w = e^z$	7	KTU March 2017, Sept 2020
16	Find the image of the rectangular region $-\pi \leq x \leq \pi, a \leq y \leq b$ under the mapping $w = sin\, z$	8	KTU March 2017
17	Find the image of the region $\left\|z - \frac{1}{3}\right\| \leq \frac{1}{3}$ under the transformation $w = \frac{1}{z}$	8	KTU April 2018
18	Under the transformation $w = z^2$, find the image of the triangular region bounded by $x = 1, y = 1$ and $x + y = 1$	8	KTU May 2019, KTU Sept 2020
19	Find the image of the half plane Re(z) ≥ 2, under the map w = iz	8	KTU July 2017
20	Under the transformation w = 1/ z, find the image of $\|z - 2i\| = 2$.	8	KTU May 2019
21	Check whether the function $f(z) = \begin{cases} \frac{Re(z^2)}{1-\|z\|}, & if\ z \neq 0 \\ 0, & if\ z = 0 \end{cases}$ is continuous at $z = 0$	7	KTU Sept 2020
22	Determine a so that $u = e^{-ax} \cos ay$ is harmonic and find the harmonic conjugate.	8	KTU Sept 2020
23	Show that $f(z) = e^z$ is analytic for all z	8	KTU Sept 2020
24	Test the continuity at $z = 0$ of $f(z) = \begin{cases} \frac{Im(z)}{\|z\|}, & z \neq 0 \\ 0, & z = 0 \end{cases}$	3	KTU Dec 2021
25	Check whether $f(z) = \bar{z}$ is an analytic function.	3	KTU Dec 2021
26	Show that an analytic function $f(z) = u + iv$ is a constant if its modulus is constant.	7	KTU Dec 2021
27	Find the image of $1 \leq \|z\| \leq 2, \frac{\pi}{6} \leq \theta \leq \frac{\pi}{3}$ under the mapping $w = z^2$	7	KTU Dec 2021
28	Verify whether $u = x^3 - 3xy^2$ is harmonic and find its conjugate harmonic function v.	7	KTU Dec 2021
29	Find the image of the region between real axis and a line parallel to real axis at $y = \frac{\pi}{2}$ under the mapping $W = e^z$.	7	KTU Dec 2021

MODULE 4

1	Evaluate $\int_c Re(z)\, dz$ where c is the straight line from $0\ to\ 1 + 2i$	7	KTU Dec 2016
2	Show that $\int_0^\infty \frac{1}{1+x^4} dx = \frac{\pi}{2\sqrt{2}}$	8	KTU Dec 2016

3	Integrate $\frac{z^2}{z^2-1}$ counter clockwise around the circle $\|z - 1 - i\| = \frac{\pi}{2}$	7	KTU Dec 2016
4	Evaluate $\int_c \|z\| dz$ (i) Where c is the line segments joining i and $-i$ (ii) Where c is the unit circle in the left of the half plane.	4+3	KTU March 2017
5	Verify Cauchy-Integral theorem for z^2 taken over the boundary of the rectangle with vertices $-1, 1, 1 + i, 1 - i$ in the counter clockwise sense.	8	KTU March 2017
6	Evaluate $\int_c Im(z^2)dz$ where c is the triangle with vertices 0, 1, i counter clockwise	7	KTU April 2018
7	Find the Taylor series and Laurent series of $f(z) = \frac{-2z+3}{z^2-3z+2}$ with centre 0 in (i) $\|z\| < 1$ (ii) $1 < \|z\| < 2$	8	KTU April 2018
8	Use Cauchy's Integral formula evaluate $\int_c \frac{z^2}{z^3-z^2-z+1} dz$ where c is taken counter clockwise around the circle (i) $\|z + 1\| = \frac{3}{2}$ (ii) $\|z - 1 - i\| = \frac{\pi}{2}$	8	KTU April 2018
9	Find the Laurent series expansion of $f(z) = \frac{1}{1-z^2}$ which is convergent in (i) $\|z - 1\| < 2$ (ii) $\|z - 1 - i\| > 2$	8	KTU March 2017
10	If $f(z) = \frac{1}{z^2}$, find the Taylor series that converges in $\|z - i\| < R$ and the Laurent series that converges in $\|z - i\| > R$	8	KTU Dec 2016
11	Using Cauchy's Integral formula evaluate $\int_c \frac{e^z}{(z^2+4)(z-1)^2} dz$ where c is the circle $\|z - i\| = 2$	7	KTU May 2019
12	Evaluate $\int_0^{2+i} (\bar{z})^2 dz$ along (i) The real axis to 2 and then vertically to $2 + i$ (ii) The line $2y = x$	8	KTU May 2019
13	Evaluate $\int_0^{1+2i} \bar{z} dz$ along $z = t^2 + it$	7	KTU Sept 2020
14	Evaluate $\int_{c^-}^{4+2i} \frac{2z-1}{z^2-z} dz$ along the curve $c: \|z\| = 3$ using Cauchy's Integral formula	8	KTU Sept 2020
15	Find the Maclaurin series of $f(z) = \sin z$	3	KTU Dec 2020
16	Evaluate $\oint_c \ln z \, dz$, where c is the unit circle $\|z\| = 1$.	3	KTU Dec 2020
17	Evaluate $\int_C \|z\|^2 \, dz$, where C is the circle $\|z\| = 2$.	7	KTU Dec 2021
18	Evaluate $\int_C \frac{z^2+2}{(z-3)^2} dz$, where C is the circle $\|z\| = 4$ using the Cauchy's integral formula.	7	KTU Dec 2021
19	(a) Evaluate $\oint_c \frac{e^z}{(z-1)(z-4)} dz$, where c is $\|z\| = 2$ using the Cauchy's integral formula.	7 + 7	KTU Dec 2021

	(b) Evaluate $\int \frac{3z^2+7z}{z+1} dz$ over (i) $\quad$ $|z| = 1.5$ (ii) $\quad$ $|z + i| = 1$		
20	Evaluate $\oint_c \frac{e^z}{z-5} dz$, where c is the circle $|z| = 4$	3	KTU Dec 2021
21	Find the Taylor series expansion of e^z about $z = \pi$.	3	KTU Dec 2021

Module 5

1	Define three types of isolated singularities with an example for each	7	KTU Dec 2016
2	Determine the nature and type of singularities of (i) $\quad$ $\frac{e^{-z^2}}{z^2}$ (ii) $\quad$ $\frac{1}{z}$	7	KTU March 2017
3	Use Residue theorem to evaluate $\int_c \frac{30z^2-23z+5}{(2z-1)^2(3z-1)} dz$ where c is $|z| = 1$.	7	KTU March 2017
4	Evaluate $\int_0^\infty \frac{1}{(1+x^2)^2} dx$ using residue theorem	8	KTU March 2017
5	Determine and classify the singular points for the following functions (i) $\quad$ $f(z) = \frac{\sin z}{(z-\pi)^2}$ (ii) $\quad$ $g(z) = (z + i)^2 e^{\frac{1}{z+i}}$	7	KTU April 2018
6	Evaluate $\int_{-\infty}^{\infty} \frac{1}{(1+x^2)^3} dx$	8	KTU April 2018
7	Evaluate $\int_{-C} \frac{\tan z}{z^2-1} dz$ counter clockwise around $c: |z| = \frac{3}{2}$ using Cauchy's Residue theorem	7	KTU April 2018
8	Using contour integration evaluate $\int_{-\infty}^{\infty} \frac{x^2-x+2}{x^4+10x^2+9} dx$	7	KTU July 2017
9	Evaluate $\int \log z \ dz$, where C is the circle $|z| = 1$.	7	KTU May 2019
10	Evaluate $\int \frac{1}{5-3\sin\theta} d\theta$	8	KTU May 2019
11	Find all singular points and residues of the functions (a) $f(z) = \frac{(z-\sin z)}{z^2}$ (b) $f(z) = \tan z$	8	KTU May 2019
12	Evaluate $\int_{-\infty}^{\infty} \frac{x^2}{(x^2+1)(x^2+4)} dx$	8	KTU May 2019
13	Find the Laurent series expansion of $f(z) = \frac{1}{z^2+3z+2}$ in the region $1 < |z| < 2$	8	KTU Sept 2020
14	Find all singularities and corresponding residues $\frac{8}{1+z^2}$, $\tan z$	8	KTU Sept 2020

15	Evaluate $\int_c \frac{e^z}{\cos n\pi} dz$, where c is the unit circle $|z| = 1$ using Residue theorem.	8	KTU Sept 2020
16	Evaluate $\int_0^{2\pi} \frac{d\theta}{2+\cos\theta}$	8	KTU Sept 2020
17	Give example of (a) removable singularity (b) pole (c) essential singularity	3	KTU Dec 2021
18	Find the Laurent series expansions of $\frac{1}{z(z-1)}$ about $z = 0$		KTU Dec 2021

19	(a) Find the Laurent series expansion of $f(z) = \frac{1}{(z-1)(z-2)}$ valid in
	    (i) $1 < |z| < 2$
	    (ii) $|z| > 2$
	 (b) Evaluate $\int \frac{1}{5-4\sin\theta} d\theta$
		7 + 7	KTU Dec 2021

20	Evaluate $\int_{-\infty}^{\infty} \frac{x^2+2}{(x^2+1)(x^2+4)} dx$	7	KTU Dec 2021
21	Using residue theorem evaluate $\oint_c \frac{z+1}{z^4-2z^3} dz$, where c is the $|z| = \frac{1}{2}$	7	KTU Dec 2021

ECT201
SOLID STATE DEVICES

Faculty - Ms.Niraja J. Shenoy

MODULE 1

Sl No	Question		Marks
1	Plot Fermi Dirac distribution function versus energy		6
	With suitable examples, distinguish between elemental and compound semiconductors. Give their applications.	KTU DEC 2020	3
	Draw the energy band diagrams under equilibrium for the following semiconductors. i) intrinsic ii) n type iii) p type	KTU DEC 2020	3
	Explain concept of quasi Fermi level	KTU DEC 2021	3
2	Calculate the thermal equilibrium electron and hole concentration in silicon at T=300K, when the Fermi energy level is 0.27 eV below the conduction band edge E_C. The effective densities of states in the conduction band and valence band are 2.8 x 10^{19} cm^{-3} and 1.04 x 10^{19} cm^{-3} respectively at 300K.	KTU DEC 2020	
3	Derive law of mass action. (8 marks)	KTU DEC 2021	8
4	a) Derive the equation for hole concentration in a semiconductor under thermal equilibrium in terms of ni , Ef and Ei b) b) A silicon sample doped with 2x1016 cm -3 of Boron atoms. (ni= 1.5x1010 cm -3 for Silicon at 300 K) Determine, i. The equilibrium electron and hole concentrations ii. Position of fermi energy level in the band gap iii. Plot the energy band diagram	KTU DEC 2020	8 6
5	Calculate the separation in the Quasi- Fermi levels (Fn-Fp). Draw the Energy band diagram.. (6 marks)	KTU DEC 2021	6
6	Draw and explain Fermi Dirac Distribution function and position of Fermi level in intrinsic and extrinsic semiconductors. (8 marks	KTU DEC 2021	10
7	The Fermi level in a Silicon sample at 300 K is located at 0.3 eV below the bottom of the conduction band. The effective densities of states N_C= 3.22 X 10^{19} cm^{-3} and N_V=1.83 x 10^{19} cm^{-3}. Determine • the electron and hole concentrations at 300K • the intrinsic carrier concentration at 400 K.	KTU DEC 2021	6
8	Illustrate the direct and indirect recombination process of excess carriers in semiconductors	KTU DEC 2021	7
9	Derive the expression for electron, hole and intrinsic concentrations at equilibrium in terms of effective density of states. Formulate the relation between these concentrations at equilibrium.	KTU DEC 2020	8
10	An n-type Si sample with Nd = 1015 cm-3 is steadily illuminated such that gop =1021 EHP/cm3 s. If τn= τp = l μs for this excitation, calculate the separation in the quasi-Fermi levels, (Fn - Fp). (ni= 1.5x1010cm-3 for Silicon at 300 K)	KTU DEC 2020	5

11	Explain the temperature dependency of carrier concentration with extrinsic and intrinsic semiconductor with the help of a graph.	KTU DEC 2020	5

MODULE 2

1	Explain the term mobility with respect to semiconductors. What are the factors on which the mobility depends on? Explain the variation of mobility with temperature and doping.	KTU DEC 2020	8
2	A potential of 100 mV is applied across a semiconductor bar, and the resulting current is 1 mA. A magnetic field of 10-4 Wb/cm2 is applied perpendicular to this semiconductor bar. The hall voltage measured is -2 mV. The dimensions of the bar are width = 0.1 mm, length = 5 mm and thickness = 10 μm. Find i. the type of the semiconductor bar ii. the concentration and the mobility of majority carriers	KTU DEC 2020	6
3	Derive Einstein relation.	KTU DEC 2021	8
4	a) Derive continuity equation for holes. b) Solve the continuity equation, under steady state conditions assuming the semiconductor is long and no drift current is present. Plot the solution. c) A p type semiconductor injected at one end with minority carrier electrons, under steady state conditions. Na = 1015 cm-3 , τn = 0.l μs, μn = 700 cm2 /V Sec. Calculate the electron diffusion length.	KTU DEC 2020	4 6 4
6	Obtain an expression for the electron concentration under excess carrier generation.	Model	6
7	Derive the expression for drift current density, mobility of carriers and conductivity of a semiconductor. (b) A Si sample with 1015/cm3 donors is uniformly optically excited at room temperature such that 1019/cm3 electron-hole pairs are generated per second. Find the separation of the quasi-Fermi levels and the change of conductivity upon shining the light. Electron and hole lifetimes are both 10 μs. Dp = 12 cm 2 /s.	KTU DEC 2021	8 6
8	Explain variation of mobility with temperature.	KTU DEC 2021	
	Explain Hall effect? Derive the expression for determining carrier concentration in a semiconductor bar using Hall effect. (i) Show that the minimum conductivity of a semiconductor sample occurs when √ (ii) What is the expression for the minimum conductivity σmin? (iii) Calculate σmin for Si at 300 K and compare with the intrinsic conductivity	KTU DEC 2021	7 7
10	Describe Hall Effect. Consider a GaAs sample at T=300K with Nd = 1016 per cm3.Calculate the drift current density if the applied electric field is 10V per cm.	KTU DEC 2020	8

MODULE 3

1	A Silicon sample having circular cross section with diameter 10μm is doped with 10^{18} cm^{-3} acceptor impurities on one side and 5×10^{15} cm^{-3} donor impurities on the other side. If the sample is at equilibrium, calculate contact potential, width of depletion region, penetration of depletion region on both N side and P side, and total charge on both N side and P side at 300K.		6
2	Draw the schematic of a PNP transistor and explain the transistor action.		6
	(a) Draw the energy band diagram of a metal N type semiconductor with ϕm > ϕs under equilibrium condition and on biasing. Is the contact rectifying or ohmic. Justify your answer.	KTU DEC 2021	9
	(b) Assume that a p-n-p transistor is doped such that the emitter doping is 20 times that in the base, the minority carrier mobility in the emitter is onefourth that in the base, and the base width is one-tenth the minority carrier diffusion length. The carrier lifetimes are equal. Calculate α and β for this transistor.		5
3	. With the help of energy band diagrams, explain the behaviour of the contact between a metal and an n -type semiconductor. Clearly distinguish between Schottky and ohmic contacts.	KTU DEC 2020	10
	b) What is base width modulation? How does it affect the input and output characteristics of a BJT?		4
4	Derive ideal diode equation A Schottky barrier diode is formed from n type Si of a doping 1016cm-3 and area 10-3 cm2 . A Si PN junction has the same area and NA=1019cm-3 , ND=1016 cm -3 , τn=τp=1μs. (i)Calculate the Schottky barrier diode current at 0.4V and 300K.	KTU DEC 2021	8
	(ii) Calculate the value of forward bias to obtain same current for a PN junction.[R*=110A/K2 , Electron affinity of Si=4.15eV, metal work function=4.9eV,Diffusion constant=12cm2 /s]		6
5	a) Derive the equation for the built in potential of a PN junction under thermal equilibrium.	KTU DEC 2020	7
	b) A PN junction, doped on one side with 1018 cm-3 Boron atoms and the other side with 1016 cm-3 of Arsenic atoms at 300 K. (ni = 1.5x1010cm-3 at 300 K and ϵr =11.9 for Silicon). Calculate, the built in potential.		3
	c) The following parameters are given for a PNP transistor. IEP= 2 mA, IEn= 0.01 mA, IcP= 1.98 mA and Icn= 0.001mA. Determine i. The base transport factor ii. The emitter injection efficiency iii. α and β		4
6	Derive the expression for depletion and diffusion capacitance of a PN junction	KTU May	6
7	Draw the energy band diagram of a PN junction i) at equilibrium, ii) under forward bias and iii) under reverse bias.	KTU May	6
8	Draw and explain the V-I characteristics of PN junction.	KTU Dec	6
9	What are the assumption taken while deriving the ideal diode equation?		6
10	Explain the electron and hole component of current in forward biased p-n junction.	Model	

MODULE 4

1	(a) Draw and explain the CV characteristics of a MOS capacitor (8) (b) For a long channel n-MOSFET with W = 1V, calculate the VG required for an ID(sat.) of 0.1 mA and VD(sat.) of 5V. Calculate the small-signal output conductance g and the transconductance g m(sat.) at VD = 10V. Recalculate the new ID for VG - VT = 3V and VD = 4V.	KTU DEC 2021	8 6
	) Draw and explain the C-V Characteristics of an Ideal MOS capacitor. Derive the expression for threshold voltage. b) Draw the energy band diagrams, of an ideal MOS capacitor under equilibrium, and strong inversion conditions	KTU DEC 2020	8 6
	a) Draw the structure of n channel MOSFET. Derive the expression for drain current of a MOSFET in the two regions of operation. What are the assumptions made in deriving the expression? b) What is meant by body effect in MOSFET? How does it affect the threshold voltage of the MOSFET?	KTU DEC 2020	10 4
2	Explain the working of ideal MOS capacitor.	Model	6
3	Derive the expression for drain current of MOSFET (square law model).Plot the V-I characteristics of a MOSFET.	Model	10
4	(a) Draw and explain the drain characteristics and transfer characteristics of a MOSFET. (8) (b) An Al-gate p-channel MOS transistor is made on an n-type Si substrate with Nd = 5x1017 cm- 3 . The SiO2 thickness is 100 Å in the gate region, and the effective interface charge Qi is 5 x 1010 q C/cm2 and the work function difference between metal and semiconductor is -0.15V. Find Wmax , VFB , and VT of the device	KTU DEC 2021	8 6
5	Draw and explain the Energy-band diagram of MOS capacitor under various biasing conditions.	Model	10
6	Explain the principle of operation of MOS capacitor with suitable energy band diagrams	Model	8
7	Define threshold voltage of MOS capacitor.	Model	3

MODULE 5

1	Explain channel length modulation.	KTU DEC 2020	3
	a) What is meant by DIBL in MOSFETs? How does it affect the threshold voltage of a MOSFET? b) Explain the concepts of velocity saturation and hot carrier effects in a MOSFET.	KTU DEC 2020	7 7
	) What is meant by scaling in MOSFETs? Explain the challenges in device scaling? b) Explain the concept of constant voltage scaling and its limitations	KTU DEC 2020	7 7
2	Explain the non linear characteristics of a MOSFET.		10
	(a) Distinguish between constant voltage scaling and constant field scaling (b) Illustrate the operation of FinFET	KTU DEC 2021	8 6
3	Explain the structure and operation of a FinFET.	Model	10

4	Plot and explain the transfer characteristics of MOSFET.	KTU Dec 2021	10
5	Explain the term drain induced barrier lowering	KTU Dec 2020	6
6	Differentiate between Enhancement type MOS Transistor and Deletion Type MOS Transistor.	KTU DEC 2020	6
7	Explain subthreshold conduction and and Velocity saturation	Model	8
8	Explain threshold variations and hot carrier effects	Model	8
	Explain any four short channel effects in MOSFET	KTU DEC 2021	14

ECT203
LOGIC CIRCUIT DESIGN

Faculty – Ms. Sreejitha S.G.

	MODULE 1	MARKS	YEAR
1	Convert $(203.52)_{10}$ to binary and hexadecimal	3	Model, KTU Dec 2021
2	Compare bitwise and logical verilog operators	3	Model,KTU Dec 2021
3	Subtract $(46)_{10}$ from $(100)_{10}$ using 2's complement arithmetic	8	Model, KTU Dec 2020
4	Give a brief description on keywords and identifiers in verilog with example	6	Model, KTU Dec 2021, KTU Dec 2020
5	Explain floating and fixed point representation of numbers	8	Model, KTU Dec 2020
6	Explain the difference between programming languages and HDLs	6	Model
7	Convert $(3A9E.B)_{16}$ to binary and decimal	3	KTU Dec 2020
8	Convert $(25)_{10}$ to binary, gray and BCD	3	KTU Dec 2020
9	What is hamming code? How is the Hamming codeword generated? Encode the data bits 1011 into 7-bit even Hamming code	8	KTU Dec 2020,KTU Dec 2021
10	Perform the following operations (i) $(A5C)_{16} + (8E4)_{16}$ (ii) $(175.6)_8 - (47.7)_8$	6	KTU Dec 2021
11	Find 11001-10001 using 1's and 2's Complement arithmetic	8	KTU Dec 2021
	MODULE 2	MARKS	YEAR
1	Prove that NAND and NOR are not associative	3	Model

2	Convert the expression ABCD+ABCbar+ACD to minterms	3	Model, KTU Dec 2020
3	Define expressions in Verilog with example	3	Model
4	(a) Simplify using K-map $f(A,B,C,D)=\sum(4,5,7,8,9,11,12,13,15)$ (b) Write a verilog code for implementing above function	14	Model
5	Write a verilog code to implement the basic gates	7	Model
6	Reduce the following Boolean function using K-map and implement the simplified function using the logic gates $f(A,B,C,D)=\sum(0,1,4,5,6,8,9,10,12,13,14)$	7	Model, KTU Dec 2020
7	Reduce the expression $F = \overline{\overline{AB}+\overline{A}+AB}$ using De-Morgan'stheorem	3	KTU Dec 2021
8	Write a verilog code for implementing a NOR gate	3	KTU Dec 2021, KTU Dec 2020
9	Obtain the canonical POS expression of F(A,B,C)=(A+Bbar)(B+C)(A+Cbar)	5	KTU Dec 2021
10	Simplify the expression Y=$\prod$M(0,1,4,5,6,8,9,12,13,14) using K-Map and implement the simplified expression using NOR logic	9	KTU Dec 2021, KTU Dec 2020
11	For the logical expression F=Abar + AB + ABDbar + ABbarDbar + C (i) Obtain Canonical SOP expression (ii) Simplify the expression using K-Map (iii) Write verilog code for the simplified expression	14	KTU Dec 2021
12	Implement an EX-OR gate using universal gates	6	KTU Dec 2020
	MODULE 3	**MARKS**	**YEAR**
1	Explain the working of a Decoder	3	Model, KTU Dec 2020

2	Design a 3-bit magnitude comparator circuit	8	Model, KTU Dec 2020
3	Write a verilog description for a one bit full adder circuit	6	Model
4	Write a verilog code to implement 4:1 multiplexer	6	Model, KTU Dec 2021
5	Implement the logic function $F(A,B,C)=\sum m(0,1,4,7)$ Using 8:1 and 4:1 multiplexers	8	Model, KTU Dec 2021,KTU Dec 2020
6	Explain the working of a multiplexer	3	KTU Dec 2021
7	Write a verilog code for half subtractor	3	KTU Dec 2021, KTU Dec 2020
8	Design a full adder circuit	8	KTU Dec 2021
9	Design a octal to binary encoder	6	KTU Dec 2021
10	Explain the working of a 4-bit parallel adder	3	KTU Dec 2020
11	Design a BCD adder circuit	8	KTU Dec 2020
	MODULE 4	**MARKS**	**YEAR**
1	What is race around condition	3	Model
2	Convert a T Flipflop to D Flipflop	3	Model,KTU Dec 2021, KTU Dec 2020
3	Design a MOD 12 asynchronous counter using T flipflop	14	Model, KTU Dec 2021,

			KTU Dec 2020
4	Explain the operation of Master Slave JK flipflop	7	Model
5	Derive the output Q_{n+1} in terms of J_n , K_n, and Q_n	7	Model
6	Write a verilog code for implementing D Flipflop	3	KTU Dec 2021
7	Explain the operation of JK flipflop using NAND gates	6	KTU Dec 2021
8	Explain the operation of a 4-bit Johnson counter with truthtable and waveforms	8	KTU Dec 2021, KTU Dec 2020
9	Explain a PISO shift register using LOAD'/SHIFT	7	KTU Dec 2021
10	Obtain the excitation table and characteristic equation of a T Flipflop	3	KTU Dec 2020
11	Design a mod-16 synchronous counter using JK flipflop	14	KTU Dec 2020
	MODULE 5	**MARKS**	**YEAR**
1	Define fan-in and fan-out of logic circuits	3	Model,KTU Dec 2020
2	Define noise margin and how can you calculate it	3	Model,KTU Dec 2021, KTU Dec 2020
3	Explain in detail about TTL with open collector output configuration	8	Model
4	Draw an ECL basic gate and explain	6	Model
5	Demonstrate the CMOS logic circuit configuration and characteristics in detail	8	Model
6	Compare the characteristics features of TTL and ECL digital	6	Model
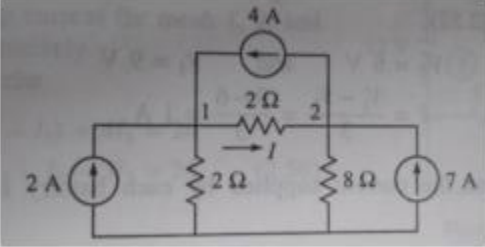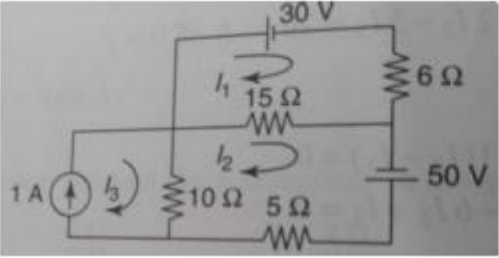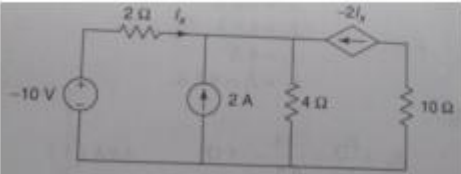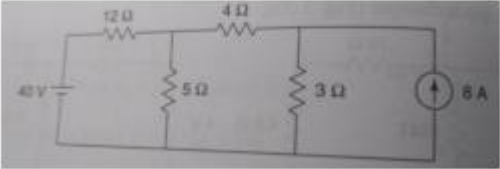
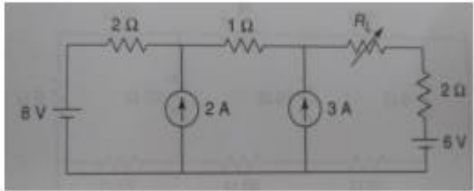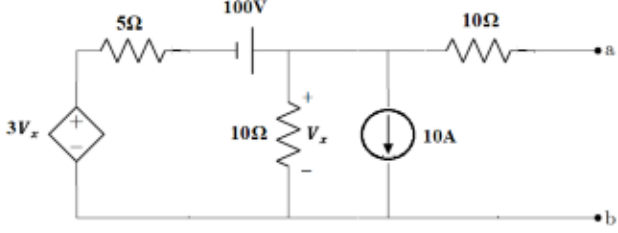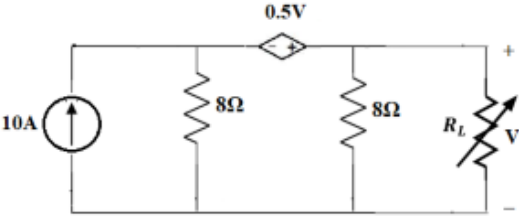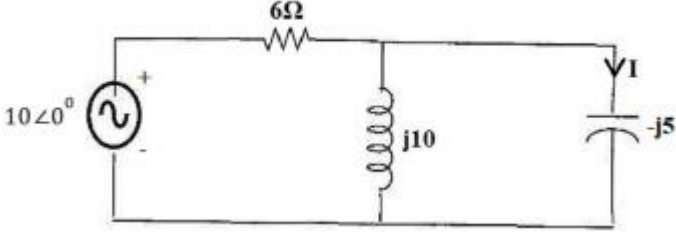|	logic families		
7	Define propagation delay and power dissipation	3	KTU Dec 2021
8	Compare TTL and CMOS logic families in terms of fan-in, fan-out, supply voltage, propagation delay and noise margin	5	KTU Dec 2021,KTU Dec 2020
9	Draw the circuit and explain the operation of transistor level TTL NAND gate	9	KTU Dec 2021,KTU Dec 2020
10	Draw the circuit diagram of a transistor level TTL Inverter and explain the working	5	KTU Dec 2021
11	Draw the circuit and explain the operation of transistor level CMOS NAND gate	9	KTU Dec 2021, KTU Dec 2020
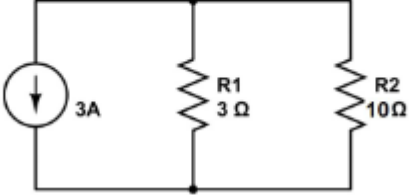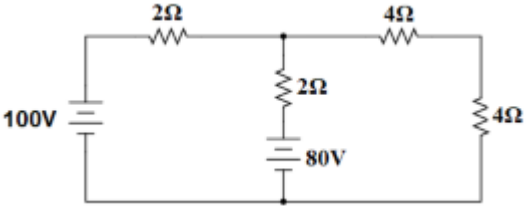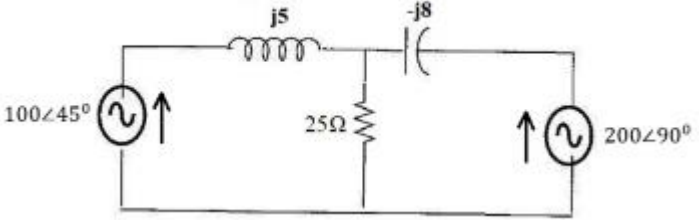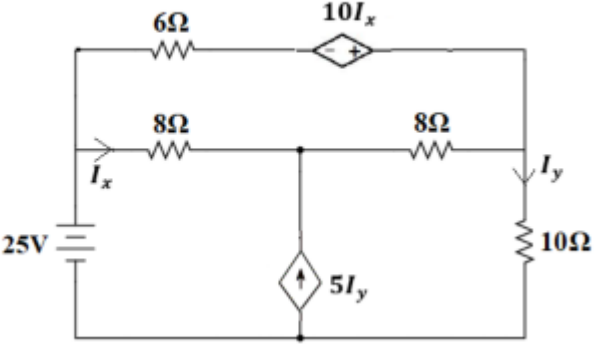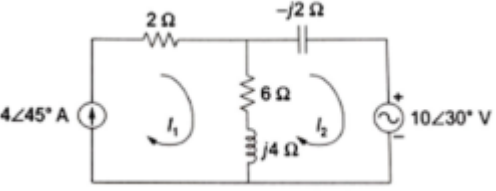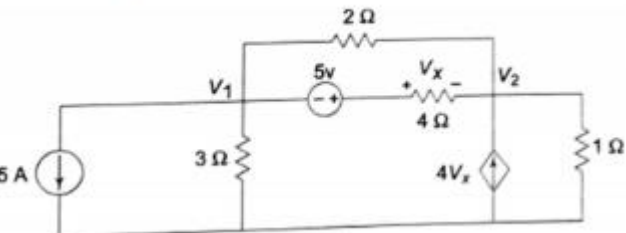
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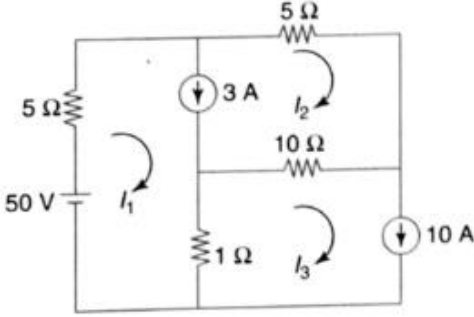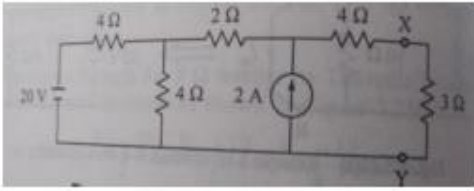
NETWORK THEORY

Faculty – Mr. Chandu C.B.
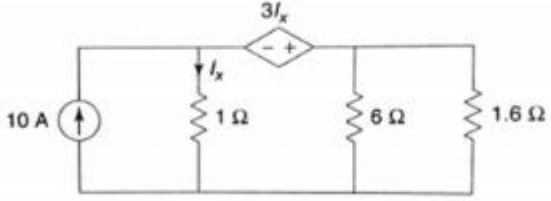
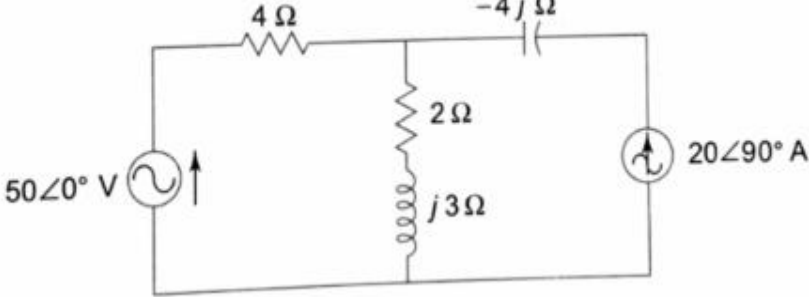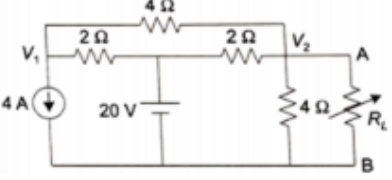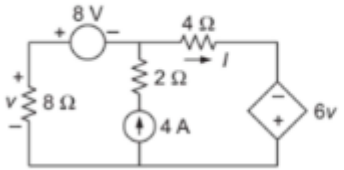| Sl No	Module 1	Marks	Year
1	Using nodal analysis ,find I in the circuit shown below 	7	Jan 2022
2	Determine the mesh currents I_1, I_2 and I_3 in the circuit given 	8	Jan 2022
3	Determine current through 2Ω resistor in the network shown in figure 	7	Jan 2022
4	Find current flowing through 4Ω resistor 	8	Jan 2022
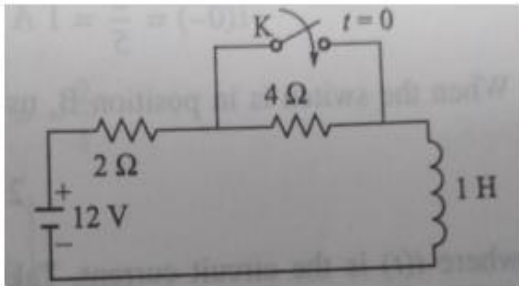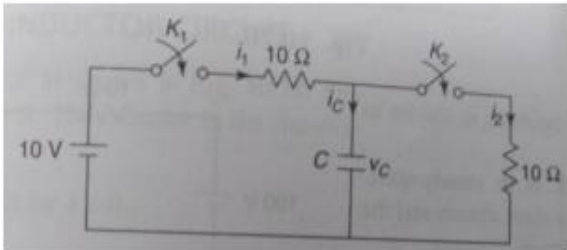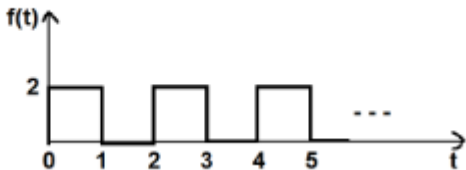
			3	Dec 2021
5	Determine the voltage across 10Ω resistor by applying suitable source transformation.			
6	Explain the different types of sources in electrical network.		3	Dec 2021
7	Find the current through the 2Ω resistors using mesh analysis		6	Dec 2021
8	Evaluate the current through 25Ω resistor using node analysis		8	Dec 2021
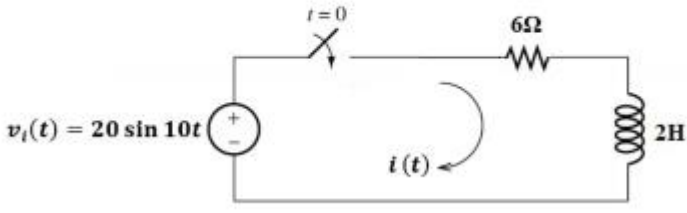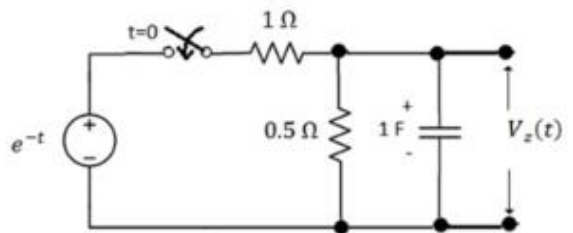
9	Evaluate the voltage across 10Ω resistor in the following network.	14	Dec 2021
10	Explain super mesh analysis Differentiate ideal and practical voltage sources.	6	Dec 2021
11	Find voltage across 6Ω resistor using mesh analysis 	7	Dec 2020
12	Find voltage across 4Ω resistor using nodal analysis 	7	Dec 2020
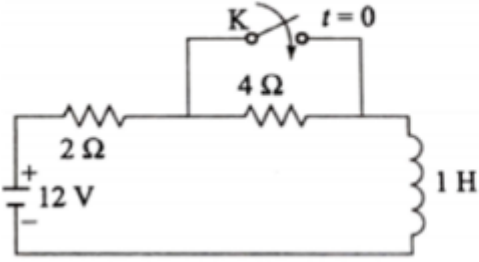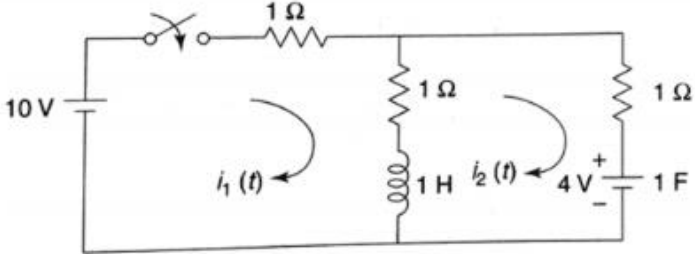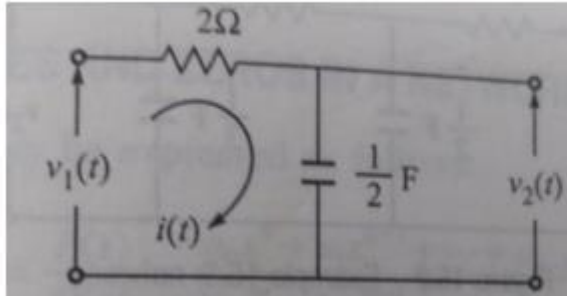
13		7	Dec 2020
	Determine current through 10Ω resistor using mesh analysis		
	MODULE 2		
1	Determine the current through 3Ω for the circuit shown using Norton's theorem	8	Jan 2022
2	For the network shown,find the value of the resistance R_L for maximum power transfer and calculate the maximum power.	7	Jan 2022
3	Write the steps for finding the Norton equivalent circuit of a given network having only dependent sources with model equivalent circuit.	3	Dec 2021
4		8	Dec
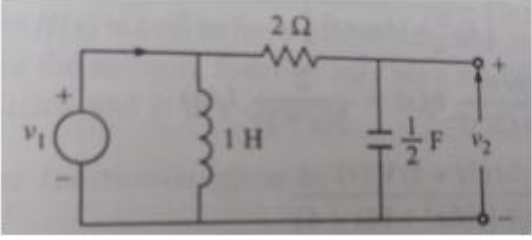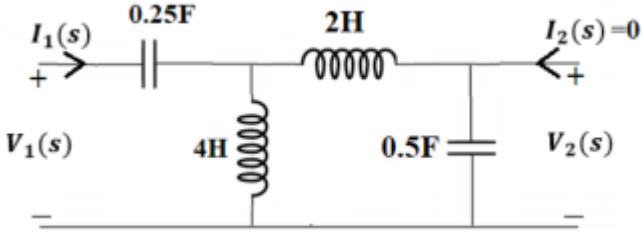
			2021
	Obtain the Thevenin equivalent circuit across the terminal a-b.		
5	Evaluate the value of R_L for maximum power. Also evaluate the maximum power across the load.	6	Dec 2021
6	Evaluate I and verify Reciprocity theorem for the following network	14	Dec 2021
7		6	Dec 2020
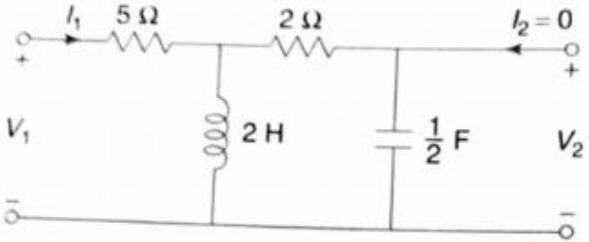
8	Find current through 1.6Ω resistor using Thevenin's Theorem	7	Dec 2020
9	Determine current in $(2 + j3)\Omega$ impedance using superposition theorem	7	Dec 2020
10	Find value of R_L for maximum power transfer. Also find the maximum power transferred.	7	Dec 2020
	Determine current through 4Ω resistor using superposition theorem.	7	Dec 2020
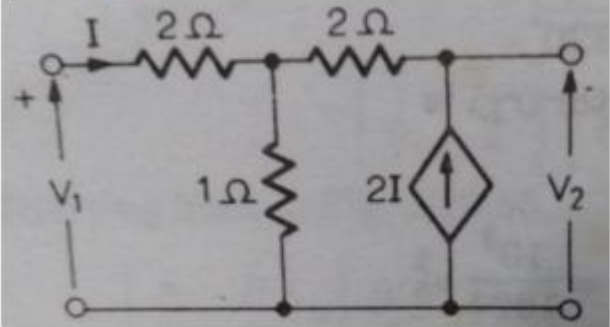
MODULE 3

1	A dc voltage is given to the circuit keeping the switch open so that steady state is reached. Determine the complete response for the circuit after closing the switch.	7	Jan 2022
2	In the circuit shown, switch K1 has been closed for a long time prior to t=0. At t=0, the switch K2 is also closed. Find $v_c(o+)$ and $i_c(0+)$	8	Jan 2022
3	Obtain the Laplace Transform of the following signal.	3	Dec 2021
4	Derive the time domain response of the RL circuit with step input.	3	Dec 2021
5	Verify initial and final value theorems of Laplace Transform for the following function. $$f(t)=e^{-t}\left(t^2+t^3+\sin 2t\right)$$	8	Dec 2021
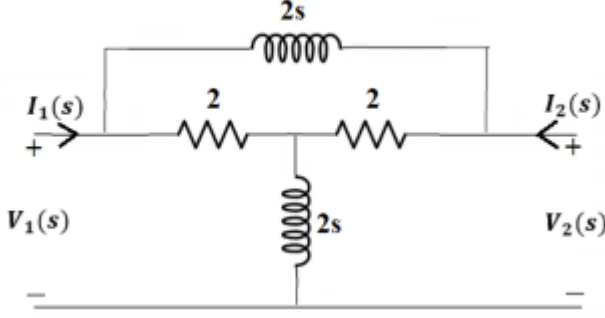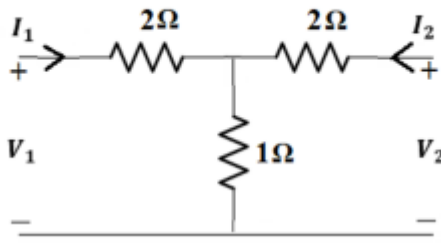
6	Derive the time domain response of an RC network for unit ramp input by assuming the initial condition as zero.	6	Dec 2021
7	Evaluate $i(t)$ in the network for $v_i(t)=20\sin 10t$. Switch is closed at $t=0$. Assume that the initial value of current through the inductor is zero.	14	Dec 2021
8	State initial value and final value theorem Find expression for current when an unit impulse is given to a series RC circuit.	6	Dec 2020
9	In the circuit, the switch is closed at $t = 0$, connecting a source e^{-t} to the RC circuit. At time $t = 0$, it is observed that capacitor voltage has the value $V_c(0) = 0.5V$. For the element values given, determine $V_z(t)$ after converting the circuit into transformed domain.	8	Dec 2020

10	Determine current flowing through the circuit shown for $t \geq 0$	6	Dec 2020
11	Find the expression for current through a series RL circuit when a pulse input of width T and amplitude A is applied across it For the circuit shown switch is closed at t = 0. Find currents $i_1(t)$ and $i_2(t)$ if initial current through inductor is zero and initial voltage on capacitor is 4V	14	Dec 2020
	MODULE 4		
1	Calculate the voltage transfer ratio $V_1(s)/V_2(s)$ for the network shown below	7	Jan 2022

2	Determine the current transfer ratio $\alpha_{12}(s)$ and transfer impedance $Z_{21}(s)$	8	Jan 2022
3	Show the pole zero plot for the given network function V(s) and obtain v(t) $$V(s) = \frac{10s}{(s+3)(s+2)}$$	7	Jan 2022
4	Describe the significance of poles and zeros of a network function		Dec 2021
5	Write the necessary conditions for the transfer functions.		Dec 2021
6	Draw the pole zero diagram of the following function and deduce the time domain response from it. $$V(s) = \frac{(s+3)(s+5)}{s(s+1)(s+4)}$$	14	Dec 2021
7	Determine the driving point impedance in the input side of the following network. Also determine voltage gain transfer function.	14	Dec 2021

8		6	Dec 2020

Is $\alpha_{12} = \frac{2s^2 + 5s + 1}{s+7}$ a valid function? Justify.

What do you mean by open circuit natural frequency and short circuit natural frequency?

9		14	Dec 2020

Obtain the time domain response of the given function using pole zero diagram

$$V(s) = \frac{(s+2)(s+6)}{(s+1)(s+5)}$$

Explain the significance of poles and zeros with reference to driving point functions and transfer functions.

10		14	Dec 2020

What are the necessary conditions for transfer function?

Determine driving point impedance $Z_{11}(s)$, transfer impedance $Z_{21}(s)$and voltage transfer ratio $G_{21}(s)$ for the network shown

	MODULE 5		
1		10	Jan 2022

The Z parameters of a circuit is given below. Obtain its transmission parameters

$$\begin{bmatrix} 4 & 1 \\ 3 & 3 \end{bmatrix}$$

2		10	Jan 2022

Obtain open circuit parameters for the network shown

3		10	Jan 2022

Currents entering port1 and port2 of a two port network are given by the following equations

$I_1 = 0.5V_1 - 0.2 V_2$

$I_2 = -0.2V_1 + V_2$

Find Z and ABCD parameters

4		3	Dec 2021

Derive the condition of symmetry and reciprocity in terms of open circuit impedance parameters.

5		3	Dec 2021

Deduce open circuit impedance parameters in terms of transmittance parameters.

6		14	Dec 2021
	Determine the Y-parameters of the following network		
7		14	Dec 2021
	Two identical sections of the following network are connected in series-parallel combination. Determine the hybrid parameters		
8		6	Dec 2020
	What are image parameters? The impedance parameters of a two-port network are $\begin{bmatrix} 6 & 3 \\ 3 & 4 \end{bmatrix}$. Find its admittance parameters.		
9		14	Dec 2020
	Derive the conditions for reciprocity and symmetry for Z parameters and for ABCD parameters. Express g parameters in terms of h parameters and T parameters.		

10	Show that when two 2 port networks are connected in parallel, the resultant Y matrix is the sum of Y matrices of each individual network. Obtain short circuit admittance parameters of the circuit shown. 	14	Dec 2020
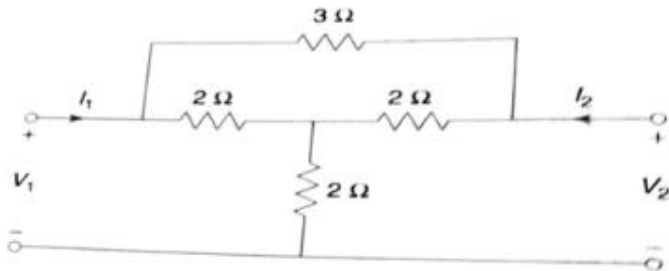
2021 Batch S3
(2022 – 2023)

HUT200
PROFESSIONAL ETHICS

Faculty – Ms. Meenu S.Nair

HUT 200 PROFESSIONAL ETHICS

<table>
<tr><td colspan="4" align="center"><u>Module 1</u></td></tr>
<tr><td>Sl No</td><td align="center">Questions</td><td>Marks</td><td>KTU,Year</td></tr>
<tr><td>1</td><td>What are the two approaches to Engineering ethics?</td><td>3</td><td>July 2021</td></tr>
<tr><td>2</td><td>List two methods of developing self confidence.</td><td>3</td><td>July 2021</td></tr>
<tr><td>3</td><td>Explain about academic integrity and write the five pillars of academic integrity.</td><td>14</td><td>July 2021</td></tr>
<tr><td>4</td><td>Explain the core elements of a strong work ethics.</td><td>14</td><td>July 2021</td></tr>
<tr><td>5</td><td>Why sharing and caring are important for a professional?</td><td>3</td><td>Dec 2020</td></tr>
<tr><td>6</td><td>Define work Ethics .</td><td>3</td><td>Dec 2020</td></tr>
<tr><td>7a</td><td>With the help of examples, distinguish between 'morality' and 'ethics' .</td><td>7</td><td>Dec 2020</td></tr>
<tr><td>b</td><td>Explain the different aspects of academic integrity</td><td>7</td><td>Dec 2020</td></tr>
<tr><td>8 a</td><td>Explain the different types of human value</td><td>7</td><td>Dec 2020</td></tr>
<tr><td>b</td><td>Explain the role of Co-operation and commitment in ethical practice</td><td>7</td><td>Dec 2020</td></tr>
<tr><td>8</td><td>Define empathy. What is the difference between empathy and sympathy</td><td>3</td><td>Dec 2021</td></tr>
<tr><td>9</td><td>What is a civic virtue and how is it related to respect for others?</td><td>3</td><td>Dec 2021</td></tr>
<tr><td>10a</td><td>Explain the role of caring and sharing in a workplace</td><td>5</td><td>Dec 2021</td></tr>
<tr><td>b</td><td>How integrity plays' a major role in work ethics. Discuss with suitable examples.</td><td>9</td><td>Dec 2021</td></tr>
<tr><td>11a</td><td>Explain the need of cooperation and commitment</td><td>8</td><td>Dec 2021</td></tr>
<tr><td>b</td><td>Write a note on "Social Expectations"</td><td>6</td><td>Dec 2021</td></tr>
<tr><td colspan="4" align="center"><u>Module 2</u></td></tr>
<tr><td>Sl No</td><td align="center">Questions</td><td>Marks</td><td>KTU,Year</td></tr>
<tr><td>1</td><td>What are the situations when moral dilemmas arise?</td><td>3</td><td>July 2021</td></tr>
</table>

2	What are the types of ethics depending upon the morality of humanity?	3	July 2021
3 a	Explain the three main levels of moral developments, deviced by Carol Gilligan.	7	July 2021
b	Discuss on three types of inquiries.	7	July 2021
4	List and explain the varieties of moral issues.	14	July 2021
5	What is moral autonomy?	3	Dec 2020
6	List out the models of professional role	3	Dec 2020
7a	Explain the various reasons for an employ'ee to behave unethically in an organisation.	7	Dec 2020
b	What are the logical steps in solving moral dilemma?	7	Dec 2020
8a	Compare Gilligan's theory with Kohlberg theory on moral development	7	Dec 2020
b	Explain the term consensus and controversy in Engineering ethics.	7	Dec 2020
9	Compare and contrast tradition and custom. Give an example	3	Dec 2021
10	Explain Normative Senses	3	Dec 2021
11 a	What is professionalism ?	4	Dec 2021
11 b	Discuss the motives of professionalism and the models for professional engineers.	10	Dec 2021
12	Compare and Contrast Kohlberg's and Gilligan's Theories with real life examples.	14	Dec 2021

Module 3

Sl No	Questions	Marks	KTU,Year
1	What are the advantages of codes of ethics?	3	July 2021
2	Differentiate between copyright and trademark.	3	July 2021
3	Explain about Bhopal Gas Tragedy and write its cause and fatal effect.	14	July 2021
4	Explain the Babylons Building Code and The United States Steamboat Code.	14	July 2021
5	List out the models of professional roles.	3	Dec 2020
6	Define plagiarism	3	Dec 2020

Sl No	Questions	Marks	KTU, Year
5 a	Explain the role of 'Codes of Ethics' in the service life of a professional Engineer.	7	Dec 2020
b	Explain the moral, conceptual, and factual issues that lead to challenger tragedy of 1986.	7	Dec 2020
6a	Evaluate the importance of accountability in a professional's life	7	Dec 2020
b	Evaluate how an Engineer can be a responsible experimenter.	7	Dec 2020
8	Why are codes of ethics important?	3	Dec 2021
9	Explain the term "Balanced outlook on law	3	Dec 2021
10	What are the different roles and functions of "code of ethics"	14	Dec 2021
11	Explain Bhopal gas tragedy. Discuss the violation of morals, ethics, and professional codes of standard in it.	14	Dec 2021

Module 4

Sl No	Questions	Marks	KTU,Year
1	Differentiate between copyright and trademark.	3	July 2021
2	What is meant by Occupational Crime?	3	July 2021
3 a	Explain the methods for managing conflict.	7	July 2021
b	Explain the types of Collective Bargaining.	7	July 2021
4	Explain the steps taken for conflict management.	14	July 2021
5	What is the significance of intellectual property rights?	3	Dec 2020
6	What is the difference between a bribe and a gift?	3	Dec 2020
7 a	Explain the various justifications for confidentiality.	7	Dec 2020
b	Explain how you can improve collegiality in an organisation where you are presently employed.	7	Dec 2020
8a	Explain the significance of different types of Authority in an organisation.	7	Dec 2020
b	Discuss about the various rights of an engine	7	Dec 2020
9	What is confidentiality and why is it needed.	3	Dec 2021
10	Explain collegiality and loyalty.	3	Dec 2021

Sl No	Questions	Marks	KTU,Year
11a	Discuss methods improve collegiality and loyalty	7	Dec 2021
b	Explain collective bargaining	7	Dec 2021
12a	What are occupational crimes and examples	7	Dec 2021
b	How conflicts can be managed in workplace ?	7	Dec 2021

Module 5

Sl No	Questions	Marks	KTU,Year
1	List any three characteristics of Business Ethics.	3	July 2021
2	List any three ethical responsibilities of consulting engineer	3	July 2021
3 a	Explain the characteristics of Business ethics.	7	July 2021
b	Explain the role of computers in technological development.	7	July 2021
4	Explain the advantages and limitations of MNCs	14	July 2021
5	What is business ethics?	3	Dec 2020
6	Differentiate between patent and trade secret	3	Dec 2020
7 a	Explain human centred Environmental ethics with nature centred ethics.	7	Dec 2020
b	Explain the different types of issues in computer ethics.	7	Dec 2020
8 a	Discuss about the role of engineers as expert witness.	7	Dec 2020
b	What are the various conflict situations faced by a project manager managing a work site?	7	Dec 2020
9	What is environmental ethics?	3	Dec 2021
10	Justify the need of moral leadership in today's business environment.	3	Dec 2021
11	Discuss in detail about the moral and ethical issues involved in the use of computers and internet with examples.	14	Dec 2021
12	Discuss the following in detail a) Engineers as consultants b) Engineers as expert witnesses	14	Dec 2021

MCN201
SUSTAINABLE ENGINEERING

Faculty – Ms. Anjana N.

MODULE 1

Sl No	Questions	Marks	KTU YEAR
1	Give an example of a technology which has contributed positively to sustainable Development	5	2017
2	Illustrate the three pillars of sustainable development	3	2021
3	Explain the three pillar model of sustainability	8	2020
4	List four strategies for achieving Sustainable development	5	2019
5	Justify, giving one reason, why sustainability is an essential component in any developmental programmes and projects	3	2020
6	Comment on any one challenge experienced in the implementation of sustainable development principles	3	2021
7	Comment on the challenges for sustainable development in our country and suggest a way to overcome the same.	5	2018
8	What is sustainable development?	5	2018
9	Write a short note on need of sustainability.	3	2020
10	Explain Millennium Development Goals (MDGs)	10	2018
11	Explain in detail the different Sustainable Development Goals	10	2019
12	What is the main motto of the Clean Development Mechanism (CDM)? Relate the same to the suggestions of Kyoto protocol.	10	2017

MODULE 2

Sl No	Questions	Marks	KTU YEAR
1	Describe carbon credit.	5	2018
2	Give an account of climate change and its effect on environment.	5	2018
3	Explain the common sources of water pollution and its harmful effects.	5	2018
4	Give an account of solid waste management in cities	10	2019
5	Explain the 3R concept in solid waste management?	10	2017
6	Write a note on any one environmental pollution problem and suggest a sustainable solution.	5	2018
7	In the absence of green house effect the surface temperature of earth would not have been suitable for survival of life on earth. Comment on this statement.	10	2018
8	Write short note on the need of environmental sustainability? Also explain the concept of zero waste?	5	2018
9	Explain Carbon credits, carbon trading and carbon foot print	14	2021
10	What is the reason behind Ozone layer depletion and suggest a remedy	14	2021
11	Briefly discuss on the impacts of global warming on earth	14	2020

MODULE 3

Sl No	Questions	Marks	KTU YEAR
1	Describe biomimicry. Give two examples.	5	2018
2	Explain the basic concept of life cycle assessment.	10	2018
3	Explain the different steps involved in the conduct of Environmental Impact Assessment.	5	2018
4	Suggest some methods to create public awareness on environmental issues.	5	2017
5	Nature is the most successful designer and the most brilliant engineer that has eve evolved. Discuss	10	2017
6	Match the items in the following sets: SetA: {ISO 14006; ISO 14041; ISO 14048;ISO 14012} Set B: {LCA Data Documentation Format; Environmental Auditing qualifying criteria;Eco design guidelines; LCA inventory analysis}	10	2017
7	Write short notes on ISO 14000 series	5	2018
8	Suppose you are required to do the Life Cycle Assessment of an Electric Vehicle. In the utilisation stage, the assessment must be made for the energy used to drive the vehicle. List any three possible impacts of the Electric Vehicle during the usage stage? Suggest a possible way to reduce the impact during utilisation of the vehicle?	5	2018
9	Differentiate between conventional and non conventional energy sources. Which willyou support? Why?	14	2021
10	Describe Environment Impact Assessment (EIA)	3	2021
11	What is Circular economy?	3	2021

MODULE 4

Sl No	Questions	Marks	KTU YEAR
1	Name three renewable energy sources	5	2018
2	Mention some of the disadvantages of wind energy	5	2018
3	Write a note on advantages of non-conventional energy sources	5	2017
4	Write a note on different hydro power plants available?	14	2018
5	Explain the working of a solar water heating system	14	2017
6	Which will you suggest conventional energy source and non-conventional energy source and why	14	2019
7	Name two energy derived from oceans and explain how	14	2021
8	What is a bio-fuel? Is it a sustainable option	14	2021
9	Write notes on: 1. Land degradation due to water logging. 2. Over exploitation of water	5	2017
10	Geothermal energy is difficult to extract. Comment on	14	2021
11	Write a note on different hydro power plants available	14	2021

MODULE 5

Sl No	Questions	Marks	KTU YEAR
1	Enlist some of the features of sustainable habitat	5	2018
2	Explain green engineering.	5	2018
3	Discuss the elements related to sustainable urbanisation.	5	2018
4	Discuss any three methods by which you can increase energy efficiency in buildings	5	2017
5	How a green building differs from a conventional building? Compare any five aspects?	5	2017, 2019
6	Explain the criteria for the material selection of sustainable builings?	10	2017
7	Write short note on the green building certification in india	5	2018
8	Write short note on sustainable transportation? What are all the characterestics?	10	2019
9	Write a note on basic concepts of sustainable habitat	14	2021
10	Suggest suitabke measures to make the conveyance energy efficient in buildings	10	2019