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10MAT31

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. For the function :

$$f(x) = \begin{cases} x & \text{in} \quad 0 < x < \pi \\ x - 2\pi & \pi < x < 2\pi \end{cases}$$

Find the Fourier series expansion and hence deduce the result $\frac{\pi}{4} = 1 - \frac{1}{3} + \frac{1}{5} - \text{-------}$. **(07 Marks)**

b. Obtain the half range Fourier cosine series of the function $f(x) = x(\ell - x)$ in $0 \le x \le \ell$. **(06 Marks)**

c. Find the constant term and first harmonic term in the Fourier expansion of y from the following table :

x	0	1	2	3	4	5
y	9	18	24	28	26	20

(07 Marks)

2 a. Find the Fourier transform of the function :

$$f(x) = \begin{cases} 1 & \text{for} \quad |x| \le a \\ 0 & \text{for} \quad |x| > a \end{cases}$$ and hence evaluate : $\int_0^\infty \frac{\sin x}{x} dx$. **(07 Marks)**

b. Obtain the Fourier sine transform of $f(x) = e^{-|x|}$ and hence evaluate $\int_0^\infty \frac{x \sin mx}{1+x^2} dx, m > 0$. **(06 Marks)**

c. Solve the integral equation : $\int_0^\infty f(x) \cos px dx = \begin{cases} 1-p, & 0 \le p \le 1 \\ 0, & p > 1 \end{cases}$ and hence deduce the value of $\int_0^\infty \frac{\sin^2 t}{t^2} dt$. **(07 Marks)**

3 a. Obtain the various possible solutions of the two dimensional Laplace's equation $u_{xx} + u_{yy} = 0$ by the method of separation of variables. **(07 Marks)**

b. A string is stretched and fastened to two points 'ℓ' apart. Motion is started by displacing the string in the form $y = a \sin\left(\frac{\pi x}{\ell}\right)$ from which it is released at time t = 0. Show that the displacement of any point at a distance 'x' from one end at time 't' is given by $y(x, t) = a \sin\left(\frac{\pi x}{\ell}\right) \cos\left(\frac{\pi ct}{\ell}\right)$. **(06 Marks)**

c. Obtain the D' Alembert's solution of the wave equation $u_{tt} = c^2 u_{xx}$ subject to the conditions $u(x, 0) = f(x)$ and $\frac{\partial u}{\partial t}(x,0) = a$. **(07 Marks)**

4 a. For the following data fit an exponential curve of the form $y = a e^{bx}$ by the method of least squares :

x	5	6	7	8	9	10
y	133	55	23	7	2	2

(07 Marks)

b. Solve the following LPP graphically :
Minimize $Z = 20x + 10y$
Subject to the constraints : $x + 2y \leq 40$
$3x + y \geq 30$
$4x + 3y \geq 60$
$x \geq 0$ and $y \geq 0$. **(06 Marks)**

c. Using Simplex method, solve the following LPP :
Maximize : $Z = 2x + 4y$
Subject to the constraints $3x + y \leq 22$
$2x + 3y \leq 24$
$x \geq 0$ and $y \geq 0$. **(07 Marks)**

PART – B

5 a. Using the Regula – Falsi method to find the fourth root of 12 correct to three decimal places. **(07 Marks)**

b. Apply Gauss – Seidal method, to solve the following of equations correct to three decimal places :
$6x + 15y + 2z = 72$
$x + y + 54z = 110$
$27x + 6y - z = 8.5$
(carry out 3 iterations). **(06 Marks)**

c. Using Rayleigh power method, determine the largest eigen value and the corresponding eigen vector, of the matrix A in six iterations. Choose $[1\ 1\ 1]^T$ as the initial eigen vector :

$$A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}.$$ **(07 Marks)**

6 a. Using suitable interpolation formulae, find y(38) and y(85) for the following data :

x	40	50	60	70	80	90
y	184	204	226	250	276	304

(07 Marks)

b. If $y(0) = -12$, $y(1) = 0$, $y(3) = 6$ and $y(4) = 12$, find the Lagrange's interpolation polynomial and estimate y at $x = 2$. **(06 Marks)**

c. By applying Weddle's rule, evaluate : $\int_0^1 \frac{x\,dx}{1+x^2}$ by considering seven ordinates. Hence find the value of $\log_e 2$. **(07 Marks)**

7 a. Using finite difference equation, solve $\frac{\partial^2 u}{\partial t^2} = 4\frac{\partial^2 u}{\partial x^2}$ subject to u(0, t) = u(4, t) = 0, $u_t(x, 0) = 0$ and u(x, 0) = x(4 – x) upto four time steps. Choose h = 1 and k = 0.5. **(07 Marks)**

b. Solve the equation $u_t = u_{xx}$ subject to the conditions u(0, t) = 0, u(1, t) = 0, u(x, 0) = sin (π x) for $0 \le t \le 0.1$ by taking h = 0.2. **(06 Marks)**

c. Solve the elliptic equation $u_{xx} + u_{yy} = 0$ for the following square mesh with boundary values as shown. Find the first iterative values of $u_i (i = 1 – 9)$ to the nearest integer. **(07 Marks)**

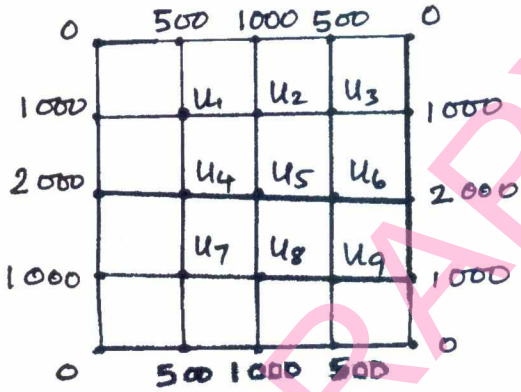

Fig.Q7(c)

8 a. Find the z – transform of $2n + \sin(n\pi/4) + 1$. **(07 Marks)**

b. Obtain the inverse z – transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(06 Marks)**

c. Using z – transform, solve the following difference equation :
$u_{n+2} + 2u_{n+1} + u_n = n$ with $u_0 = u_1 = 0$. **(07 Marks)**

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10ES32

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Analog Electronic Circuit

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting atleast TWO questions from each part.***

PART – A

1 a. With necessary equivalent circuit, explain the various diode equivalent circuits. **(06 Marks)**

b. What do you understand by reverse recovery time? Explain its importance in selection of a diode for an application. **(06 Marks)**

c. For the diode circuit shown in Fig. Q1(c) draw the transfer characteristics. The input is 40 sin ωt. Show clearly the steps of analysis. All diodes are ideal. **(08 Marks)**

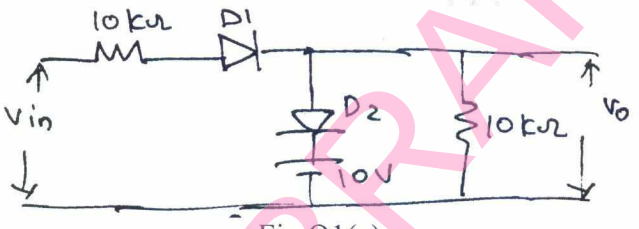

Fig.Q1(c)

2 a. Discuss the effect of varying I_B and V_{CC} on the Q – point. Explain your answer with relevant diagram. **(06 Marks)**

b. An emitter bias circuit has $R_C = 2\ k\Omega$, $R_E = 680\ \Omega$, $V_E = 2.1V$, $V_{CE} = 7.3V$, $I_B = 20\ \mu A$. Find V_{CC}, R_B and β. **(06 Marks)**

c. A voltage divider biased circuit has $R_1 = 39\ k\Omega$, $R_2 = 8.2\ k\Omega$, $R_C = 3.3\ k\Omega$, $R_E = 1\ k\Omega$, $V_{CC} = 18V$. The silicon transistor used has $\beta = 120$. Find Q – point and stability factor. **(08 Marks)**

3 a. Derive an expression for voltage gain, input impedance and output impedance of an emitter follower amplifier using re-model. **(06 Marks)**

b. A voltage divider biased amplifier has $R_1 = 82\ k\Omega$, $R_2 = 22\ k\Omega$, $R_E = 1\ k\Omega$, $R_C = 2.2\ k\Omega$, $V_{CC} = 18\ V$. The silicon transistor has $\beta = 100$. Take $R_S = 1\ k\Omega$, $R_L = 5.6\ k\Omega$. Find voltage gain, input impedance, output impedance. **(06 Marks)**

c. A transistor in CE mode has $h_{ie} = 1100\ \Omega$, $h_{fe} = 100$, $h_{re} = 2.5 \times 10^{-4}$, $h_{oe} = 25\ \mu\mho$. Find voltage gain, input impedance and output impedance. Take $R_S = 1\ k\Omega$, $R_L = 1\ k\Omega$. Also find current gain. **(08 Marks)**

4 a. Discuss with relevant equivalent circuit the method of determination of lower cutoff frequency for a voltage divider biased CE amplifier. **(10 Marks)**

b. A voltage divider biased CE amplifier has $R_S = 1\ k\ \Omega$, $R_1 = 40\ k\Omega$, $R_2 = 10\ k\Omega$, $R_E = 2\ k\Omega$, $R_C = 2.2\ k\Omega$, $C_S = 10\ \mu F$, $C_C = 1\ \mu F$, $C_E = 20\ \mu F$, $\beta = 100$, $V_{CC} = 20$. The parasitic capacitance are $C_\pi(C_{be}) = 36\ pF$, $C\mu(C_{bc}) = 4\ pF$, $C_{ce} = 1\ pF$, $C_{wi} = 6\ pF$, $C_{wo} = 8\ pF$. Determine higher cutoff frequency. **(10 Marks)**

PART – B

5 a. Obtain expression for voltage gain, input impedance and output impedance of a Darlington emitter follower. Draw necessary equivalent circuit. **(08 Marks)**

b. Mention the different configuration of feedback amplifiers and obtain expression for voltage gain with feedback for any one configuration. **(06 Marks)**

c. What are the advantages of cascading amplifiers? Obtain expression for overall voltage gain for an n – stage cascaded amplifier. **(06 Marks)**

6 a. Prove that the maximum conversion efficiency of class A transformer coupled amplifier is 50%. **(08 Marks)**

b. With neat diagram, explain the methods of obtaining phase shift of input signal for class B operation. **(06 Marks)**

c. The harmonic distortion component in an power amplifier is $D_2 = 0.1$, $D_3 = 0.02$, $D_4 = 0.03$. The fundamental current amplitude is 4 A and it supplies a load of 8 Ω. Find total harmonic distortion, fundamental power and total power. **(06 Marks)**

7 a. What is Barkhansen criteria for sustained oscillation? Explain basic principle of operation of oscillators. **(08 Marks)**

b. With a neat circuit diagram, explain the working of Hartley oscillator. Write the equation for frequency of oscillations. **(08 Marks)**

c. A crystal has mounting capacitance of 10 pF. The inductance equivalent of mass is 1 mH, the frictional resistance = 1 kΩ and compliance = 1 pF. Find series and parallel resonant frequency. **(04 Marks)**

8 a. Obtain the expression for voltage gain, input impedance output impedance for a JFET common source amplifier with self – bias configuration. **(08 Marks)**

b. For the FET amplifier in Fig. Q8(b), find voltage gain, input impedance and output impedance. The FET has I_{DSS}= 15 mA, V_p = –6V, Y_{OS} = 25 μs. **(08 Marks)**

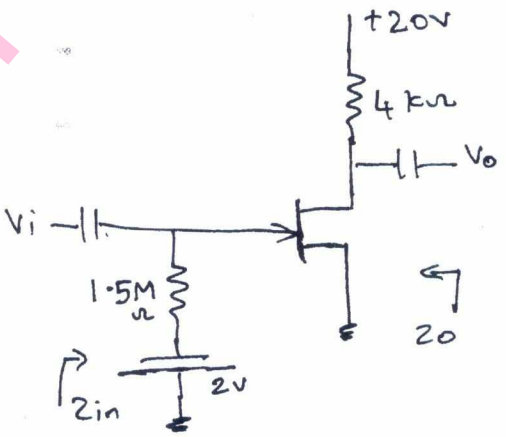

Fig.Q8(b)

c. Mention the difference between BJT and FET. **(04 Marks)**

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10ES33

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Logic Design

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Define combinational logic. Two motors M_2 and M_1 are controlled by three sensors S_1, S_2 and S_3. One motor M_2 is to run any time when all three sensors are on. The other motor (M_1) is to run whenever sensors S_2 or S_1 but not both are on and S_3 is off. For all sensors combinations where M_1 is on, M_2 is to be off, except when all sensors are off and then both motors remain off. Construct the truth table and write the Boolean output equation. **(05 Marks)**

b. The following Boolean function into their proper canonical form in decimal notation.
i) $M = p(q' + s)$
ii) $N = (w' + x)(y + z)$ **(07 Marks)**

c. Reduce the following Boolean function using K-map and realize the simplified expression using NAND gates.
$T = f(a,b,c,d) = \sum m(1,3,4,5,13,15) + \sum d(8,9,10,11)$ **(08 Marks)**

2 a. Simplify the following function using Quine-McClusky method and realize the simplified using NOR gates.
$P = f(w,x,y,z) = \sum m(7,9,12,13,14,15) + \sum d(4,11)$ **(12 Marks)**

b. Simplify $f(a,b,c,d) = \sum m(0,4,5,6,13,14,15) + \sum d(2,7,8,9)$ using MEV technique using basic gates. **(08 Marks)**

3 a. Design a combinational circuit to find the 9's complement of a single digit BCD number. Realize the circuit using suitable logic gates. **(08 Marks)**

b. Draw the logic diagram for 2 to 4 line decoder with an active low encoder enable and active high data output. Construct a truth table and describe the circuit function with logic symbol (74139IC's) for the decoder. **(06 Marks)**

c. Design a 4 to 16 line decoder using 2 to 4 line decoder which has the active low outputs and active low enable input. Explain its operation. **(06 Marks)**

4 a. Design a binary full adder using only two input NAND gates. Write a truth table. **(06 Marks)**

b. Implement the following Boolean function using 4 : 1 multiplexer (MUX)
$Y = f(A,B,C,D) = \sum m(0,1,2,4,6,9,12,14)$ **(06 Marks)**

c. Define magnitude comparator. Design a two-bit binary comparator and implement with suitable logic gates. **(08 Marks)**

PART – B

5 a. Discuss the difference between a flip flop and latch. Explain the operation of gated SR latch with a logic diagram, truth table and logic symbol. **(06 Marks)**

b. Explain the working of Master Slave JK flip flops with functional table and timing diagram. Show how race around condition is overcome. **(08 Marks)**

c. Obtain the characteristic equation of JK and SR flipflops. **(06 Marks)**

6 a. Describe the block diagram of a MOD-7 twisted ring counter and explain its operation with the count sequence table and decoding logic used to identify the various states. **(08 Marks)**

b. Design a mod-6 synchronous counter using clocked JK flipflops, the count sequence being 0, 2, 3, 6, 5, 1, 0, 2……. **(12 Marks)**

7 a. With a suitable block diagram, explain the Mealy and Moore model, in a sequential circuit analysis. **(10 Marks)**

b. Explain 4 bit universal shift Register using 4 : 1 MUX with help of logic diagram. Write a mode control table. **(10 Marks)**

8 a. Describe the following terms with respect to sequential machines:
i) State ii) Present states iii) Next states. **(06 Marks)**

b. A sequential circuit has one input one output. The state diagram is shown in Fig. Q8 (b). Design a sequential circuit with T flip flops. **(14 Marks)**

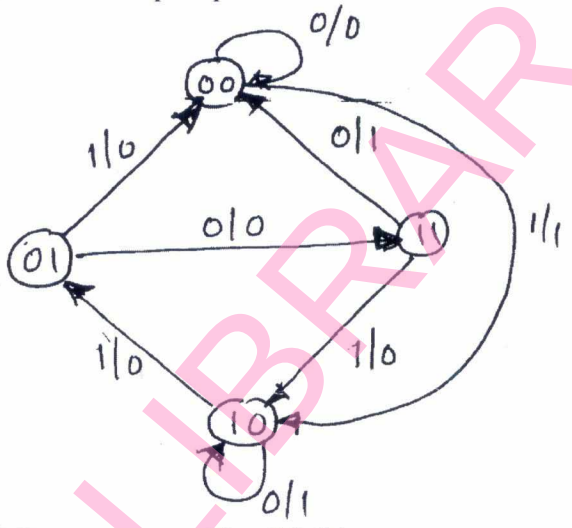

Fig. Q8 (b)

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10ES34

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Network Analysis

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Find the equivalent resistance between the terminals A and B in the network shown in Fig Q1 (a) using Star – Delta transformation. **(06 Marks)**

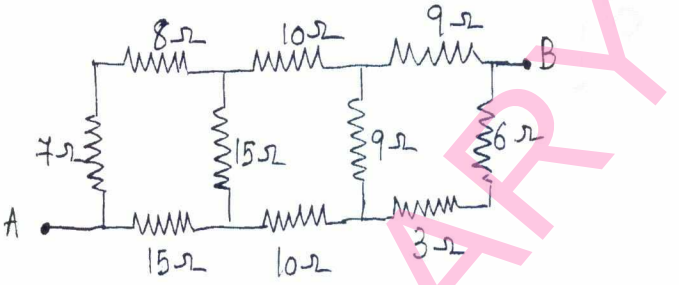


Fig. Q1(a)

b. Find the power delivered by the dependent voltage source in the circuit shown in Fig Q1 (b) by mesh current method. **(06 Marks)**

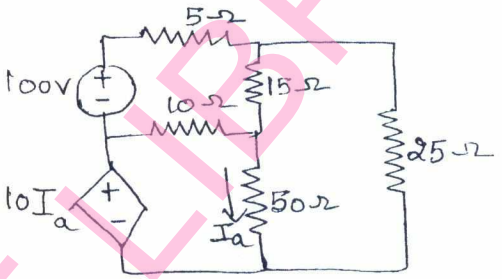


Fig. Q1(b)

c. Find the current i, in the circuit shown in Fig Q1 (c) using Nodal Analysis. **(08 Marks)**

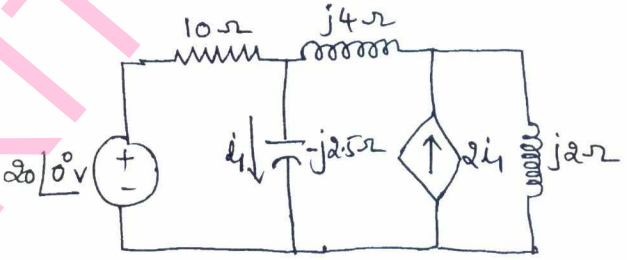


Fig. Q1(c)

2 a. Define the terms tree, cotree, link, cutset schedule and Tie set schedule. **(10 Marks)**

b. Draw the graph of the network shown in Fig Q2 (b). Write the cut set schedule and find all node voltages, branch voltages and branch currents. Assume branches (2) and (3) to form the tree. **(10 Marks)**

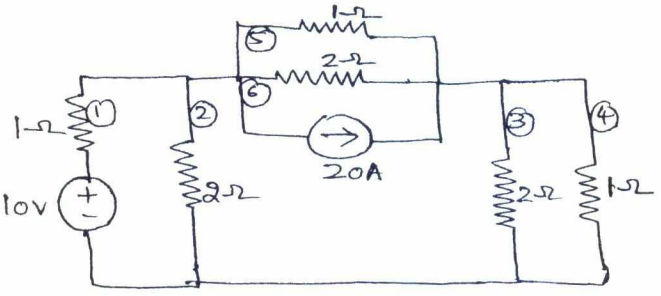


Fig. Q2(b)

3 a. Find I_x for the circuit shown in figure Q3(a) using the principle of superposition. **(06 Marks)**

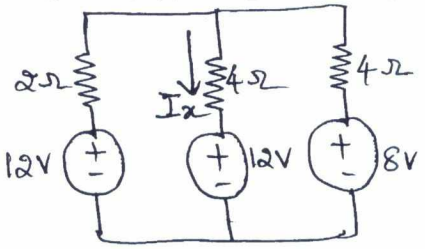


Fig. Q3(a)

b. State and explain Millman's theorem. **(06 Marks)**

c. Verify reciprocity theorem for the circuit shown in Fig Q 3(c) with response I. **(08 Marks)**

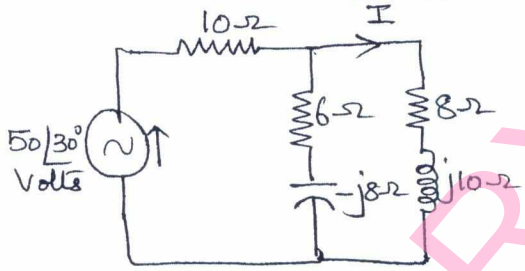


Fig. Q3(c)

4 a. State and explain the Vinin's theorem. **(06 Marks)**

b. In the circuit shown in Fig Q4(b), find the value of the current through the 667Ω resistor using Norton's theorem. **(06 Marks)**

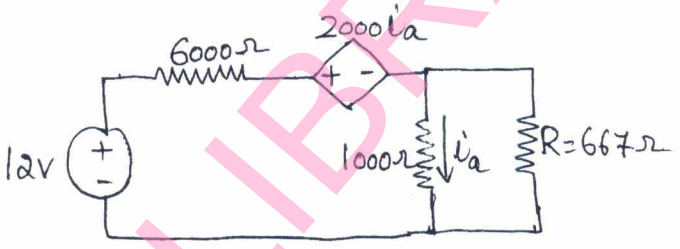


Fig Q4(b)

c. In the circuit shown in Fig Q4(c), find the value of R_L for which maximum power is delivered. Also find the maximum power that is delivered to the load R_L. **(08 Marks)**

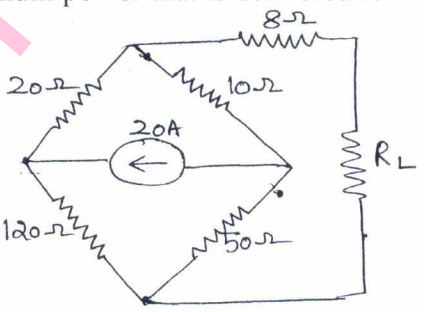


Fig. Q4(c)

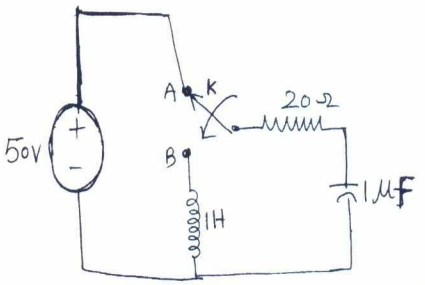
PART – B

5 a. It is required that a series RLC circuit should resonate at 500KHz. Determine the values of R, L and C if the Bandwidth of the circuit is 10KHz and its impedance is 100Ω at resonance. Also find the voltages across L and C at resonance if the applied voltage is 75 volts. **(10 Marks)**

b. Derive an expression for the resonant frequency of a parallel resonant circuit. Also shown that the circuit is resonant at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$ where R_L = Resistance in the indicator branch, R_C = Resistance in the capacitor branch. **(10 Marks)**

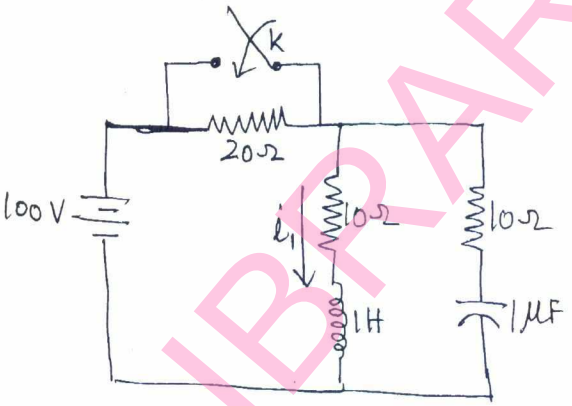
6 a. In the circuit shown in Fig Q6(a), the switch K is changed from position A to B at t = 0, steady state having been leached before switching. Calculate i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at $t = 0^+$. **(10 Marks)**

Fig. Q6(a)



b. In the Network shown in Fig Q6(b), steady state is leached with switch K open. The switch is closed at time t = 0. Solve for i_1, i_2, $\frac{di_1}{dt}$ and $\frac{di_2}{dt}$ at $t = 0^+$. **(10 Marks)**

Fig. Q6(b)



7 a. Obtain the Laplace transform of the Periodic signal shown in Fig.Q 7(a) **(10 Marks)**

Fig. Q7(a)

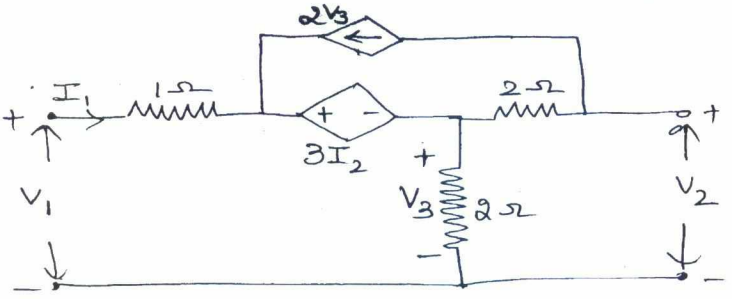
b. Find the convolution of $h(t) = e^{-t}$ and $f(t) = e^{-2t}$. **(04 Marks)**

c. State and prove the initial value theorem. **(06 Marks)**

8 a. Derive Y–parameters and Transmission parameters of a circuit in terms of its z – parameters. **(10 Marks)**

b. Find the z parameters and h – parameters for the circuit shown in Fig. Q8(b) **(10 Marks)**

Fig. Q8(b)



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10EE35

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Electrical and Electronic Measurements and Instrumentation

Time: 3 hrs. Max. Marks:100

Note: ***Answer FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. Check the following equation dimensionally. If not correct, find the error.

$$I = \frac{V\omega M}{\sqrt{(\omega^2 m^2 + R_2)^2 + \omega^2 L_1 L_2 R_1^2}}$$

Where 'M' is mutual inductance. **(10 Marks)**

b. Mention the factors on which earth resistance depends. **(03 Marks)**

c. Explain the fall of potential method used for the measurement of earth resistance. **(07 Marks)**

2 a. With a neat circuit diagram derive the balancing equation for Maxwell Inductance – Capacitance Bridge. **(05 Marks)**

b. Mention the special features of High Voltage Schering Bridge. **(05 Marks)**

c. A capacitor bushing forms arm AB of Schering Bridge and a standard capacitor of 500pF capacitance and negligible loss forms arm AD. Arm BC consists of non-inductive resistance of 300Ω. When the bridge is balanced Arm CD has a resistance of 72.6Ω, in parallel with a capacitance of 0.148μF. The supply frequency is 50Hz. Calculate the capacitance and dielectric loss angle of capacitor. **(05 Marks)**

d. An a.c bridge is balanced at 2KHz with the following components in each arm,
Arm AB = 10KΩ
Arm BC = 100μF in series with 100KΩ
Arm AD = 50KΩ
Find the unknown parameters in the Arm DC if the detector is between BD. **(05 Marks)**

3 a. What are shunts and multipliers? Derive an expression for both with reference to the meters with which they are used in electrical circuits. **(10 Marks)**

b. Draw the equivalent circuit and vector diagram of a current transformer and hence write the expression for its ratio error and phase angle error. **(08 Marks)**

c. Define transformation ratio and nominal ratio of instrument transformers. **(02 Marks)**

4 a. What is creeping? Discuss the error and adjustments in single phase energymeter. **(10 Marks)**

b. Explain the construction, working principle, advantages and disadvantages of Dynamometer type wattmeter with a neat circuit diagram. **(10 Marks)**

PART – B

5 a. With a neat sketch explain the construction and working of Weston frequency meter. **(10 Marks)**

b. Explain with a block diagram the true RMS voltmeter. **(05 Marks)**

c. Mention the advantages of electronic instruments over conventional meters. **(05 Marks)**

6 a. With a neat block diagram, explain the working of a digital storage oscilloscope. **(10 Marks)**
b. Explain with help of a block diagram, dual trace oscilloscope. **(10 Marks)**

7 a. Prove that guage factor of strain guage is given by $K = 1 + 2\mu$, where 'μ' is the Poisson's ratio. **(08 Marks)**
b. Explain the classification of transducers with the help of examples. **(06 Marks)**
c. What are the selection criteria for the transducer? **(06 Marks)**

8 a. With a neat block diagram explain the basic elements of a digital acquisition system. **(06 Marks)**
b. Write a note on LED and LCD display. **(06 Marks)**
c. With a neat diagram, explain the operation of x-y recorder. **(08 Marks)**

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10EE36

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016
Electric Power Generation

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Missing data, if any, may be suitably assumed.

PART – A

1 a. With a neat schematic diagram, explain the essential elements of high head hydroelectric power plant. **(08 Marks)**

b. Explain working of wind energy conversion system with a block diagram. **(06 Marks)**

c. Mention any three merits and three demerits of wind energy. **(06 Marks)**

2 a. Write short notes on :
i) Air pre heater
ii) condenser
iii) super heater
iv) boiler
v) turbo alternator. **(10 Marks)**

b. Explain briefly why the overall efficiency of thermal or steam power plant is very low? **(05 Marks)**

c. Mention the factors to be considered for site selection of steam power plant. **(05 Marks)**

3 a. Explain the working of gas turbine power plant with a schematic diagram. **(08 Marks)**

b. With a neat diagram, briefly explain boiling water reactor. **(06 Marks)**

c. Mention the merits and demerits of tidal power plant. **(06 Marks)**

4 a. Mention the factors which go in favour of nuclear energy. **(05 Marks)**

b. Write briefly about nuclear waste disposal. **(07 Marks)**

c. Discuss some of the safety measures incorporated for nuclear power plant. **(08 Marks)**

PART – B

5 a. Define the following terms as applied to power system.
i) Load factor
ii) diversity factor
iii) load curve
iv) load duration curve. **(08 Marks)**

b. The annual load duration curve of a certain power station can be considered as a straight line from 20 MW to 4 MW. To meet this load, three turbine generator units, two rated at 10 MW each and one rated at 5 MW are installed. Determine :
i) installed capacity
ii) plant factor
iii) units generated per annum
iv) load factor
v) utilization factor. **(06 Marks)**

c. A generating station has the following daily load cycle

Time (Hrs)	0 – 6	6 – 10	10 – 12	12 – 16	16 – 20	20 – 24
Load (MW)	40	50	60	50	70	40

Draw the load curve and find :
i) maximum demand
ii) units generated per day
iii) average load
iv) load factor. **(06 Marks)**

6 a. What are the disadvantages and causes of poor power factor? **(08 Marks)**

b. Describe the desirable characteristics of a tariff. **(06 Marks)**

c. Explain briefly two part tariff, p.f. tariff and maximum demand tariff. **(06 Marks)**

7 a. With a diagram, explain the inter connection of power stations. Also mention its merits. **(08 Marks)**

b. Write short note on :

i) Neutral grounding

ii) Earthing transformer. **(06 Marks)**

c. With neat sketches, explain the following :

i) Single bus bar system with bus sectionalizer

ii) Double bus bar system with single breaker. **(06 Marks)**

8 a. With neat sketches, explain the following :

i) Resistance grounding

ii) Reactance grounding. **(10 Marks)**

b. Discuss on the following :

i) Location of substation

ii) Substation equipment. **(10 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec.2015/Jan.2016

Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions.***

1 a. Express the following in the form a + ib,
$\frac{3}{1+i}-\frac{1}{2-i}+\frac{1}{1-i}$ and also find the conjugate. **(06 Marks)**

b. Show that $(a+ib)^n+(a-ib)^n=2(a^2+b^2)^{n/2}\cos(n\tan^{-1}(b/a))$. **(07 Marks)**

c. Find the fourth roots of $1-i\sqrt{3}$ and represent them on an argand plane. **(07 Marks)**

2 a. Find the n^{th} derivative of $\cos 2x \cos 3x$. **(06 Marks)**

b. If $y=e^{a\sin^{-1}x}$ then prove that $(1-x^2)y_{n+2}-(2n+1)xy_{n+1}-(n^2+a^2)y_n=0$. **(07 Marks)**

c. Find the n^{th} derivative of $\frac{x}{(x-1)(2x+3)}$. **(07 Marks)**

3 a. Find the angle between the radius vector and the tangent to the curve $r=a(1-\cos\theta)$ at the point $\theta=\frac{\pi}{3}$. **(06 Marks)**

b. Find the pedal equation to the curve $r=a(1+\cos\theta)$. **(07 Marks)**

c. Obtain the Maclaurin's series expansion of the function $e^x \sin x$. **(07 Marks)**

4 a. If $u=e^{x^3+y^3}$, then prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}=3u\log u$. **(06 Marks)**

b. If $u=f\left(\frac{x}{y},\frac{y}{z},\frac{z}{x}\right)$, prove that $x\frac{\partial u}{\partial x}+y\frac{\partial u}{\partial y}+z\frac{\partial u}{\partial z}=0$. **(07 Marks)**

c. If $u=x^2+y^2+z^2$, $v=xy+yz+zx$, $w=x+y+z$, find $J\left(\frac{u,v,w}{x,y,z}\right)$. **(07 Marks)**

5 a. Obtain the reduction formula for $I_n=\int_0^{\pi/2}\cos^n x\,dx$ where n is a positive integer. **(06 Marks)**

b. Evaluate : $\int_0^{2a}\int_0^{\sqrt{2ax-x^2}} xy\,dy\,dx$. **(07 Marks)**

c. Evaluate : $\int_0^1\int_0^1\int_0^1 (x+y+z)\,dx\,dy\,dz$. **(07 Marks)**

6 a. Prove that $\beta(m,n)=\frac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$. **(06 Marks)**

b. Evaluate: $\int_0^4 x^{3/2}(4-x)^{5/2}dx$. **(07 Marks)**

c. Evaluate: $\int_0^\infty x^6 e^{-3x}dx$. **(07 Marks)**

7 a. Solve: $\frac{dy}{dx}+x\sin 2y=x^3\cos^2 y$. **(06 Marks)**

b. Solve: $(e^y+y\cos xy)dx+(xe^y+x\cos xy)dy=0$. **(07 Marks)**

c. Solve: $x^2ydx-(x^3+y^3)dy=0$. **(07 Marks)**

8 a. Solve: $\frac{d^3y}{dx^3}-6\frac{d^2y}{dx^2}+11\frac{dy}{dx}-6y=0$. **(06 Marks)**

b. Solve : $(D^2-4)y=e^x+\sin 2x$. **(07 Marks)**

c. Solve : $(D^2+D+1)y=1+x+x^2$. **(07 Marks)**

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