USN | | | | | | | | | |

06MAT31

Third Semester B.E. Degree Examination, May/June 2010
Engineering Mathematics – III

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Expand the function $f(x) = x - x^2$ in the interval $-\pi < x < \pi$. Deduce that $\frac{\pi^2}{12} = \frac{1}{1^2} - \frac{1}{2^2} + \frac{1}{3^2} - \frac{1}{4^2} \ldots\ldots$ **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$. **(07 Marks)**

c. The following table gives the variations of periodic current over a period

t (sec) :	0	$T/6$	$T/3$	$T/2$	$2T/3$	$5T/6$	T
A (amp) :	1.98	1.30	1.05	1.30	-0.88	-0.25	1.98

Show that there is a direct current part of 0.75 amp in the variable current and obtain the amplitude of the 1st harmonic. **(06 Marks)**

2 a. Express the function $f(x) = \begin{cases} 1, & |x| < 1 \\ 0, & |x| > 1 \end{cases}$ as a Fourier integral and hence evaluate $\int_0^\infty \frac{\operatorname{Sin} x}{x} dx$. **(07 Marks)**

b. Find Fourier sine transform of $\frac{1}{x} e^{-ax}$. **(07 Marks)**

c. Use convolution theorem to find the inverse Fourier transform of $\frac{1}{(1+s^2)^2}$ given that $\frac{2}{1+s^2}$ is the Fourier transform of $e^{-|x|}$. **(06 Marks)**

3 a. Form the partial differential equation by eliminating the arbitrary function from $Z = y^2 + 2f\left(\frac{1}{x} + \log y\right)$. **(07 Marks)**

b. Solve $\frac{\partial^2 z}{\partial x \partial y} = \operatorname{Sin} x \operatorname{Sin} y$, given that $\frac{\partial z}{\partial x} = -2 \operatorname{Sin} y$, when x = 0; and z = 0 when y is an odd multiple of $\pi/2$. **(07 Marks)**

c. Solve $x(y^2 - z^2)p + y(z^2 - x^2)q = z(x^2 - y^2)$. **(06 Marks)**

4 a. Derive the one dimensional heat equation in the standard form. **(07 Marks)**

b. Obtain the various solutions of the Laplace's equation $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$ by the method of separation of variables. **(07 Marks)**

c. A string stretched between the two fixed points (0, 0) and (1, 0) and released at rest from the position $y = \lambda \operatorname{Sin}(\pi x)$. Show that the formula for its subsequent displacement y (x, t) is $\lambda \operatorname{Cos}(c\pi t) \operatorname{Sin}(\pi x)$. **(06 Marks)**

PART – B

5 a. Show that a real root of the equation tan x + tan hx = 0 lies between 2 and 3. Then apply the regula falsi method to find the third approximation. **(07 Marks)**

b. Apply Gauss – Jordan method to solve the system of equations:
$2x + 5y + 7z = 52$; $2x + y - z = 0$; $x + y + z = 9$. **(07 Marks)**

c. Use power method to find the dominant eigen value and the corresponding eigen vector of the matrix $A = \begin{bmatrix} 2 & -1 & 0 \\ -1 & 2 & -1 \\ 0 & -1 & 2 \end{bmatrix}$ with the initial eigen vector as $[1, 1, 1]^T$. **(06 Marks)**

6 a. Under the suitable assumptions find the missing terms in the following table:

x :	-0.2	0.0	0.2	0.4	0.6	0.8	1.0
f (x) :	2.6	-	3.4	4.28	-	14.2	29

(07 Marks)

b. Use Newton's divided difference formula to find f (4) given :

x :	0	2	3	6
f (x) :	-4	2	14	158

(07 Marks)

c. Using Simpson's $3/8^{th}$ rule, evaluate $\int_0^{0.3} \sqrt{1-8x^3}\, dx$, by taking 7 ordinates. **(06 Marks)**

7 a. Solve the variational problem $\delta \int_0^{\pi/2} \left((y)^2 - (y')^2\right) dx$ under the conditions y (0) = 0, $y\left(\pi/2\right) = 2$. **(07 Marks)**

b. Find the curve on which the function $\int_0^{\pi/2} \left[(y)^2 - (y')^2 - y \sin x\right] dx$ under the conditions $y(0) = y\left(\pi/2\right) = 0$, can be extremised. **(07 Marks)**

c. Prove that the catenary is the plane curve which when rotated about a line (x – axis) generates a surface of revolution of minimum area. **(06 Marks)**

8 a. Find the Z – transform of i) n^2 ; ii) $n\, e^{-an}$. **(07 Marks)**

b. Prove that : i) $Z(\cos n\theta) = \dfrac{z(z - \cos\theta)}{z^2 - 2z\cos\theta + 1}$; ii) $z(\sin n\theta) = \dfrac{z \sin\theta}{z^2 - 2z\cos\theta + 1}$. **(07 Marks)**

c. Find the inverse Z – transform of $\dfrac{Z}{(Z-1)(Z-2)}$. **(06 Marks)**

* * * * *

USN

06ES32

Third Semester B.E. Degree Examination, May/June 2010
Analog Electronics Circuit

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer any FIVE full questions, selecting at least TWO questions from each part.***
2. Draw equivalent circuit wherever necessary.

PART – A

1 a. Explain the different diode equivalent circuits – with necessary approximations if any. **(06 Marks)**

b. Define clipper circuit. Draw and explain symmetrical double ended diode clipper circuit with the help of transfer characteristics. **(06 Marks)**

c. A full wave rectifier using centre tapped transformer supplies a resistive load of 1 K Ω. The transformer secondary end to end voltage is 60 V rms at 50 Hz. The filer capacitance is 500 μF. Calculate : i) Ripple factor ; ii) Output resistance of the filter (Ro) ; iii) Vdc ; iv) Idc ; v) % regulation. **(08 Marks)**

2 a. Explain Emitter bias circuit, with the help of B.E. loop and C.E. loop. Write the necessary equations. **(08 Marks)**

b. Explain the circuit of a transistor switch being used as an inverter. **(05 Marks)**

c. Determine the dc bias voltage V_{CE} and the current I_C for the voltage – divider configuration of Fig.2(c), show below. **(07 Marks)**

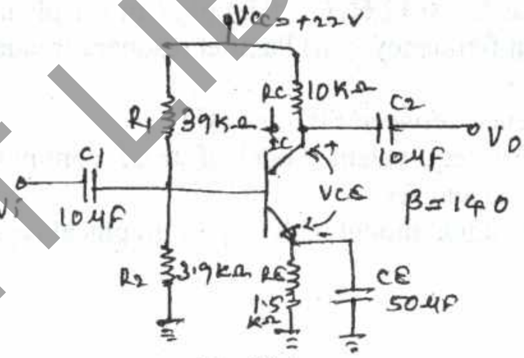

Fig.2(c).

3 a. Define h – parameters. Draw the complete hybrid equivalent circuit of a transistor. **(05 Marks)**

b. Sketch the r_e – equivalent circuit of CE fixed bias configuration and derive the expression for Ar, Ai, Zi and Zo. Show the phase relationship between input and output wave form. **(10 Marks)**

c. For common base configuration shown in Fig.3(c). Determine :
i) re ; ii) Zi ; iii) Zo ; iv) Ar ; v) Ai. **(05 Marks)**

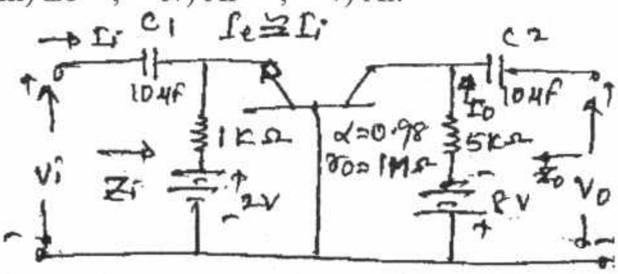

Fig.3(c)

4 a. Describe miller effect and derive an equation for miller input and output capacitances. **(10 Marks)**

b. Discuss the low frequency response of BJT amplifier and give expression for lower cut-off frequency due to C_C, C_E and C_S. **(10 Marks)**

PART – B

5 a. Draw the cascade configuration and list the advantages of this circuit. **(05 Marks)**

b. With necessary equivalent circuit diagram obtain the expression for Zin, Zo and Av for a Darlington Emitter follower. **(08 Marks)**

c. Derive expression for Zif and Zof for voltage series feed back amplifier and list the advantages of negative feed back amplifier. **(07 Marks)**

6 a. Give the definition of power amplifiers and list the types of power amplifier based on the location of 2 – point. **(04 Marks)**

b. Explain the workings of class – B push pull amplifier. Obtain an expression for maximum conversion efficiency of this amplifier. **(10 Marks)**

c. Calculate the harmonic-distoration components for an output signal having fundamental amplitude of 2.5 V, second harmonic amplitude of 0.25, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05 V and also calculate the total harmonic distoration for the amplitude components given above. **(06 Marks)**

7 a. Explain how a feed back circuit can be used as oscillators. **(04 Marks)**

b. Explain with help of circuit diagram, the working of an RC phase shift oscillator. **(08 Marks)**

c. A quartz crystal has L = 0.12 H, C = 0.04 pF, Cm = 1 pF and R = 9.2 K Ω. Find:
i) Series resonant frequency ; ii) Parallel resonant frequency. **(08 Marks)**

8 a. Discuss the difference between FET and BJT. **(04 Marks)**

b. With a necessary oc equivalent model of JFET common-drain configuration. Obtain the expression for Zi, Zo and Av. **(10 Marks)**

c. Explain FET small signal model with help of graphical representation of gm. **(06 Marks)**

* * * * *

USN | | | | | | | | | | | **06ES33**

Third Semester B.E. Degree Examination, May/June 2010
Logic Design

Time: 3 hrs. Max. Marks:100

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages. 2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

PART – A

1 a. Simplify the following expressions using k – map. Implement the simplified expression using basic gates :
i) $T = f(wxyz) = \sum m(2, 3, 4, 5, 13, 15) + \sum d(8, 9, 10, 11)$
ii) $R = f(abcd) = \pi M(2, 3, 4, 6, 7, 10, 11, 12)$. **(12 Marks)**

b. Place the following equations into proper canonical form :
i) $P = f(a, b, c) = ab' + ab' + bc$
ii) $T = f(a, b, c)\ (a + b')(b' + c)$. **(04 Marks)**

c. Define the following terms :
i) Minimum iii) Canonical sum of products
ii) Maximum iv) Canonical product of sum. **(04 Marks)**

2 a. Simplify the logic function given below using variable entered mapping (VEM) technique :
$f(a, b, c, d) = \sum m(2, 9, 10, 11, 13, 14, 15)$. **(08 Marks)**

b. Simplify the following function using Quine-McClusky minimization technique :
$T = f(a, b, c, d) = \sum m(0, 1, 2, 3, 6, 7, 8, 9, 14, 15)$. **(12 Marks)**

3 a. Design a combinational logic circuit to output the 2's compliment of a 4-bit binary numbers:
i) Construct the truth table
ii) Simplify each output function using k-map and write reduced equations
iii) Draw the resulting logic diagram. **(12 Marks)**

b. Construct a scheme to obtain a 4-to-16 line decoder using 74138 (3-8 line decoder). **(05 Marks)**

c. Write a note on encodes. **(03 Marks)**

4 a. Realize the following Boolean function $f(ABC) = \sum(0, 1, 3, 5, 7)$ using,
i) 8 : 1mux(74151)
ii) 4 : 1mux(74153). **(06 Marks)**

b. Design a comparator to check if two n-bit numbers are equal. Configure this using cascaded stage of 1 bit equality comparator. **(08 Marks)**

c. Implement full subtractor using gates and write a truth table. **(06 Marks)**

PART – B

5 a. Explain the operation of SR latch. Explain one of its applications. **(12 Marks)**

b. Draw the logic diagrams for
i) Gated SR latch iii) Master slave JK flip flop
ii) Master slave SR flip flop iv) Positive edge triggered 'D' flip flop. **(08 Marks)**

6 a. Differentiate between combinational logic circuit and sequential logic circuits. **(03 Marks)**

b. Explain universal shift register with the help of logic diagram, mode control table and symbol. **(09 Marks)**

c. Explain Jonson counter, with its circuit diagram, and timing diagram. **(08 Marks)**

7 a. Explain Moore and Meclay models for clocked synchronous sequential circuits. **(10 Marks)**
b. Construct the excitation table, transition table, state table and state diagram, for the Moore sequential circuit shown in Fig. Q7(b). **(10 Marks)**

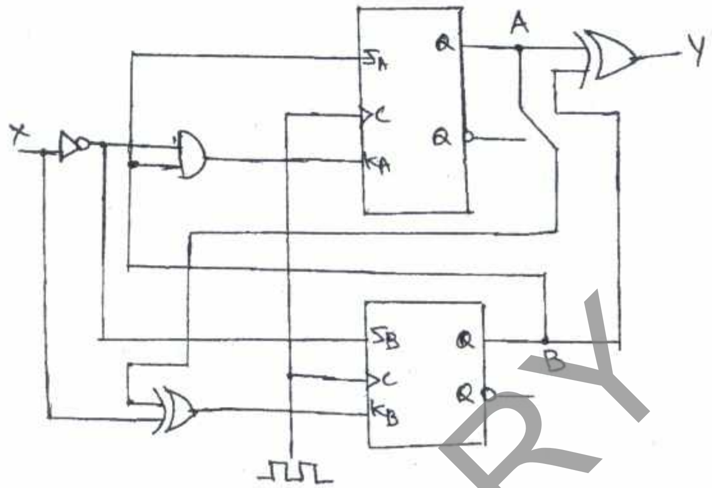

Fig. Q7(b)

8 a. Write a note on construction of state diagram. **(05 Marks)**
b. Design a counter using JK-flip flops whose counting sequence is 000, 001, 100, 110, 111, 101, 000 etc., by obtaining its minimal sum equations. **(10 Marks)**
c. Write a note on characteristic equations. **(05 Marks)**

* * * * *

USN

06ES34

Third Semester B.E. Degree Examination, May/June 2010
Network Analysis

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Using Y-Δ transformation, find an equivalent resistance between A and B for the network shown in Fig.Q1(a). **(06 Marks)**

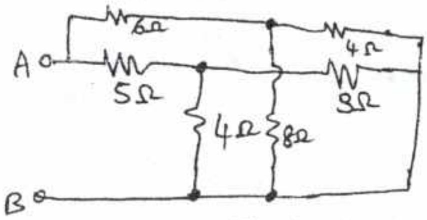

Fig.Q1(a)

Fig.Q1(b)

b. For the network shown in Fig.Q1(b), find the current through 4Ω and 6Ω resistors. (Use mesh analysis). **(07 Marks)**

c. By using the nodal analysis, find the voltage V_{AB} for the network shown in Fig.Q1(c).

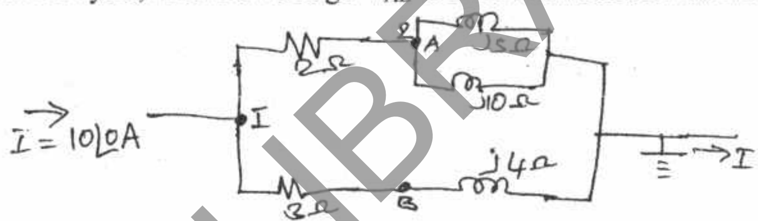

Fig.Q1(c) **(07 Marks)**

2 a. For the network shown in Fig.Q2(a), write the Tie set matrix and obtain the network equilibrium equations in matrix form, using KVL. Calculate the loop currents and branch voltages. Choose AD, BD and CD as tree branches (4, 5, 6 branches). **(08 Marks)**

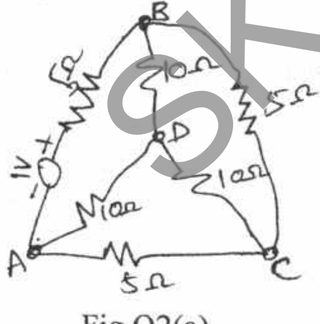

Fig.Q2(a)

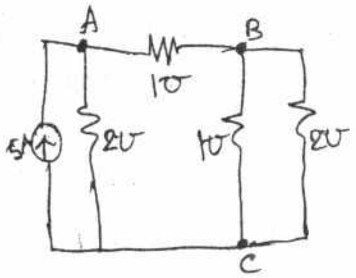

Fig.Q2(b)

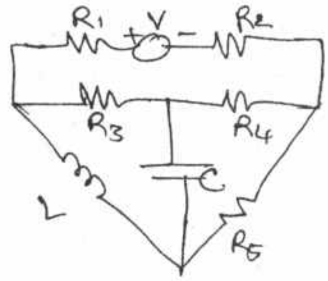

Fig.Q2(c)

b. For the network shown in Fig.Q2(b), write the f-cutset matrix and hence obtain the equilibrium equations on node basis. Choose AC and BC as twigs. **(08 Marks)**

c. For the network shown in Fig.Q2(c), draw the dual network. **(04 Marks)**

3 a. State and explain (i) Reciprocity theorem (ii) Millman's theorem as applied to electrical circuits. **(10 Marks)**

b. By using superposition principle, find the current through the (4+j3) impedance as shown in Fig.Q3(b). **(10 Marks)**

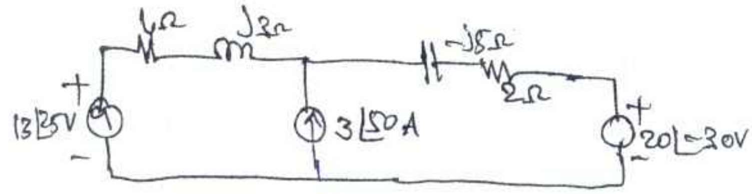

Fig.Q3(b)

4 a. Find the current in the 10Ω resistor in the network shown in Fig.Q4(a), by using Thevenin's theorem. **(06 Marks)**

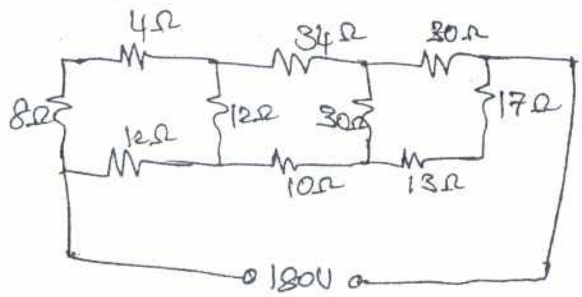

Fig.Q4(a)

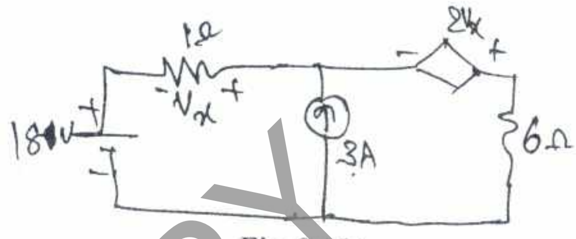

Fig.Q4(b)

b. For the network shown in Fig.Q4(b), find the Thevenin's voltage, short circuit current and determine the actual current flowing through the 6Ω resistor. **(07 Marks)**

c. Find the maximum power transferred to the load Z_L of the network shown in Fig.Q4(c).

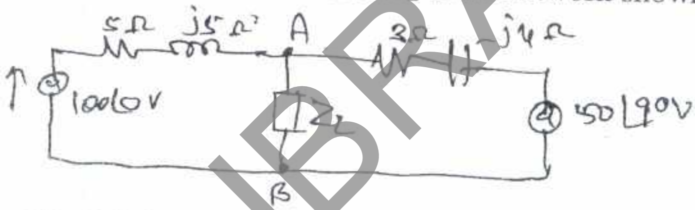

Fig.Q4(c)

(07 Marks)

PART – B

5 a. Determine i) the line current, ii) the power factor and iii) the voltage across the coil, when a coil of resistance 40Ω and inductance of 0.75H forms a part of a series circuit, for which the resonant frequency is 55Hz, if the supply is 250V, 50Hz. **(08 Marks)**

b. Give the comparison between the series resonance and parallel resonance. **(04 Marks)**

c. Derive an expression for the resonance frequency of a resonant circuit consisting of $R_L L$ in parallel with $R_C C$. Draw the frequency response curve of the above circuit, indicating the half power frequencies. **(08 Marks)**

6 a. In the network shown in Fig.Q6(a), K is changed from position a to b, at t = 0. Solve for i, $\frac{di}{dt}$ and $\frac{d^2i}{dt^2}$ at t = 0+, if R = 1000Ω, L = 1 H, C = 0.1 μF and V = 100V. Assume that the capacitor is initially uncharged. **(10 Marks)**

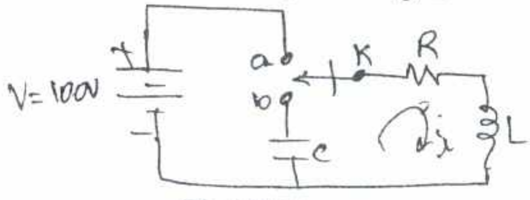

Fig.Q6(a)

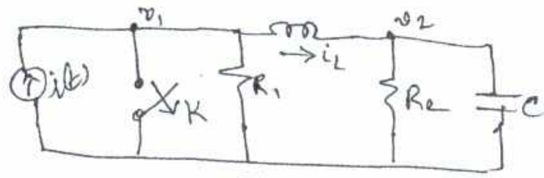

Fig.Q6(b)

6 b. The network shown in Fig.Q6(b), has two independent node pairs; of the switch K is opened at $t = 0$, find the following quantities at $t = 0+$.
i) v_1 ii) v_2 iii) dv_1/dt iv) dv_2/dt v) di_L/dt **(10 Marks)**

7 a. In the network shown in Fig.Q7(a), the switch 'K' is closed and the steady state is reached. At $t = 0$, the switch is opened. Find the expression for the current in the inductor using Laplace transform. **(10 Marks)**

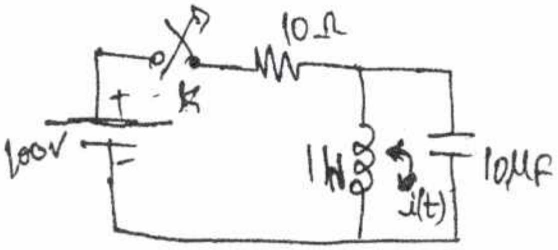

Fig.Q7(a)

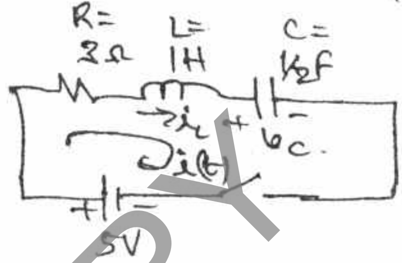

Fig.Q7(b)

b. For the series RLC circuit shown in Fig.Q7(b), the initial conditions are $i_{Lo} = 2A$ and v_{Co}=2V. It is connected to a DC voltage of 5V at $t = 0$. Find the current i(t) after the switching action, using Laplace transform. **(10 Marks)**

8 a. The bridged T-RC network is shown in Fig.Q8(a). For the values given, find the Y and Z parameters. **(10 Marks)**

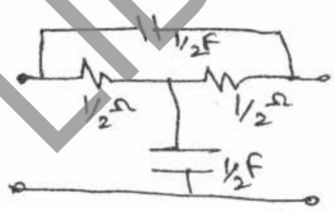

Fig.Q8(a)

b. For the network shown in Fig.Q8(b), determine the ABCD parameters. **(10 Marks)**

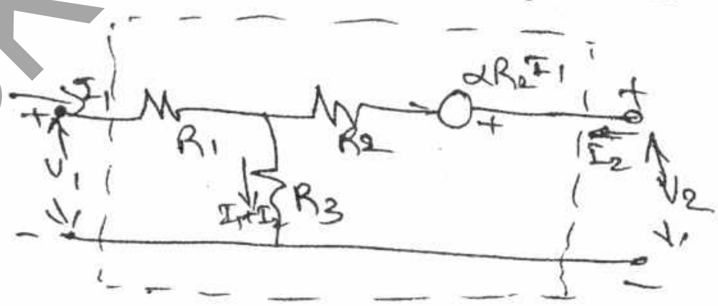

Fig.Q8(b)

* * * * *

USN										

06ES36

Third Semester B.E. Degree Examination, May/June 2010

Field Theory

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the term 'Electric field intensity' and derive the expression for field due to an infinite line of charge. **(12 Marks)**

b. Given $\vec{D} = 5r\hat{a}_r\ c/m^2$, prove divergence theorem for a shell region enclosed by spherical surfaces at r = a and r = b (b>a) and centered at the origin. **(08 Marks)**

2 a. Prove that the energy density in an electrostatic field is given by $\frac{1}{2} \in \vec{E}^2\ J/m^3$. **(08 Marks)**

b. Given $V = 2x^2y - 5z$ at point P(-4, 3, 6). Find the potential, electric field intensity and volume charge density. **(08 Marks)**

c. Derive the boundary conditions for $\vec{E}$ and $\vec{D}$ between two dielectrics. **(04 Marks)**

3 a. State and prove uniqueness theorem. **(10 Marks)**

b. Derive the expression for capacitance of a coaxial cable using Laplace's equation. **(10 Marks)**

4 a. State and explain Biot-Savart law for a small differential current element. **(04 Marks)**

b. Derive the expression for magnetic flux density on the axis of a circular loop of radius 'a' carrying current I using Biot Savart law. **(07 Marks)**

c. Vector magnetic potential in free space is given by $\vec{A} = 100e^{1.5}\hat{a}_z$ Wb/m. Find the magnetic field intensity and current density and hence prove Ampere's circuital law for $\rho = 1$. **(09 Marks)**

PART – B

5 a. Deduce the expression for inductance of a toroidal coil having N turns and carrying a current of I amps. **(06 Marks)**

b. A point charge Q = 18 nC has a velocity of 5×10^6 m/s in the direction $\hat{a} = 0.6\hat{a}_x + 0.75\hat{a}_y + 0.3\hat{a}_z$. Calculate the magnitude of the force exerted on the charge by the field $\vec{B} = -3\hat{a}_x + 4\hat{a}_y + 6\hat{a}_z$ mT. **(06 Marks)**

c. A sq. loop carrying 2 mA current is placed in the field of an infinite filament carrying current of 15 Amp as shown, fig. Q5 (c). Find the force exerted on the sq.loop. **(08 Marks)**

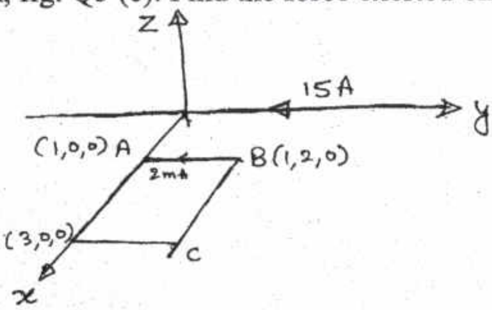

Fig. Q5 (c)

6 a. What do you mean by displacement current and equation of continuity? Derive Maxwell's I equation fro Ampere's circuital law. **(08 Marks)**

b. Write Maxwell's equations in point form and integral form. **(06 Marks)**

c. A 9.375 GHz uniform plane wave is propagating in polyethylene ($\epsilon_r = 2.26$). If the amplitude of the $\vec{E}$ is 500 V/m and the material is assumed to be lossless, find

i) Phase constant ii) Wavelength iii) Velocity of propagation
iv) Intrinsic impedance v) Magnetic field intensity **(06 Marks)**

7 a. What is meant by 'uniform plane wave'? Derive the expression for UPW in free space. **(07 Marks)**

b. Deduce the expressions for α and β for a wave traveling in lossy medium. **(07 Marks)**

c. A 100 V/m wave of frequency 300 MHz is traveling through a lossy medium having $\epsilon_r = 9$, $\mu_r = 1$ and $\sigma = 10$ S/m. Find the power dissipated over a distance of 1 μm with surface area of 2 m^2. **(06 Marks)**

8 Write short notes on:

a. Poynting's theorem.

b. Reflection of plane waves at normal incidence. **(20 Marks)**

* * * * *

USN | | | | | | | | | | |

MATDIP301

Third Semester B.E. Degree Examination, May/June 2010
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Express the complex number $\frac{(1+i)(1+3i)}{1+5i}$ in the form x + iy. **(06 Marks)**

b. Prove that $(1+i)^n + (1-i)^n = 2^{\frac{n}{2}+1}\cos\left(\frac{n\pi}{4}\right)$. **(07 Marks)**

c. Expand $\cos^8\theta$ in a series of cosines multiples of θ. **(07 Marks)**

2 a. Find the n^{th} derivative of $e^{ax}\sin(bx+c)$. **(06 Marks)**

b. If y = a cos (log x) + b sin (log x), prove that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2+1)y_n = 0$. **(07 Marks)**

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

3 a. State Taylor's theorem and expand the polynomial $2x^3 + 7x^2 + x - 6$ in powers of (x -1). **(06 Marks)**

b. Expand tan x in ascending powers of x using MacLaurin's theorem upto the term containing x^4. **(07 Marks)**

c. If $Z = \frac{x^2+y^2}{x+y}$ prove that $\left(\frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)^2 = 4\left(1 - \frac{\partial z}{\partial x} - \frac{\partial z}{\partial y}\right)$. **(07 Marks)**

4 a. If $u = \tan^{-1}\left(\frac{x^3+y^3}{x-y}\right)$, prove that $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} = \sin 2u$. **(06 Marks)**

b. If u = f(x, y) where x = r cos θ and y = r sin θ, prove that $\left(\frac{\partial u}{\partial x}\right)^2 + \left(\frac{\partial u}{\partial y}\right)^2 = \left(\frac{\partial u}{\partial r}\right)^2 + \frac{1}{r^2}\left(\frac{\partial u}{\partial \theta}\right)^2$. **(07 Marks)**

c. If $u = x^2 - 2y$, v = x + y + z and w = x – 2y + 3z, find the value of $J\left(\frac{u, v, w}{x, y, z}\right)$. **(07 Marks)**

5 a. Obtain the reduction formula for $\int \sin^m x \cos^n x \, dx$. **(06 Marks)**

b. Evaluate $\int_0^a \frac{x^7}{\sqrt{a^2-x^2}} dx$. **(07 Marks)**

c. Evaluate $\int_0^1 \int_0^x e^{\left(\frac{y}{x}\right)} dy\, dx$. **(07 Marks)**

6 a. Evaluate $\int_0^1 \int_0^{\sqrt{1-x^2}} \int_0^{\sqrt{1-x^2-y^2}} xyz\,dz\,dy\,dx$. **(06 Marks)**

b. Prove that $\beta(m,n) = \dfrac{\Gamma(m)\,\Gamma(n)}{\Gamma(m+n)}$. **(07 Marks)**

c. Show that $\int_0^{\pi/2} \sqrt{\sin\theta}\,d\theta \times \int_0^{\pi/2} \dfrac{d\theta}{\sqrt{\sin\theta}} = \pi$. **(07 Marks)**

7 a. Solve $3e^x \tan y\,dx + (1 - e^x)\sec^2 y\,dy = 0$. **(06 Marks)**

b. Solve $x^2 y\,dx = (x^3 + y^3)\,dy$. **(07 Marks)**

c. Solve $x\dfrac{dy}{dx} + y = x^3 y^6$. **(07 Marks)**

8 a. Solve $\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} = x^2 + 2x + 4$. **(06 Marks)**

b. Solve $\dfrac{d^2y}{dx^2} + 3\dfrac{dy}{dx} + 2y = 4\cos^2 x$. **(07 Marks)**

c. Solve $\dfrac{d^3y}{dx^3} + 2\dfrac{d^2y}{dx^2} + \dfrac{dy}{dx} = e^{-x} + \sin 2x$. **(07 Marks)**

* * * * *