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06MAT31

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Engineering Mathematics - III

Time: 3 hrs. Max. Marks:100

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

Part A

1 a. Find the Fourier series for the function $f(x)=x+x^2$ from $x=-\pi$ to $x=\pi$ and deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+\ldots\ldots$ (07 Marks)

b. Obtain the cosine half-range Fourier series for $f(x)=Kx, \quad \text{in } 0\le x\le l/2$ $=K(l-x) \text{ in } l/2\le x\le l$. (07 Marks)

c. The following table gives the variating 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 first harmonic. (06 Marks)

2 a. Obtain the finite Fourier Cosine transform of the function $f(x)=e^{ax}$ in $(0, l)$. (07 Marks)

b. Find the Fourier sine and cosine transforms of

$$f(x)=\begin{cases}x, & 0<x<2\\ 0, & \text{otherwise}\end{cases}.$$ (07 Marks)

c. Solve the integral equation,

$$\int_0^\infty f(x)\cos(\alpha x)dx=\begin{cases}1-\alpha, & 0\le\alpha\le 1\\ 0, & \alpha>1\end{cases}.$$

Hence evaluate $\int_0^\infty \frac{1-\cos x}{x^2}dx$. (06 Marks)

3 a. Form the P.D.E by eliminating the arbitrary function from $z=y^2+2f\left(\frac{1}{x}+\log y\right)$. (07 Marks)

b. Solve $x^2\frac{\partial u}{\partial x}+y^2\frac{\partial u}{\partial y}=0$ by the method of separation of variables. (07 Marks)

c. Solve $(y^2+z^2)p+x(yq-z)=0$. (06 Marks)

4 a. Derive the one dimensional heat equation. (07 Marks)

b. Solve the wave equation $\frac{\partial^2 u}{\partial t^2}=C^2\frac{\partial^2 u}{\partial x^2}$ given $u(0,t)=0$; $u(l,t)=0$; $\frac{\partial u}{\partial t}=0$ when $t=0$ and $u(x,0)=u_0\sin\frac{\pi x}{l}$. (07 Marks)

c. Obtain the various possible solutions of the Laplace's equation $u_{xx}+u_{yy}=0$ by the method of separation of variables. (06 Marks)

Part B

5 a. Find the real root of the equation $3x = \cos x + 1$ correct to four decimal places using Newton's method. **(07 Marks)**

b. Solve the system of equations,

$2x + y + z = 10$

$3x + 2y + 3z = 18$

$x + 4y + 9z = 16$

by Gauss-Jordan method. **(07 Marks)**

c. Find the largest eigen value and the corresponding eigen vector of the following matrix by using power method.

$$A = \begin{bmatrix} 2 & 0 & 1 \\ 0 & 2 & 0 \\ 1 & 0 & 2 \end{bmatrix}$$

Taking $[1 \quad 0 \quad 0]^T$ as the initial eigen vector. Carry out four iterations. **(06 Marks)**

6 a. Given f(0) = 1, f(1) = 3, f(2) = 7, f(3) = 13. Find f(0.1) and f(2.9) using Newton Interpolation formula. **(07 Marks)**

b. Using Newton's divided difference formula evaluate f(8) and f(15), given that **(07 Marks)**

x	4	5	7	10	11	13
f(x)	48	100	294	900	1210	2028

c. Evaluate $\int_4^{5.2} \log_e x\,dx$ by using Weddle's rule, taking 7 ordinates. **(06 Marks)**

7 a. Derive the Euler's equation in the form $\frac{\partial f}{\partial y} - \frac{d}{dx}\left(\frac{\partial f}{\partial y'}\right) = 0$. **(07 Marks)**

b. Find the extremal of the functional $\int_0^{\pi/2} \left[y^2 - (y')^2 - 2y\sin x\right] dx$ under the conditions $y(0) = y\left(\frac{\pi}{2}\right) = 0$. **(07 Marks)**

c. Find the geodesics on a surface, given that the arc length on the surface is $s = \int_{x_1}^{x_2} \sqrt{x\left[1 + (y')^2\right]}\,dx$. **(06 Marks)**

8 a. Find the z-transforms of i) $(n+1)^2$ ii) $\sin(3n+5)$. **(07 Marks)**

b. Obtain the inverse Z transform of $\frac{2z^2 + 3z}{(z+2)(z-4)}$. **(07 Marks)**

c. Solve the difference equation,

$y_{n+2} + 6y_{n+1} + 9y_n = 2^n$ with $y_0 = y_1 = 0$ using Z transforms. **(06 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

1 a. Find the n^{th} derivative of – i) $\cos(ax+b)$ ii) $\log(ax+b)$. **(06 Marks)**

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

c. If $y = \tan^{-1} x$ prove that : $(1+x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$. **(07 Marks)**

2 a. With usual notation prove that $\tan\phi = r\frac{d\theta}{dr}$. **(06 Marks)**

b. Find the angle between the pairs of curves : $r = 6\cos\theta$ $r = 2(1+\cos\theta)$. **(07 Marks)**

c. Obtain Maclaurin's series expansion of the function $e^x \sin x$ up to the term containing x^4. **(07 Marks)**

3 a. If $u = \phi(x+ay) + \Psi(x-ay)$, prove that $\frac{\partial^2 u}{\partial y^2} = a^2\frac{\partial^2 u}{\partial x^2}$. **(07 Marks)**

b. Verify Euler's theorem for the function: $u = x\tan^{-1}\left(\frac{y}{x}\right)$. **(06 Marks)**

c. If $x = r\cos\theta$, $y = r\sin\theta$ find $\frac{\partial(r,\theta)}{\partial(x,y)}$ in terms of r. **(07 Marks)**

4 a. Find the reduction formula for $\int \sin^n x\,dx$. **(06 Marks)**

b. Find the value of $\int_0^1 \left(\frac{x^4}{\sqrt{4-x^2}}dx\right)$. **(07 Marks)**

c. Evaluate $\int_0^1\int_{x^2}^{x}(x^2+3y+2)dydx$. **(07 Marks)**

5 a. Prove that $\Gamma\left(\frac{1}{2}\right) = \sqrt{\pi}$. **(06 Marks)**

b. Prove that $\beta(m,n) = 2\int_0^{\pi/2}\sin^{2m-1}\theta\cos^{2n-1}\theta\,d\theta$ and hence evaluate $\int_0^{\pi/2}\sqrt{\tan x}dx$. **(07 Marks)**

c. Prove that $\int_0^\infty \sqrt{x}e^{-x^2}dx \times \int_0^\infty \frac{e^{-x^2}}{\sqrt{x}}dx = \frac{\pi}{2\sqrt{2}}$. **(07 Marks)**

6 a. Solve $(4x+y+1)^2 = \frac{dy}{dx}$ **(06 Marks)**

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

c. Solve $\frac{dy}{dx} = e^{x-y}(e^x - e^y)$. **(07 Marks)**

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

b. Solve $\frac{d^2y}{dx^2} + 4\frac{dy}{dx} + 5y = 2\cosh x$. **(07 Marks)**

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

8 a. Find the modulus and amplitude of $(1-\cos\alpha+i\sin\alpha)$. **(06 Marks)**

b. Prove that $(1+\cos\theta+i\sin\theta)^n + (1+\cos\theta-i\sin\theta)^n = 2^{n+1}\cos^n\frac{\theta}{2}\cos\frac{n\theta}{2}$. **(07 Marks)**

c. Prove that $\sin^7\theta = -\frac{1}{64}(\sin 7\theta - 7\sin 5\theta + 21\sin 3\theta - 35\sin\theta)$. **(07 Marks)**

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06ES32

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

1 a. What do you understand by 'reverse recovery time' of a diode? Explain. **(05 Marks)**

b. The input voltage V_i to the two level clipper circuit [as shown in Fig. Q1(b)] varies linearly from o to 150 V. Sketch the output voltage V_0 to the time scale. Assume diodes as ideal.

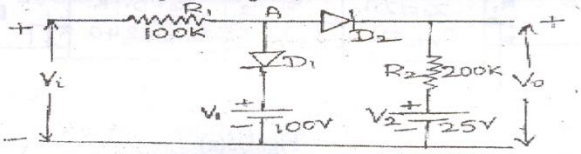

Fig. Q1(b) **(10 Marks)**

c. Draw and explain the working of the clamper circuit which clamps the positive peak of a signal to zero volts. **(05 Marks)**

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

b. Derive an expression for the stability factor, S(Ico), of the voltage divider Bias circuit. **(06 Marks)**

c. In the circuit of Fig. Q2(c) $V_{CC} = 10$ V, $R_C = 1.5$ kΩ, $I_C = 2$ mA, $V_{CE} = 5$ V, $V_{BE} = 0.7$V, $\beta = 50$ and stability factor S = 5, find R_1 and R_2.

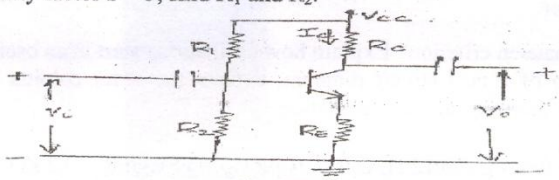

Fig. Q2(c) **(09 Marks)**

3 a. Derive the expressions for A_V, A_I, Z_i and Z_o for CE fixed bias configuration using complete hybrid equivalent model. **(12 Marks)**

b. For common base amplifier shown in Fig Q3(b), determine Z_i, A_I, A_V and Z_o using complete hybrid equivalent model.

Given $h_{ie} = 1.6k\Omega$, $h_{fe} = 110$ **(08 Marks)**

$h_{re} = 2 \times 10^{-4}$, $h_{oe} = 20\ \mu S$.

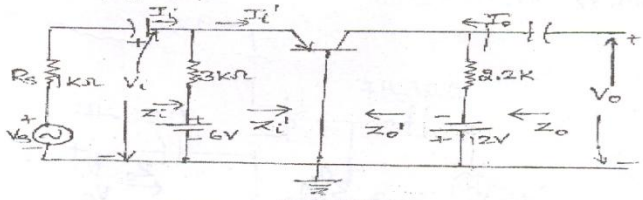

Fig. Q3(b)

4 a. The input power to a device is 10,000 W at a voltage of 1000 V. The out put power is 500W and the output impedance is 20Ω.

i) Find power gain in decibels, ii) Find voltage gain in decibels. **(04 Marks)**

b. Describe miller effect and derive an equation for miller input and output capacitances.

c. Discuss the factors that affect the low frequency response of a BJT–CE amplifier. **(10 Marks)**

5 a. Fig. Q5(a) shows cascading of an emitter follower circuit and a common base circuit. Find
i) The loaded gain of each stage
ii) The total gain for the system, A_V and A_{VS}.
iii) The total current gain for the system
iv) The total gain far the system if the emitter follower circuit were removed. **(09 Marks)**

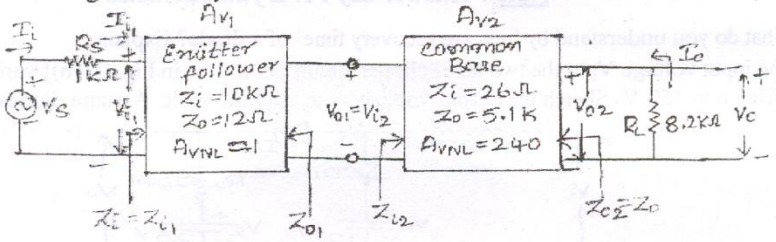

Fig. Q5(a)

b. Show that negative feedback increases the bandwidth of an amplifier. **(06 Marks)**
c. Derive an expression for output resistance of a voltage series feedback amplifier. **(05 Marks)**

6 a. With the help of a circuit diagram, explain the working of class–B pushpull amplifier. Obtain an expression for maximum conversion efficiency of this amplifier. **(09 Marks)**
b. Discuss the different types of power amplifiers. **(05 Marks)**
c. For distortion readings of $D_2 = 0.15$, $D_3 = 0.01$ and $D_4 = 0.05$ with $I_1 = 3.3$ Amps and $R_C = 4\Omega$. Find – i) Total harmonic distortion D, ii) Fundamental power component, iii) Total power. **(06 Marks)**

7 a. What is Barkhausen criterion? Explain how oscillations start in an oscillator. **(07 Marks)**
b. With the help of a neat circuit diagram, explain transistor colpitts oscillator. Write the expression for the frequency of oscillation. **(08 Marks)**

c. A quartz crystal has L = 0.12 H, C = 0.04 pF C_M = pF and R = 9.2 kΩ. Find
i) Series resonant frequency, ii) Parallel resonant frequency. **(05 Marks)**

8 a. Discuss the differences between FET and BJT. **(04 Marks)**
b. Derive the expressions for Z_i, Z_o and A_V for common drain JFET amplifier. **(09 Marks)**
c. A dc analysis of source follower network shown in Fig. Q8(c) results in $V_{GSQ} = -2.86$ V and $I_{DQ} = 4.56$ mA. Determine
i) g_m, ii) r_d, ii) Z_i, iv) Z_o with and without r_d, v) A_V with and without r_d.
$I_{DSS} = 16$mA, $V_P = -4$V, $Y_{OS} = 25$ μS.

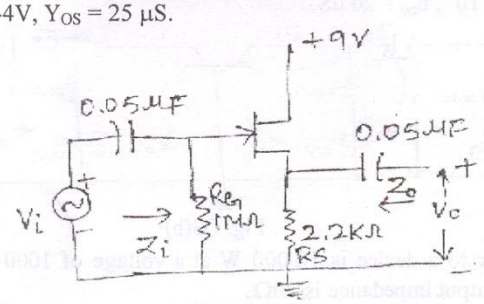

Fig. Q8(c) **(07 Marks)**

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06ES33

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Logic design

Time: 3 hrs. Max. Marks:100

Note : *1. Answer any FIVE full questions.*
2. Assume missing data if any suitably.

1 a. Two motors M_2 and M_1 are controlled by three sensors S_3, S_2 and S_1. One motor M_2 is to run any time all three sensors are on. The other motor is to run whenever sensors S_2 or S_1 but not both are on and S_3 is off. For all sensor combinations where M_1 is on, M_2 is to be off except when all the three sensors are off and then both motors must remain off. Construct the truth table and write the Boolean output equation. **(06 Marks)**

b. Simplify using Karnaugh map. Write the Boolean equation and realize using NAND gates. $D = f(w,x,y,z) = \Sigma(0,2,4,6,8) + \Sigma d(10,11,12,13,14,15)$. **(06 Marks)**

c. Simplify $P = f(a,b,c,) = \Sigma(0,1,4,5,7)$ using two variable Karnaugh map. Write the Boolean equation and realize using logic gates. **(08 Marks)**

2 a. Simplify using Karnaugh map $L = f(a,b,c,d) = \pi(2,3,4,6,7,10,11,12)$ **(06 Marks)**

b. Simplify using Quine Mc Cluskey tabulation algorithm-
$V = f(a,b,c,d) = \Sigma(2,3,4,5,13,15) + \Sigma d(8,9,10,11)$ **(14 Marks)**

3 a. Design a combinational circuit that will multiply two two-bit binary values. **(08 Marks)**

b. Design a 4 to 16 decoder using two 3 to 8 decoder (74LS138). **(06 Marks)**

c. Design a keypad interface to a digital system using ten line BCD encoder (74LS147). **(06 Marks)**

4 a. Design a binary full subtractor using minimum number of gates. **(06 Marks)**

b. Explain the terms
i) Ripple – carry propagation
ii) Propagation delay
iii) Look- ahead carry
iv) Iterative design. **(04 Marks)**

c. Realize $F = f(x,y,z,) = \Sigma(1,2,4,5,7)$ using 8 – to – 1 multiplexer (74LS151). **(04 Marks)**

d. Design a two bit binary magnitude comparator. **(06 Marks)**

5 a. Explain with timing diagram the working of a S. R latch as a switch debouncer. **(06 Marks)**

b. Explain the working of a Master – slave JK Flip-Flop with functional table and timing diagram. Show how race around condition of master-slave SR Flip-Flop is over come. **(08 Marks)**

c. What is the significance of edge triggering? Explain the working of edge triggered D-flip-flop and T-flip-flop with their functional table. **(06 Marks)**

6 a. Obtain the characteristic equation for a SR flip-flop **(04 Marks)**

b. With a neat circuit diagram, explain the working of a universal shift register. **(08 Marks)**

c. Design a synchronous Mod-6 counter using clocked J K flip-flop. **(08 Marks)**

7 a. Explain mealy and Moore sequential circuit models. **(04 Marks)**

b. For the state machine M_1 shown in Fig. Q 7(b), obtain

i) State table
ii) Transition table
iii) Exaltation table for T flip-flop
iv) Logic circuit for T exaltation realization.

(16 Marks)

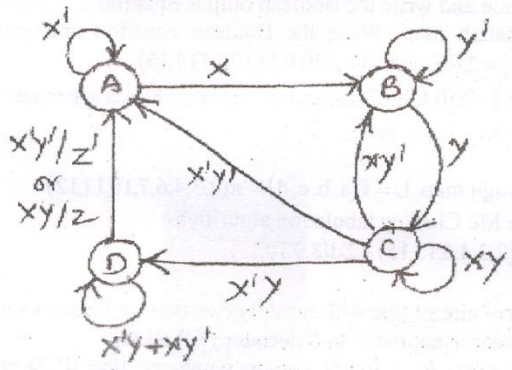

Fig. Q 7(b)

8 a. Construct a mealy state diagram that will detect a serial sequence of 10110. When the input pattern has bee detected, cause an output Z to be asserted high. **(08 Marks)**

b. Design a cyclic modulo-8 synchronous counter using J–K flip-flop that will count the number of occurrences of an input; that is, the number of times it is a 1. The input variable X must be coincident with the clock to be counted. The counter is to count in binary. **(12 Marks)**

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06ES34

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Network Analysis

Time: 3 hrs. Max. Marks:100

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

1 a. Calculate the current through 2 ohm resistor in the network shown in figure Q1(a) by source transformation method. **(06 Marks)**

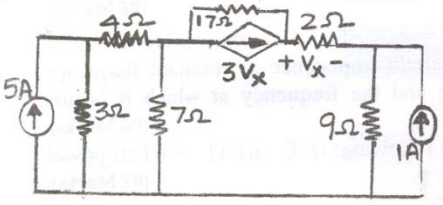

Fig. Q1 (a)

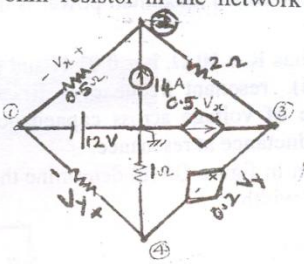

Fig. Q1 (b)

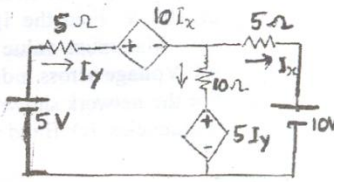

Fig. Q1 (c)

b. Find the voltages at nodes 1, 2, 3, 4 for the network shown in figure Q1 (b) using nodal analysis. **(07 Marks)**

c. Using mesh analysis find the current through 10 ohm resistor in the network shown in figure Q1 (c). **(07 Marks)**

2 a. Find the maximum possible number of trees for the network shown in figure Q2 (a).

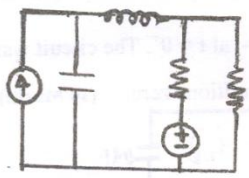

Fig. Q2 (a)

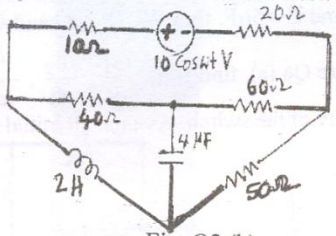

Fig. Q2 (b)

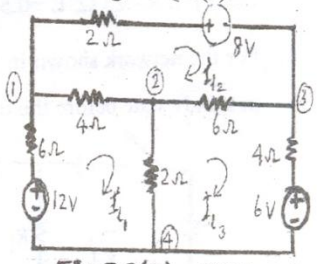

Fig Q 2(c)

b. Draw the dual of the network shown in figure Q2 (b). **(06 Marks)**

c. For the network shown in figure Q2 (c), calculate I_{l_1}, I_{l_2}, I_{l_3} using graph theory and network equilibrium equation based on KVL. **(10 Marks)**

3 a. Using superposition principle, find the current in 6 ohm resistor in the network shown in figure Q3 (a). **(06 Marks)**

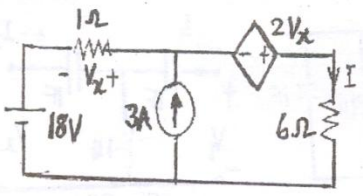

Fig. Q3 (a)

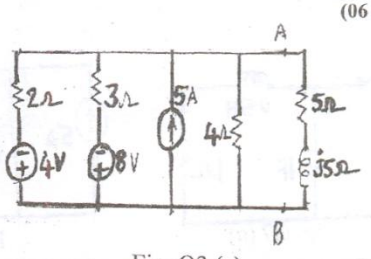

Fig. Q3 (c)

b. State and explain reciprocity theorem. **(07 Marks)**

c. Find Thevenin's equivalent circuit across AB using Millman's theorem and find the current through the load (5+J5)Ω shown in figure Q3 (c). **(07 Marks)**

4 a. Calculate Thevenin's equivalent circuit across AB for the network shown in figure Q4 (a). **(07 Marks)**

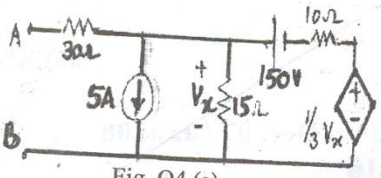

Fig. Q4 (a)

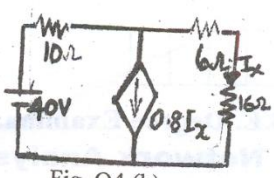

Fig. Q4 (b)

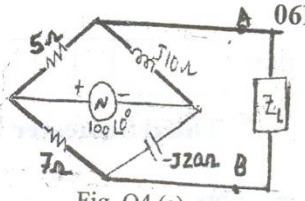

Fig. Q4 (c)

b. State Norton's theorem and find the current through 16 ohm resistor using Norton's theorem in figure Q4 (b). **(07 Marks)**

c. Find the value of Z_L for which maximum power is transferred to the load Z_L from the network in figure Q4 (c). **(06 Marks)**

5 a. A series RLC circuit has R = 50 Ω, L = 0.01 H and C = 0.04 μF and is connected to ac source of 100 V. Find the i) resonant frequency ii) Circuit impedance at resonant frequency iii) Maximum value of voltage across capacitance and the frequency at which it occurs iv) Voltage across inductance at resonance. **(06 Marks)**

b. For the network shown in figure Q5 (b) determine the following: i) f_o ii) Q iii) half power frequencies iv) Band width. **(07 Marks)**

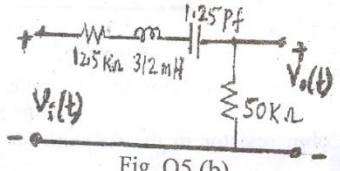

Fig. Q5 (b)

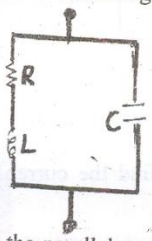

Fig. Q5 (c)

c. Derive the expression for resonant frequency for the parallel resonant circuit shown in figure Q5 (c). If R =25 Ω, L =0.5 H and C = 5μF, find W_0, Q and bandwidth for the circuit. **(07 Marks)**

6 a. For the network shown in figure Q6 (a), find i_1, i_2, $\frac{di_1}{dt}$, $\frac{di_2}{dt}$, $\frac{d^2i_2}{dt^2}$ at $t = 0^+$. The circuit was in steady state before the closure of the switch. Assume all initial conditions zero. **(10 Marks)**

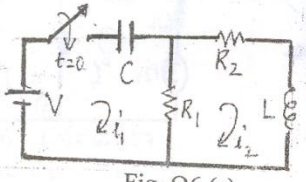

Fig. Q6 (a)

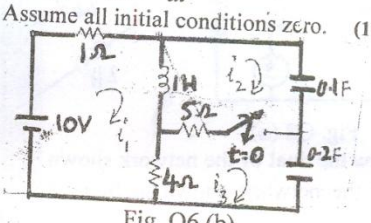

Fig. Q6 (b)

b. The network shown in figure Q6 (b) was in steady state before t = 0. The switch is closed at t = 0. Determine the three mesh currents i_1, i_2, i_3 at $t = 0^+$. **(10 Marks)**

7 a. The network shown in figure Q7 (a) was in steady state before t = 0. The switch is opened at t = 0. Find i(t) for t > 0 using Laplace transform. **(10 Marks)**

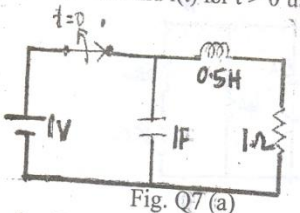

Fig. Q7 (a)

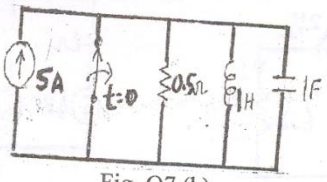

Fig. Q7 (b)

b. For the network shown in figure Q7 (b) find the voltage across 0.5 Ω resistor, when the switch is opened at t = 0. Assume all initial conditions zero. **(10 Marks)**

8 a. Determine the h-parameters for the network shown in figure Q8 (a). **(10 Marks)**

b. Z – parameters of a network are obtained from an experiment. Explain how Y-parameters and transmission parameters can be computed from the experimental data. **(10 Marks)**

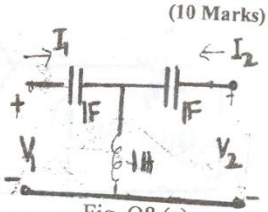

Fig. Q8 (a)

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06IT35

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Electronic Instrumentation

Time: 3 hrs. Max. Marks:100

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

1 a. Define the following terms as applied to an electronic instrument:
i) Accuracy ii) Precision iii) Resolution. **(06 Marks)**

b. Explain the working of a true RMS voltmeter with the help of a suitable block diagram. **(08 Marks)**

c. Determine the value of the multiplier resistance on the 50 V range of a dc voltmeter, that uses a 250 μA meter movement with an internal resistance of 100 Ω. **(06 Marks)**

2 a. Discuss the advantages of a digital voltmeter over an analog voltmeter. **(04 Marks)**

b. Explain the working of a digital frequency meter with the help of a block diagram. **(10 Marks)**

c. Determine the resolution of a 3½ digit display on 1 V and 10 V ranges. **(06 Marks)**

3 a. Draw the basic block diagram of an oscilloscope. Explain the functions of each block. **(08 Marks)**

b. Describe the following modes of operation available in a dual trace oscilloscope:
i) ALTERNATE mode ii) CHOP mode. **(06 Marks)**

c. Explain the operation of an electronic switch with the help of a block diagram. **(06 Marks)**

4 a. Explain why time delay is necessary in oscilloscopes. **(04 Marks)**

b. Explain the operation of a digital storage oscilloscope with the help of a block diagram. Mention the advantages. **(10 Marks)**

c. Write an explanatory note on sampling oscilloscopes. **(06 Marks)**

5 a. Explain the operation of a conventional standard signal generator with the help of a block diagram. Mention the applications. **(08 Marks)**

b. Explain the operating principle of a function generator with the help of a block diagram. **(08 Marks)**

c. Describe briefly any one application of sweep frequency generator. **(04 Marks)**

6 a. A highly sensitive galvanometer can detect a current as low as 0.1 nA. This galvanometer is used in a Wheatstone Bridge as a detector. Each arm of the bridge has a resistance of 1 kΩ. The input voltage applied to the bridge is 20 V. Calculate the smallest change in resistance, which can be detected assuming the resistance of the galvanometer is negligible. **(06 Marks)**

b. Explain the operation of the Wien's Bridge with a neat circuit diagram. Derive the expression for the frequency. **(08 Marks)**

c. Write a note on Wagner's earth connection. **(06 Marks)**

7 a. Distinguish between active and passive transducers with an example. **(04 Marks)**

b. A 120 Ω strain gage with a gage factor of 2 is affixed to a metal bar. The bar is stretched and this causes a change in resistance of 0.001 Ω. Find the change in length if the original length was 10 cm. **(06 Marks)**

c. Describe the different types of thermistor. **(04 Marks)**

d. Explain the working principle of a photo cell with an application. **(06 Marks)**

8 a. Compare LED and LCD types of displays. **(06 Marks)**

b. Explain how power is measured using a bolometer, with a suitable diagram. **(08 Marks)**

c. Write a short note on signal conditioning system. **(06 Marks)**

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06ES36

Third Semester B.E. Degree Examination, Dec. 07 / Jan. 08
Field Theory

Time: 3 hrs. Max. Marks:100

Note : 1. *Answer any FIVE full questions.*
2. *Assume any missing data suitably.*

1 a. State and explain Gauss Law. Find out the relation between D and E. **(06 Marks)**

b. Charge is distributed uniformly along an infinite straight line with constant density ρ_l. Develop the expression for E at the general point P. **(06 Marks)**

c. A vector field is given by, $A(r,\phi,z)=30e^{-r}a_r-2za_z$. Verify the divergence theorem for the volume enclosed by, $r=2$, $z=5$. **(08 Marks)**

2 a. If $E=-8xya_x-4x^2a_y+a_z(V/m)$. Find the work done in carrying a 6 coulomb charge from A(1, 8, 5) to B(2, 18, 6) along the path $y=3x+2$, $z=x+4$. **(08 Marks)**

b. A potential function is $v=2x+4y$ volts, is in free space. Find the stored energy in free space in the 1 m^3 volume centered at origin. **(06 Marks)**

c. Starting with principle of charge conservation, obtain point form of continuity equation. **(06 Marks)**

3 a. Obtain the conditions on the tangential and normal components of electric field intensity and electric flux density at the boundary between two dielectric media. **(08 Marks)**

b. Derive Poisson's and Laplace's equations starting from point form of Gauss law. **(06 Marks)**

c. State and explain uniqueness theorem. **(06 Marks)**

4 a. Find H at the centre of a square current loop of side 4 meters, if a current of 5 amp is passing through it. **(08 Marks)**

b. State and explain Ampere's circuit law. **(06 Marks)**

c. Given $A=(y\cos ax)a_x+(y+e^x)a_z$, find $\nabla\times A$ at the origin. **(06 Marks)**

5 a. Derive Lorentz force equation and mention the application of its solution. **(06 Marks)**

b. Define torque. Find the torque about the z-axis for a conductor located at $x=0.4$ m, $y=0$ and $0 < z < 2$m, which carries a current of 5A in the a_z direction, along the length of the conductor. $B=2.5a_z$ Tesla. **(06 Marks)**

c. Derive the expression for the inductance of a toroidial ring with N turns and carrying current I amp. Assume the radius of the toroid be 'R' m and area of cross section of toroidial ring be 'A' m^2. **(08 Marks)**

6 a. State and explain Faraday's law for EMF when a closed conductor single loop circuit is placed in time varying magnetic field and hence show that $\nabla\times E=-\partial B/\partial t$. **(07 Marks)**

b. Write Maxwell's equations for free space in point and integral forms. **(08 Marks)**

c. Write a short note on retarded potentials. **(05 Marks)**

7 a. What is uniform plane wave? Explain its propagation in free space with necessary equations. **(08 Marks)**

b. What is loss tangent? Explain its practical importance. **(06 Marks)**

c. Find the skin depth δ at a frequency of 1.6 MHz in aluminium, where σ = 38.2 MS/m and $\mu_r=1$. Also find γ, λ and V_p. **(06 Marks)**

8 a. Define the terms i) Reflection co-efficient and ii) Transmission co-efficient. Also bring out the relation between them. **(08 Marks)**

b. Write a short note on SWR. **(05 Marks)**

c. A 50 MHz uniform plane wave has electric field amplitude 10 V/m. The medium is lossless, having $\epsilon_r=9$ and $\mu_r=1$. The wave propagates in the x, y plane at a 30° angle to the x axis and is linearly polarized along z. Write down the phasor expression for the electric field. Also find λ_x, λ_y, V_{px} and V_{py}. **(07 Marks)**