CBCS Scheme

USN | | | | | | | | | |

15MAT31

Third Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – III

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Obtain the Fourier series for the function :

$$f(x)=\begin{cases}-\pi, & -\pi<x<0\\ x, & 0<x<\pi\end{cases}$$

Hence deduce that $\frac{\pi^2}{8}=\frac{1}{1^2}+\frac{1}{3^2}+\frac{1}{5^2}+----$. **(08 Marks)**

b. Obtain the half–range cosine series for the function $f(x)=(x-1)^2$, $0\le x\le 1$. Hence deduce that $\frac{\pi^2}{6}=\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+-----$. **(08 Marks)**

OR

2 a. Find the Fourier series of the periodic function defined by $f(x)=2x-x^2$, $0<x<3$. **(06 Marks)**

b. Show that the half range sine series for the function $f(x)=\ell x-x^2$ in $0<x<\ell$ is $\frac{8\ell^2}{\pi^3}\sum_0^\infty\frac{1}{(2n+1)^3}\sin\left(\frac{2n+1}{\ell}\right)\pi x$. **(05 Marks)**

c. Express y as a Fourier series upto 1^{st} harmonic given :

x	0	1	2	3	4	5
y	4	8	15	7	6	2

(05 Marks)

Module-2

3 a. Find the Fourier transform of

$$f(x)=\begin{cases}1-|x|, & |x|\le 1\\ 0, & |x|>1\end{cases}$$

and hence deduce that $\int_0^\infty\frac{\sin^2 t}{t^2}dt=\frac{\pi}{2}$. **(06 Marks)**

b. Find the Fourier Sine and Cosine transforms of $f(x)=e^{-\alpha x}$, $\alpha>0$. **(05 Marks)**

c. Solve by using z – transforms $y_{n+1}+\frac{1}{4}y_n=\left(\frac{1}{4}\right)^n$ $(n\ge 0)$, $y_0=0$. **(05 Marks)**

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.

OR

4 a. Find the Fourier transform of $f(x) = e^{-|x|}$. **(06 Marks)**

b. Find the Z – transform of sin(3n + 5). **(05 Marks)**

c. Find the inverse Z – transform of : $\frac{z}{(z-1)(z-2)}$. **(05 Marks)**

Module-3

5 a. Find the correlation coefficient and the equation of the line of regression for the following values of x and y. **(06 Marks)**

x	1	2	3	4	5
y	2	5	3	8	7

b. Find the equation of the best fitting straight line for the data : **(05 Marks)**

x	0	1	2	3	4	5
y	9	8	24	28	26	20

c. Use Newton – Raphson method to find a real root of the equation $x \log_{10} x = 1.2$ (carry out 3 iterations). **(05 Marks)**

OR

6 a. Obtain the lines of regression and hence find the coefficient of correlation for the data :

x	1	2	3	4	5	6	7
y	9	8	10	12	11	13	14

(06 Marks)

b. Fit a second degree parabola to the following data : **(05 Marks)**

x	1	2	3	4	5
y	10	12	13	16	19

c. Use the Regula–Falsi method to find a real root of the equation $x^3 - 2x - 5 = 0$, correct to 3 decimal places. **(05 Marks)**

Module-4

7 a. Given Sin45° = 0.7071, Sin50° = 0.7660, Sin55° = 0.8192, Sin60° = 0.8660 find Sin57° using an appropriate interpolation formula. **(06 Marks)**

b. Construct the interpolation polynomial for the data given below using Newton's divided difference formula :

x	2	4	5	6	8	10
y	10	96	196	350	868	1746

(05 Marks)

c. Use Simpson's $\frac{1}{3}$rd rule with 7 ordinates to evaluate $\int_2^8 \frac{dx}{\log_{10} x}$. **(05 Marks)**

OR

8 a. Given f(40) = 184, f(50) = 204, f(60) = 226, f(70) = 250, f(80) = 276, f(90) = 304, find f(38) using Newton's forward interpolation formula. **(06 Marks)**

b. Use Lagrange's interpolation formula to fit a polynomial for the data :

x	0	1	3	4
y	–12	0	6	12

Hence estimate y at x = 2. **(05 Marks)**

c. Evaluate $\int_0^1 \frac{x}{1+x^2}dx$ by Weddle's rule taking seven ordinates and hence find $\log_e 2$. **(05 Marks)**

Module-5

9 a. Find the area between the parabolas $y^2 = 4x$ and $x^2 = 4y$ using Green's theorem in a plane. **(06 Marks)**

b. Verify Stoke's theorem for the vector $\vec{F} = (x^2 + y^2)i - 2xyj$ taken round the rectangle bounded by x = 0, x = a, y = 0, y = b. **(05 Marks)**

c. Find the extremal of the functional : $\int_{x_1}^{x_2} [y' + x^2 (y')^2] dx$. **(05 Marks)**

OR

10 a. Verify Green's theorem in a plane for $\oint_c (3x^2 - 8y^2)\,dx + (4y - 6xy)\,dy$ where c is the boundary of the region enclosed by $y = \sqrt{x}$ and $y = x^2$. **(06 Marks)**

b. If $\vec{F} = 2xyi + yz^2j + xzk$ and S is the rectangular parallelopiped bounded by x = 0, y = 0, z = 0, x = 2, y = 1, z = 3 evaluate $\iint_S \vec{F}\cdot\hat{n}\,ds$. **(05 Marks)**

c. Find the geodesics on a surface given that the arc length on the surface is $S = \int_{x_1}^{x_2} \sqrt{x[1+(y')^2}\ dx$. **(05 Marks)**

* * * * *

CBCS Scheme

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

15EC32

Third Semester B.E. Degree Examination, June/July 2018

Analog Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Derive an expression for A_v, Z_i and Z_0 for CE–fixed bias using r_e-equivalent model. **(08 Marks)**

b. Define h-parameters and derive h-parameters model of CE-BJT. **(08Marks)**

OR

2 a. For the emitter-follower network of Fig.Q2(a). Determine : i) r_e ii) Z_i iii) Z_0 iv) A_V. **(08 Marks)**

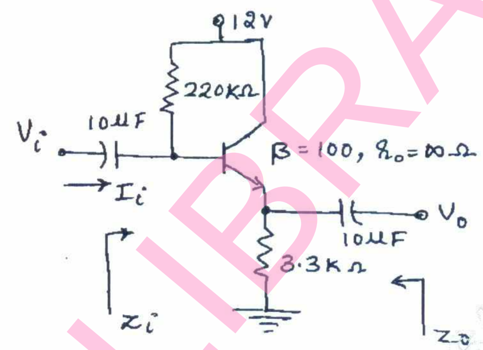


Fig.Q2(a)

b. With a neat circuit explain the high frequency transistor small-signal AC equivalent circuit. **(08 Marks)**

Module-2

3 a. Briefly explain the construction, operation and characteristics of n-channel D-type MOSFET. **(08 Marks)**

b. The fixed-bias configuration of Fig.Q3(b) has an operating point defined by $V_{GS_Q} = -2V$ and $I_{D_Q} = 5.625mA$, with $I_{DSS} = 10mA$ and $V_P = -8V$.

Determine : i) g_m ii) r_d iii) Z_i iv) Z_0 v) A_V. **(08 Marks)**

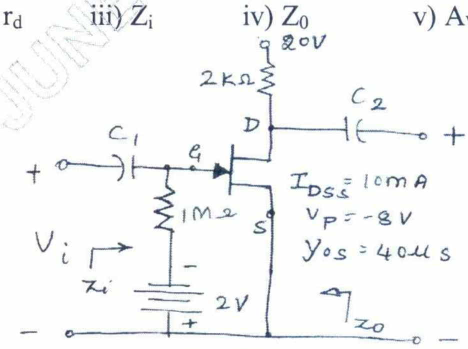


Fig.Q3(b)

OR

4 a. Explain the small signal model of the FET. **(06 Marks)**
b. Compare JFET and MOSFET. **(03 Marks)**
c. Draw the JFET common drain configuration circuit. Drive Z_i, Z_0 and A_V using small signal model. **(07 Marks)**

Module-3

5 a. The input power to a device is 10,000W at a voltage of 1000V. The output power is 500W and the output impedance is 20Ω
i) Find a power gain in decibels
ii) Find the voltage gain in decibels
iii) Find input impedance. **(06 Marks)**
b. Describe Miller's effect and derive an equation for Miller input and output capacitance. **(06 Marks)**
c. Discuss the effect of various capacitors on low-frequency response of BJT amplifier. **(04 Marks)**

OR

6 a. An amplifier rated 40W output is connected to a 10Ω speaker.
i) Calculate the input power required for full power output if the power gain is 25dB.
ii) Calculate the input voltage for rated output if the amplifier voltage gain 40dB. **(04 Marks)**
b. Determine the high-cutoff frequencies of JFET amplifier for the following specification:
$C_G = 0.01\mu F$, $C_C = 0.5\mu F$, $C_S = 2\mu F$,
$R_{sig} = 10\ K\Omega$, $R_G = 1m\Omega$, $R_D = 4.7K\Omega$, $R_S = 1K\Omega$, $R_L = 2.2K\Omega$,
$I_{DSS} = 8mA$, $V_P = -4V$, $r_d = \infty\Omega$, $V_{DD} = 20V$,
$C_{gd} = 2\ PF$, $C_{gs} = 4\ PF$, $C_{ds} = 0.5\ PF$, $C_{wi} = 5\ PF$, $C_{W0} = 6\ PF$ and $A_V = -3$. **(06 Marks)**
c. Explain the effect of multistage frequency of an amplifier. **(06 Marks)**

Module-4

7 a. Mention the types of feedback connections. Draw their block diagrams indicating input and output signal. **(08 Marks)**
b. With a neat circuit diagram, explain the working principle of FET phase–shift oscillator, with relevant equations. **(08 Marks)**

OR

8 a. What are the effects of negative feedback in an amplifier? Show how bandwidth of an amplifier increases with negative feedback. **(06 Marks)**
b. With a neat circuit and waveforms, explain the working operation of UJT relaxation oscillator. **(05 Marks)**
c. Determine the voltage gain, input and output impedance with feedback for voltage – series feedback having $A = -100$, $R_i = 10\ K\Omega$ and $R_0 = 20\ k\Omega$ for feedback factor $\beta = -0.1$. **(05 Marks)**

Module-5

9 a. With a neat circuit diagram, explain the operation of a series –fed class A power amplifier and prove that $\eta = 25\%$. **(08 Marks)**

b. Calculate the output voltage and the zener current in the regulator circuit of Fig.Q9(b) with $R_L = 1K\Omega$. **(04 Marks)**

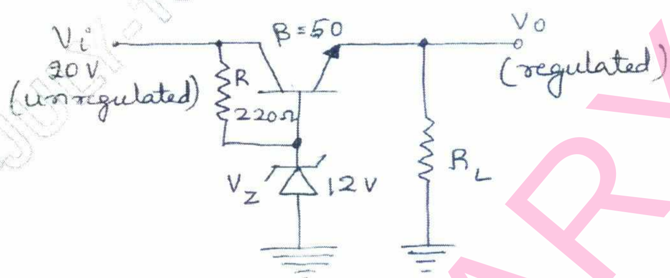


Fig.Q9(b)

c. Calculate the harmonic distortion components for an output signal with fundamental amplitude of 2.5V, second harmonic amplitude of 0.25, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05V. Also find total harmonic distortion. **(04 Marks)**

OR

10 a. Explain the operation of a transformer coupled, push-pull class –B amplifier and derive its conversion efficiency. **(07 Marks)**

b. Explain the fold –back current limiting circuit of voltage series regulator. **(05 Marks)**

c. Determine the regulated voltage and currents of shunt regulation of Fig.Q10(C). **(04 Marks)**

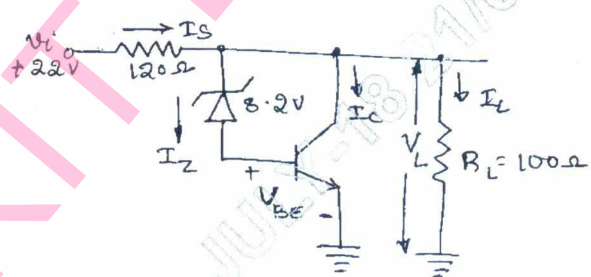


Fig.Q10(c)

* * * * *

USN | | | | | | | | | | 15EC33

Third Semester B.E. Degree Examination, June/July 2018

Digital Electronics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Given, $F = A(B + C) + D$, obtain : i) minimal SOP ii) minimal POS iii) canonical SOP iv) canonical POS. **(08 Marks)**

b. Realize a circuit for Ex-NOR using only four NOR gates. **(02 Marks)**

c. Simplify the function using K-map. :

$Y = f(a,b,c,d) = \sum m(0,1,2,3,5,6,8,10,15)$.

Write the simplified SOP expression. **(06 Marks)**

OR

2 a. Simplify the following function using Quine – McClusky method :

$P = f(a, b, c, d) = \Sigma_m(0, 2, 3, 5, 8, 10, 11, 13)$. **(06 Marks)**

b. Reduce the following Boolean function using K-map and realize the simplified expression using NOR gates.

$T = f(a, b, c, d) = \Sigma_m(0, 2, 3, 5, 6, 7, 8, 9) + \Sigma_d(10, 11, 12, 13, 14, 15)$. **(06 Marks)**

c. Prove that, $ABC + AB\overline{C} + A\overline{B}C + \overline{A}BC = AB + BC + CA$ **(04 Marks)**

Module-2

3 a. Design a binary full subtractor using logic gates. Write a truth table Implement the logic circuit using basic gates. **(06 Marks)**

b. Define magnitude comparator. Design a two bit binary comparator and implement with suitable logic gates. **(10 Marks)**

OR

4 a. Implement full adder using 4 : 1 multiplexer (MUX). **(08 Marks)**

b. With a neat logic diagram, explain carry look ahead adder. **(08 Marks)**

Module-3

5 a. Obtain the characteristic equation for D and T flip-flop. **(04 Marks)**

b. Explain the working of a master–slave SR flip-flop with the help of a logic diagram, function table, logic symbol and timing diagram. **(08 Marks)**

c. Differentiate sequential logic circuit and combinational logic circuit. **(04 Marks)**

OR

6 a. Explain the working of master slave JK flip-flops with functional table and timing diagram. Show how race around condition is over come. **(08 Marks)**

b. Discuss the difference between a flip-flop and latch. **(04 Marks)**

c. Derive the characteristic equations of SR and JK flip-flops. **(04 Marks)**

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.

Module-4

7 a. Design a synchronous mod-5 counter using JK flip-flops and implement it. **(08 Marks)**

b. Design synchronous mod-6 counter using D flip-flop to generate the count sequence, (0, 2, 3, 6, 5, 1, 0). **(08 Marks)**

OR

8 a. Design divide by 6 synchronous counter using T – flip-flops. Write state table and reduce the expression using K-map. **(06 Marks)**

b. Compare synchronous and asynchronous counters. **(04 Marks)**

c. Design mod-6 ripple counter using T flip-flops. **(06 Marks)**

Module-5

9 a. Design a Moore type sequence detector to detect a serial input sequence of 101. **(08 Marks)**

b. Design a synchronous counter using JK – flip-flops to count the sequence 0, 1, 2, 4, 5, 6, 0, 1, 2. Use state diagram and state table. **(08 Marks)**

OR

10 a. Explain the Mealy model and Moore model of a clocked synchronous sequential network. **(08 Marks)**

b. Design a Mealy type sequence detector to detect a serial input sequence of 101. **(08 Marks)**

* * * * *

USN | | | | | | | | | | | **15EC34**

Third Semester B.E. Degree Examination, June/July 2018
Network Analysis

Time: 3 hrs.   Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Determine the equivalent resistance across XY shown in Fig.Q1(a) **(05 Marks)**

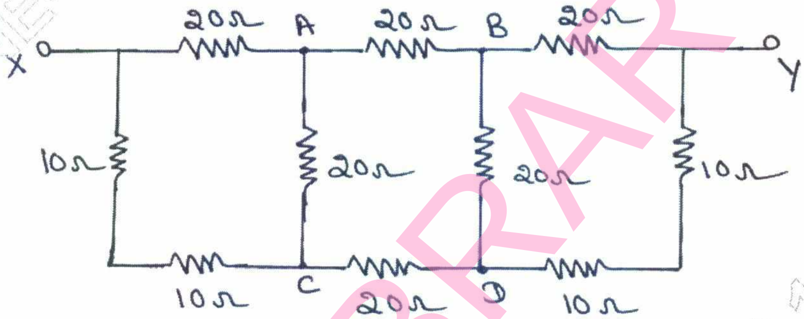


Fig.Q1(a)

b. Calculate the voltage across the 6Ω resistor using source shifting and transformation technique shown in Fig.Q1(b). **(05 Marks)**

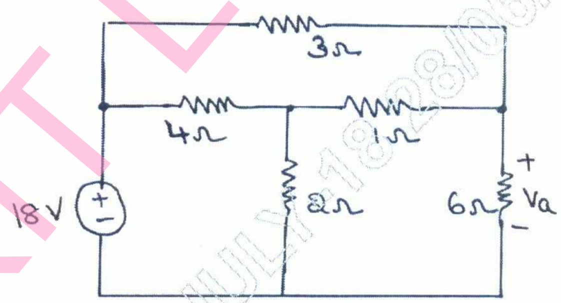


Fig.Q1(b)

c. Determine the power supplied by the dependent source of Fig.Q1(c) shown. **(06 Marks)**

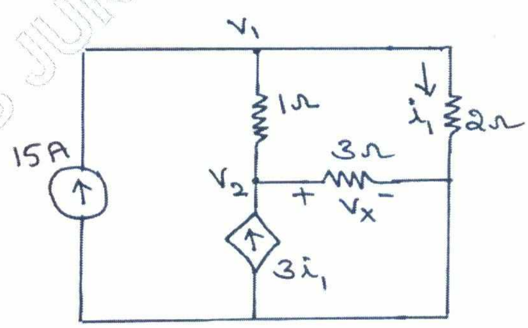


Fig.Q1(c)

OR

2 a. Using Mesh current analysis, find the current through 24Ω in the circuit shown in Fig.Q2(a). **(08 Marks)**

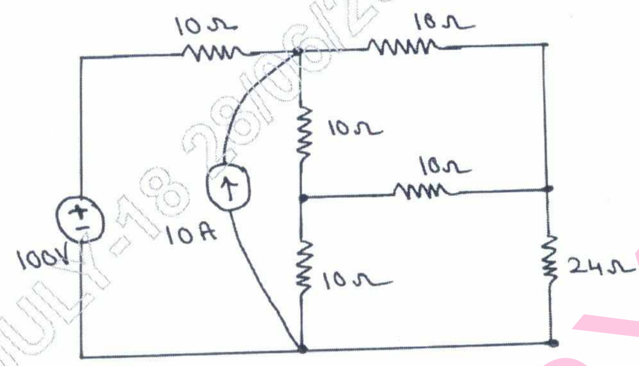


Fig.Q2(a)

b. For the network of Fig.Q2(b) determine the node voltage by nodal analysis. **(08 Marks)**

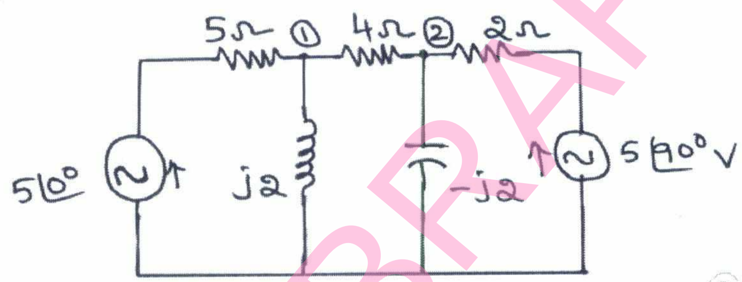


Fig.Q2(b)

Module-2

3 a. State superposition theorem. In the circuit of Fig.Q3(a), use the superposition principle to determine the value of i_x. **(08 Marks)**

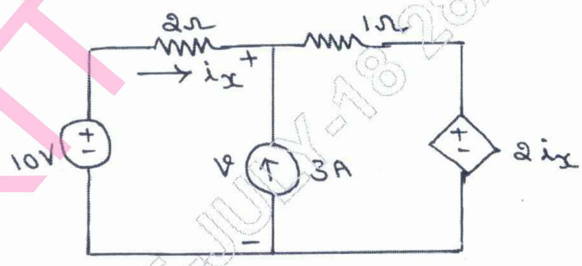


Fig.Q3(a)

b. Obtain the Thevenin and Norton equivalent circuits at terminals AB for the network shown in Fig.Q3(b). **(08 Marks)**

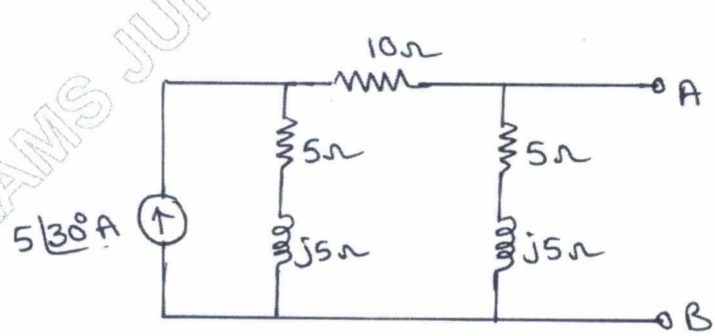


Fig.Q3(b)

OR

4 a. Using Millman's theorem, find I_L through R_L for the network shown in Fig.Q4(a). **(06 Marks)**

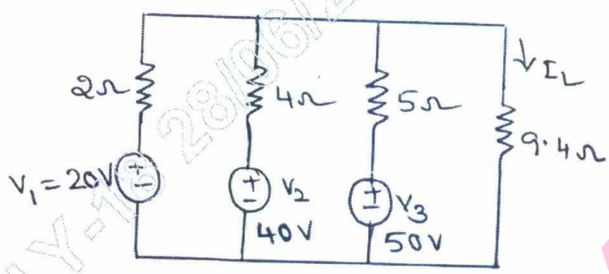


Fig.Q4(a)

b. Verify reciprocity theorem for the circuit shown in Fig.Q4(b). **(06 Marks)**

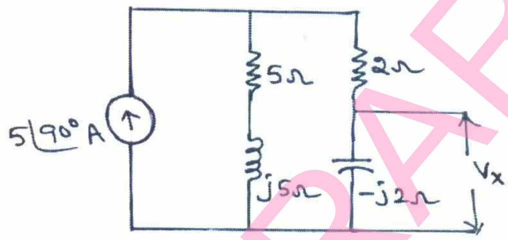


Fig.Q4(b)

c. State and explain maximum power transfer theorem. **(04 Marks)**

Module-3

5 a. In the circuit shown in Fig.Q5(a), the switch K is changed from position 1 to position 2 at t = 0, the steady state has been reached before switching. Find the values of i, $\frac{di}{dt}$ and $\frac{di^2}{dt^2}$ at $t = 0$. **(08 Marks)**

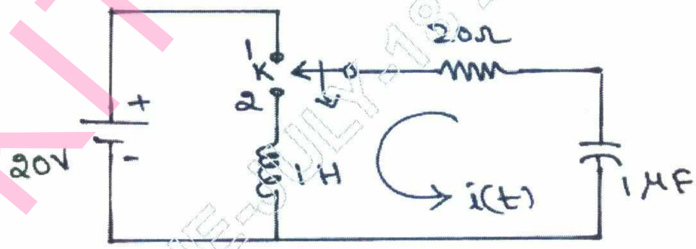


Fig.Q5(a)

b. The switch in the network shown in Fig.Q5(b) is closed at t = 0. Determine the voltage across the capacitor. Use Laplace transform. **(08 Marks)**

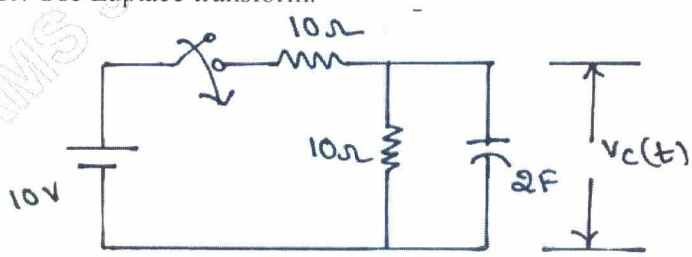


Fig.Q5(b)

OR

6 a. In the network shown in Fig.6(a), the switch K is opened at t = 0. At $t = 0^+$, solve for the values of v, $\frac{dv}{dt}$ and $\frac{d^2v}{dt^2}$ if I = 2A, R = 200Ω and L = 1H. **(08 Marks)**

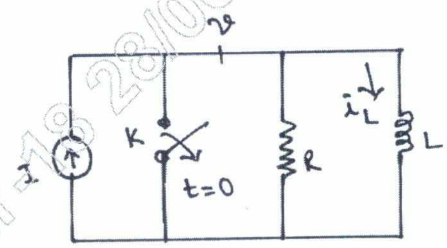


Fig.Q6(a)

b. Determine the Laplace transform of the periodic saw tooth waveform of Fig.Q6(b). Use gate function. **(08 Marks)**

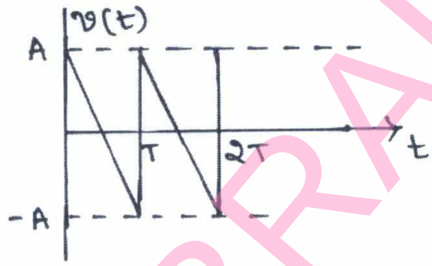


Fig.Q6(b)

Module-4

7 a. Derive for a resonant circuit, the resonant frequency $f_0 = \sqrt{f_1 f_2}$, where f_1 and f_2 are the two half power frequencies. **(07 Marks)**

b. Find the value of L for which the circuit shown in Fig.Q7(b) is resonant at a frequency of w = 5000 rad/sec. **(06 Marks)**

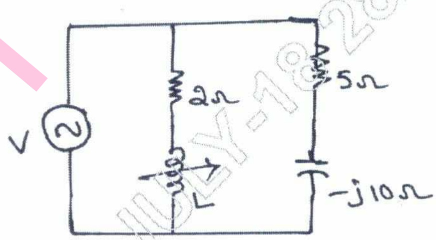


Fig.Q7(b)

c. A series RLC circuit has R = 10Ω, L = 0.01H and c = 0.01μF and it is connected across 10mV supply. Calculate : i) f_0 ii) Q_0 iii) B.w. **(03 Marks)**

OR

8 a. A series RLC circuit has a resistance of 10Ω, an inductance of 0.3H and a capacitance of 100μF. The applied voltage is 230V. Find : i) Resonant frequency ii) Quality factor iii) Lower and upper cut off frequencies iv) Bandwidth v) Current at resonance vi) currents at f_1 and f_2 vii) voltage across inductance at resonance. **(08 Marks)**

b. Derive an expression for the resonant frequency of a parallel resonant circuit. Also show that the circuit is resonant at all frequencies if $R_L = R_C = \sqrt{\frac{L}{C}}$ where R_L = Resistance in the inductor branch, R_C = resistance in the capacitor branch. **(08 Marks)**

CBCS SCHEME

USN | | | | | | | | | | | **15EC35**

Third Semester B.E. Degree Examination, June/July 2018
Electronic Instrumentation

Time: 3 hrs. Max. Marks: 80

Note: ***Answer any FIVE full questions, choosing one full question from each module.***

Module-1

1 a. Briefly explain Gross Errors, Absolute error and relative error with examples. **(05 Marks)**

b. Draw the block diagram of a true RMS voltmeter and explain its operation. **(05 Marks)**

c. Design a multirange ammeter using Aryton Shunt for the ranges 0 – 10 mA, 100 mA and 1 A, using a D'Arsonval movement having internal resistance of 1 KΩ and a full scale current of 100 μA. **(06 Marks)**

OR

2 a. Sketch and explain the operation of a multirange ammeter using Aryton shunt. **(05 Marks)**

b. A resistor of 1 KΩ with an accuracy of $\pm 5\%$, carries a current of 10 mA. The current is measured with an ammeter of 30 mA full scale with an accuracy of $\pm 2\%$ at full scale. Calculate the power dissipation in the resistor and the accuracy of the power measurement. **(05 Marks)**

c. What is the loading effect of a voltmeter of low sensitivity? A voltage of 100 V dc is applied across a series combination of two resistors R1 and R2 each of 10 KΩ. A voltmeter of sensitivity 1 KΩ/V is used to measure the voltage across R2 in the range of 50 V. Calculate the voltmeter reading and percentage error of reading. **(06 Marks)**

Module-2

3 a. Describe with diagram the operation of a Ramp type DVM. What are its limitations? **(08 Marks)**

b. (i) With the help of a block diagram, explain the operation of a digital time period measurement instrument.

(ii) The lowest range of a $4\frac{1}{2}$ digit DVM is 10 mV full scale. Determine its sensitivity. **(08 Marks)**

OR

4 a. Describe with diagram, the operation of a successive approximation type DVM. **(08 Marks)**

b. (i) With the help of a block diagram, explain the operation of a digital capacitance meter.

(ii) What are the outstanding characteristics of a DVM? **(08 Marks)**

Module-3

5 a. Draw the block diagram of a simple CRO and state the functions of each block. What is the advantage of using –ve HV supply in CRO? **(08 Marks)**

b. Explain with the help of a block diagram of a function generator, how it generates the different waveforms. **(08 Marks)**

OR

6 a. (i) Describe the operation of a digital storage oscilloscope with the help of a block diagram.
(ii) The number of vertical and horizontal tangencies of a Lissajous figure are 2 and 6 respectively. What is the frequency of the signal connected to vertical plates, if horizontal plate signal frequency is 1 kHz. **(08 Marks)**

b. Sketch the block diagram of a square and pulse generator and describe how it generates the square waveform and pulses. **(08 Marks)**

Module-4

7 a. (i) Explain with diagram the working of a phase sensitive detector.
(ii) What is the principle of working of a stroboscope? **(08 Marks)**

b. Draw the circuit of a Wheatstone's bridge and explain how it can be used to measure an unknown resistance. **(05 Marks)**

c. If the two arms of a Wheatstone's Bridge are R_1 = 1 KΩ and R_2 = 10 KΩ. Find the range of the third arm resistance R_3 to be used to measure unknown resistance R4 of the range 1 KΩ to 100 KΩ, in the fourth arm. **(03 Marks)**

OR

8 a. Define Q factor. With diagram, explain the operation of a Q meter to measure Q and inductance of a coil. **(08 Marks)**

b. Draw the diagram of a Maxwell's Bridge and obtain the equations to measure R_x, L_x and Q. **(05 Marks)**

c. A Maxwell's Bridge has components values at balance as C_1 = 0.01 μF, R_1 = 470 KΩ, R_2 = 5.1 KΩ, R_3 = 100 KΩ. Find the value of the inductive impedance connected in the fourth arm (Rx and Lx). **(03 Marks)**

Module-5

9 a. Explain the operation of a resistive position transducer. **(05 Marks)**

b. Describe with diagram the operation of a piezo electric transducer. **(05 Marks)**

c. With circuit diagram, explain the operation of a LVDT the method of measuring displacement. **(06 Marks)**

OR

10 a. (i) Explain with diagram the construction of a Bonded Resistance wire gauge. How does it senses strain/stress?
(ii) How it is used in a bridge arrangement with a dummy gauge and what is the advantages of such an arrangement? **(08 Marks)**

b. Briefly explain the construction and operation of a photoconductive cell and a photo transistor. **(04 Marks)**

c. With a circuit explain how a photo transistor can be used to operate a street light relay. **(04 Marks)**

* * * * *

CBCS SCHEME

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

15EC36

Third Semester B.E. Degree Examination, June/July 2018
Engineering Electromagnetics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

Module-1

1 a. Define electric field intensity and flux density and also establish the relationship between them. **(04 Marks)**

b. State and explain Coulomb's law of force between two print charges. **(06 Marks)**

c. Two uniform line charges of densities 4 nc/m and 6nc/m lying x = 0 plane at y = 5m and y = -6m respectively. Find electric field intensity at P(4, 0, 5)m. **(06 Marks)**

OR

2 a. Derive an expression for electric field intensity due to infinite line charge. **(08 Marks)**

b. A volume charge density $\rho_v = \frac{5k}{r}$, where r ≠ 0, k = constant exists within a sphere of radius $\frac{a}{2}$. Determine the magnitude of point charge placed at origin which will produce the same electric field at $r = \frac{a}{2}$. **(08 Marks)**

Module-2

3 a. Derive the Maxwell's first equation in electrostatics. **(04 Marks)**

b. Derive the expression for continuity of current. **(06 Marks)**

c. Find the total charge in a volume defined by six planes for which $1 \le x \le 2$; $2 \le y \le 3$; $3 \le z \le 4$. If $\vec{D} = \left[4x\,\hat{a}_x + 3y^2\,\hat{a}_y + 2z^3\,\hat{a}_z\right]$ c/m^2. **(06 Marks)**

OR

4 a. Briefly explain Gauss's divergence theorem. **(06 Marks)**

b. Obtain an expression for the energy expanded in moving a point charge in an electric field. **(06 Marks)**

c. Let $V = \frac{\cos 2\phi}{r}$ in free space in cylindrical system. Find $\vec{E}$ at B(2, 30°, 1). **(04 Marks)**

Module-3

5 a. With the usual notations, deduce the Poisson's and Laplace's equation from the Maxwell's first equation. **(06 Marks)**

b. Determine whether or not the following vector represents a possible electric field. $\vec{E} = 5\cos z\,\hat{a}_z$ V/m. **(04 Marks)**

c. Prove that the line integral of magnetic field intensity $\vec{H}$ around a closed path is exactly equal to current 'I' enclosed by that path. **(06 Marks)**

OR

6 a. Solve Laplace's equation to determine the capacitance of a coaxial cable when the inner radius is 'a' and outer radius is 'b' respectively. **(08 Marks)**

b. State and explain 'stokes theorem'. **(04 Marks)**

c. Given the vector magnetic potential $\vec{A} = x^2\,\hat{a}_x + 2yz\,\hat{a}_y + (-x^2)\hat{a}_z$. Find magnetic flux density. **(04 Marks)**

Module-4

7 a. Derive Lorentz force equation and mention the application of solution. **(05 Marks)**

b. A point charge Q = -1.2C has velocity $\vec{V} = (5\,\hat{a}_x + 2\hat{a}_y - 3\hat{a}_z)$ m/s. Find the magnitude of force exerted on the charge if,

i) $\vec{E} = -18\,\hat{a}_x + 5\,\hat{a}_y - 10\,\hat{a}_z$ V/m

ii) $\vec{B} = -4\,\hat{a}_x + 4\,\hat{a}_y + 3\,\hat{a}_z$ T

iii) Both are present simultaneously. **(06 Marks)**

c. Briefly explain force between differential current elements. **(05 Marks)**

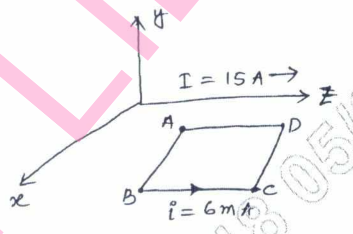
OR

8 a. Discuss the magnetic boundary condition at the interface between two different magnetic materials. **(05 Marks)**

b. Briefly explain potential energy and forces on magnetic materials. **(05 Marks)**

c. A rectangular loop of wire in free space joins A(1, 0, 1), B (3, 0, 1) to C(3, 0, 4) to D (1, 0, 4) to A. The wire carries a current of 6mA flowing in $\hat{a}_z$ direction from B to C. A filamentary current of 15A flows along the entire z-axis in the $\hat{a}_z$ direction as shown in Fig.Q.8(c). Find: i) Force on side BC ii) Force on side AB iii) Total force on loop. **(06 Marks)**

Fig.Q.8(c)



Module-5

9 a. State and explain Faraday's law in point and integral form. **(06 Marks)**

b. Derive Ampere's circuit law in point form and integral form suitable for Time-varying fields. **(07 Marks)**

c. Find the angular frequency at which the conduction current and displacement current are equal in medium with $\sigma = 5.6 \times 10^{-6}$ ℧/m and $\epsilon_r = 40$. **(03 Marks)**

OR

10 a. State and prove Poynting theorem. **(06 Marks)**

b. Briefly explain skin depth and skin effect. **(05 Marks)**

c. A 300MHz uniform plane wave propagation through fresh water for which $\sigma = 0$, $\mu_r = 1$ and $\epsilon_r = 78$. Calculate:

i) Attenuation constant

ii) Phase constant

iii) Wave length

iv) Intrinsic impedance. **(05 Marks)**

* * * * *

CBCS Scheme

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

15MATDIP31

Third Semester B.E. Degree Examination, June/July 2018
Additional Mathematics – I

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the modulus and amplitude of $\dfrac{(1+i)^2}{3+i}$. **(05 Marks)**

b. Prove that $\left(\dfrac{1+\cos\theta+i\sin\theta}{1+\cos\theta-i\sin\theta}\right)^n = \cos n\theta + i\sin n\theta$. **(05 Marks)**

c. If $z=\cos\theta+i\sin\theta$, then show that $x^n+\dfrac{1}{x^n}=2\cos n\theta$, $x^n-\dfrac{1}{x^n}=2i\sin n\theta$. **(06 Marks)**

OR

2 a. Find the sine of the angle between $\vec{a}=2\hat{i}-2\hat{j}+\hat{k}$ and $\vec{b}=\hat{i}-2\hat{j}+2\hat{k}$. **(05 Marks)**

b. Find the unit vector perpendicular to both $\vec{a}$ and $\vec{b}$, where $\vec{a}=\hat{i}-2\hat{j}+3\hat{k}$, $\vec{b}=2\hat{i}+\hat{j}+\hat{k}$ **(05 Marks)**

c. Show that (3, –2, 4), (6, 3, 1), (5, 7, 3) and (2, 2, 6) are coplanar. **(06 Marks)**

Module-2

3 a. Find the n^{th} derivative of sin(3x)cosx. **(05 Marks)**

b. Find the angle between radius vector and tangent to the curve $\gamma^m \cos m\theta = a^m$. **(05 Marks)**

c. Find the pedal equation of $\gamma = a(1+\cos\theta)$. **(06 Marks)**

OR

4 a. If $u=\tan^{-1}\left(\dfrac{x^3+y^3}{x-y}\right)$, prove that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}=\sin(2u)$. **(05 Marks)**

b. If $u=f\left(\dfrac{x}{y},\dfrac{y}{z},\dfrac{z}{x}\right)$, prove that $x\dfrac{\partial u}{\partial x}+y\dfrac{\partial u}{\partial y}+z\dfrac{\partial u}{\partial z}=0$. **(05 Marks)**

c. If $u=x+y$, $v=y+z$, $w=z+x$, find $J\left(\dfrac{uvw}{xyz}\right)$. **(06 Marks)**

Module-3

5 a. Evaluate $\int_0^{\pi} x\cos^6 x\,dx$. (05 Marks)

b. Evaluate $\int_0^{\infty} \frac{x^2}{(1+x^6)^{7/2}}\,dx$ (05 Marks)

c. Evaluate $\int_0^1 x^5(1-x^2)^{5/2}\,dx$. (06 Marks)

OR

6 a. Evaluate $\int_1^2\int_3^4 (xy+e^y)\,dy\,dx$. (05 Marks)

b. Evaluate $\int_0^1\int_x^{\sqrt{x}} xy\,dy\,dx$. (05 Marks)

c. Evaluate $\int_0^1\int_0^1\int_0^y xyz\,dx\,dy\,dz$. (06 Marks)

Module-4

7 a. Find the angle between the tangents to the curve $x=t^2, y=t^3, z=t^4$ at $t=2$, and $t=3$. (05 Marks)

b. Find the unit normal to the curve $\vec{\gamma}=4\sin t\,\hat{i}+4\cos t\,\hat{j}+3t\,\hat{k}$. (05 Marks)

c. Find the velocity and acceleration to the curve $\vec{\gamma}=t^2\,\hat{i}-t^3\,\hat{j}+t^4\,\hat{k}$ at $t=1$. (06 Marks)

OR

8 a. Find the directional derivative of $\varphi=x^3y^3z^3$ at (1, 2, 1) in the direction of $\hat{i}+2\hat{j}+2\hat{k}$. (05 Marks)

b. Find the unit normal to the surface $xy+x+zx=3$ at $(1,1,1)$. (05 Marks)

c. If $\vec{F}=\nabla(x^3+y^3+z^3-3xyz)$, find div $\vec{F}$. (06 Marks)

Module-5

9 a. Solve $\frac{dy}{dx} = \frac{y^2}{xy - x^2}$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + y\cot x = \sin x$. **(05 Marks)**

c. Solve $y(x+y)dx + (x+2y-1)dy = 0$. **(06 Marks)**

OR

10 a. Solve $(x^2 + y)dx + (y^3 + x)dy = 0$. **(05 Marks)**

b. Solve $\frac{dy}{dx} + \frac{y}{x} = xy^2$. **(05 Marks)**

c. Solve $(x^2 + y^2)\frac{dy}{dx} = xy$. **(06 Marks)**

* * * * *