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10MAT31

Third Semester B.E. Degree Examination, June/July 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. Find the Fourier series for the function $f(x) = x(2\pi - x)$ in $0 \le x \le 2\pi$. Hence deduce that $\dfrac{\pi^2}{8} = 1 + \dfrac{1}{3^2} + \dfrac{1}{5^2} + \text{- - - - -}$. **(07 Marks)**

b. Find the half-range cosine series for the function $f(x) = (x-1)^2$ in $0 < x < 1$. **(06 Marks)**

c. Obtain the constant term and the co-efficient of the 1st sine and cosine terms in the Fourier series of y as given in the following table. **(07 Marks)**

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

2 a. Solve the integral equation:

$$\int_0^\infty f(\theta)\cos\alpha\theta\, d\theta = \begin{cases} 1-\alpha, & 0 \le \alpha \le 1 \\ 0, & \alpha > 1 \end{cases}.\ \text{Hence evaluate } \int_0^\infty \frac{\sin^2 t}{t^2}\, dt.$$ **(07 Marks)**

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

c. Find the infinite Fourier cosine transform of e^{-x^2}. **(07 Marks)**

3 a. Solve two dimensional Laplace equation $u_{xx} + u_{yy} = 0$ by the method of separation of variables. **(07 Marks)**

b. 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 $\dfrac{\partial u}{\partial t}(x,0) = 0$. **(06 Marks)**

c. Solve the boundary value problem $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$, $0 < x < \ell$ subject to the conditions $\dfrac{\partial u}{\partial x}(0,t) = 0$; $\dfrac{\partial u}{\partial x}(\ell,t) = 0$, $u(x, 0) = x$. **(07 Marks)**

4 a. Find the equation of the best fit straight line for the following data and hence estimate the value of the dependent variable corresponding to the value of the independent variable x with 30. **(07 Marks)**

x	5	10	15	20	25
y	16	19	23	26	30

b. Solve by graphical method:

Max $Z = x + 1.5y$

Subject to the constraints $x + 2y \le 160$

$3x + 2y \le 240$

$x \ge 0;\ y \ge 0$. **(06 Marks)**

c. Solve by simplex method:

max $z = 3x + 5y$

subject to $3x + 2y \le 18$

$x \le 4$

$y \le 6$

$x, y \ge 0$. **(07 Marks)**

PART – B

5 a. Using the method of false position, find a real root of the equation $x \log_{10} x - 1.2 = 0$, correct to 4 decimal places. **(07 Marks)**

b. By relaxation method, solve :
$10x + 2y + z = 9$; $x + 10y - z = -22$; $-2x + 3y + 10z = 22$. **(06 Marks)**

c. Find the largest Eigen value and the corresponding Eigen vector for the matrix $\begin{bmatrix} 6 & -2 & 2 \\ -2 & 3 & -1 \\ 2 & -1 & 3 \end{bmatrix}$ using Rayleigh's power method, taking $x_0 = [1\ 1\ 1]^T$. Perform 5 iterations. **(07 Marks)**

6 a. Find the cubic polynomial by using Newton's forward interpolation formula which takes the following values.

x	0	1	2	3
y	1	2	1	10

Hence evaluate f(4). **(07 Marks)**

b. Using Lagrange's formula, find the interpolating polynomial that approximate the function described by the following table.

x	0	1	2	5
f(x)	2	3	12	147

Hence find f(3). **(06 Marks)**

c. Evaluate $\int_4^{5.2} \log_e x \, dx$ using Weddler's rule by taking 7 ordinates. **(07 Marks)**

7 a. Solve $u_{xx} + u_{yy} = 0$ in the following square Mesh. Carry out two iterations. **(07 Marks)**

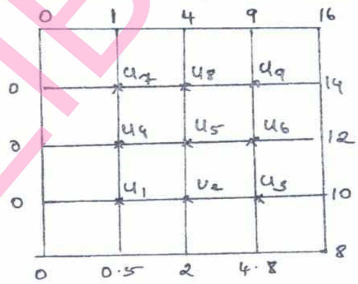

Fig. Q7(a)

b. The transverse displacement of a point at a distance x from one end to any point 't' of a vibrating string satisfies the equation : $\frac{\partial^2 u}{\partial t^2} = 25 \frac{\partial^2 u}{\partial x^2}$ with boundary condition $u(0, t) = u(5, t) = 0$ and initial condition $u(x, 0) = \begin{cases} 20x & \text{for } 0 \le x \le 1 \\ 5(5-x) & \text{for } 1 \le x \le 5 \end{cases}$ and $u_t(x, 0) = 0$ solve by taking $h = 1$, $k = 0.2$ upto $t = 1$. **(06 Marks)**

c. Find the solution of the equation $u_{xx} = 2u_t$ when $u(0, t) = 0$ and $u(4, t) = 0$ and $u(x, 0) = x(4 - x)$ taking $h = 1$. Find values upto $t = 5$. **(07 Marks)**

8 a. Find the Z – transformation of the following : i) $3n - 4 \sin \frac{\pi}{4} + 5a^2$ ii) $\frac{a^n e^{-a}}{n!}$. **(07 Marks)**

b. Find the inverse Z – transformation of $\frac{4z^2 - 2z}{z^3 + 5z^2 + 8z - 4}$. **(06 Marks)**

c. Solve the difference equation : $y_{n+2} + 6y_{n+1} + 9y_n = 2^n$; given $y_0 = y_1 = 0$ using Z – transformation. **(07 Marks)**

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Third Semester B.E. Degree Examination, June/July 2016

Analog Electronic Circuits

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain Reverse recovery time of a semiconductor diode. **(06 Marks)**

b. The Fig. Q1 (b) shows two way clipper. Determine its output wave form. Assume diode drop of 0.7V. **(07 Marks)**

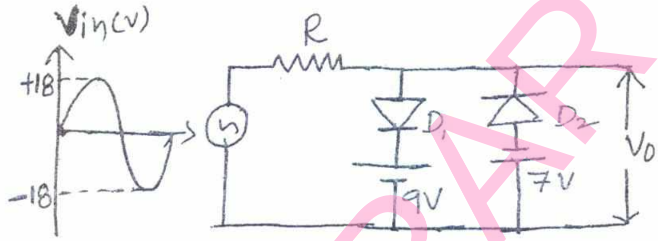


Fig. Q1(b)

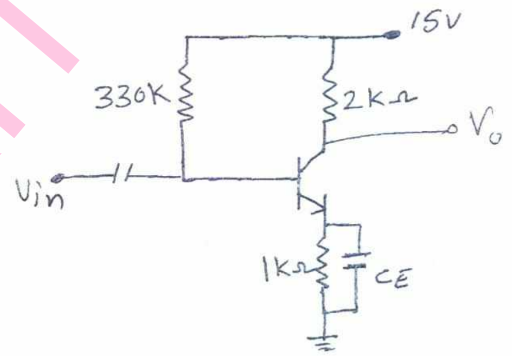
c. What is clamper circuit? Explain the operation of Positive and Negative clamper circuits and draw the wave form. [Assume Ideal Diode]. **(07 Marks)**

2 a. What is transistor biasing? Discuss the causes of bias instability in a transistor. **(06 Marks)**

b. Derive the expression for I_B, V_{CE} and $S(I_{CO})$ for voltage divider bias using exact analysis. **(07 Marks)**

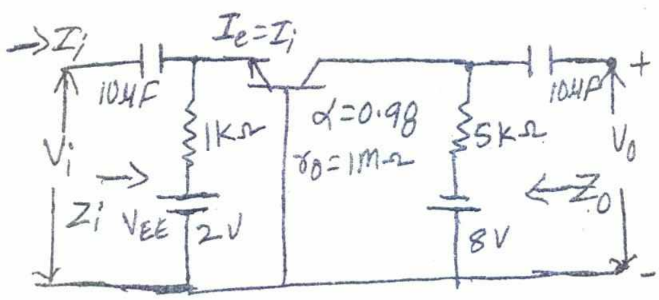
c. For the circuit shown in Fig. Q2(c). Find I_B, I_C, V_{CE}, V_C and V_E. Assume $\beta = 100$, VBE = 0.7. **(07 Marks)**

Fig. Q2(c)



3 a. For common base configuration shown in Fig Q3(a). Find r_e, z_i, z_o and A_v. **(06 Marks)**

Fig. Q3(a)



b. Derive an expression for z_i, z_o, A_V and A_i of a CE fixed bias configuration using r_e model. **(07 Marks)**

c. Using h-parameter model for a transistor in C.E configuration. Derive expressions for A_I, z_i and A_v. **(07 Marks)**

4 a. An amplifier consists of 3 identical stages in cascade; the bandwidth of overall amplifier extends from 20Hz to 20KHz. Calculate the band width of Individual stage. **(06 Marks)**

b. Describe miller effect and derive an equation for miller input and output capacitance. **(07 Marks)**

c. Draw and explain frequency response of an amplifier and briefly discuss the effect of various capacitors on frequency response. **(07 Marks)**

PART – B

5 a. Explain the need of cascade amplifier and list the advantage of this circuit. **(06 Marks)**

b. With block diagram, explain the concept of feedback. List the advantages of negative feedback. **(07 Marks)**

c. Derive the expression for input resistance (R_{if}) for voltage series feedback amplifier. **(07 Marks)**

6 a. Draw input and output wave forms of Class – A, Class – B and Class – C power amplifiers based on the location of Q - point, and briefly discuss. **(06 Marks)**

b. Draw the circuit diagram of series fed directly coupled Class – A amplifier. Give the expression for dc power input and a.c power output and show that efficiency is 25%. **(07 Marks)**

c. What is Harmonic distortion? Calculate the harmonic distortion components for an output signal having fundamental amplitude of 2.5V second harmonic amplitude of 0.25V, third harmonic amplitude of 0.1 V and fourth harmonic amplitude of 0.05V. Also calculate the total harmonic distortion. **(07 Marks)**

7 a. With neat circuit diagram explain the operation of BJT Hartley oscillator. **(06 Marks)**

b. i) The frequency sensitive arms of the wien bridge oscillator uses $C_1 = C_2 = 0.001\mu F$ and $R_1 = 10k\Omega$ while R_2 is kept variable. The frequency is to be varied from 10KHz to 50KHz by varying R_2. Find the minimum and maximum values of R_2.

ii) Design the value of an inductor to be used in Colpitts oscillator to generate a frequency of 10MHz. The circuit is used a value of $C_1 = 100pF$ and $C_2 = 50pF$. **(07 Marks)**

c. With neat circuit explain the working of series resonant crystal oscillator. A crystal has $L = 0.1H$, $C = 0.01pF$ find the series resonating frequency. **(07 Marks)**

8 a. Define transconductance g_m and derive expression for gm. **(06 Marks)**

b. With equivalent model of JFET common drain configuration. Obtain the expression for z_i, z_o and A_v. **(07 Marks)**

c. For common gate amplifier as shown in Fig Q8.(c), gm = 2.8ms, r_d = 50kΩ Calculate z_i, z_o and A_V. **(07 Marks)**

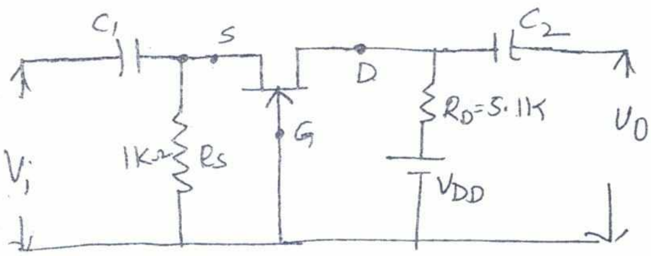


Fig. Q8(c)

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10ES33

Third Semester B.E. Degree Examination, June/July 2016
Logic Design

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. Explain the following canonical form :

i) $F(x,y,z) = x + \bar{x}y + \bar{x}\bar{z}$

ii) $F(x,y,z) = (x+z)(\bar{x}+y)(y+z)$ **(10 Marks)**

b. Find the minimal POS expression of incompletely specified Boolean function using K–map,

$f(a, b, c, d) = \pi M(1, 2, 3, 4, 9, 10) + \pi d(0, 14, 15)$. **(05 Marks)**

c. Find all the minimal SOP expression of
$f(a, b, c, d) = \Sigma(6, 7, 9, 10, 13) + \Sigma d(1, 4, 5, 11, 15)$ using k – map. **(05 Marks)**

2 a. Find all the prime implicants of the function :
$f(a, b, c, d) = \Sigma(7, 9, 12, 13, 14, 15) + \Sigma d(4, 11)$ using Quine – MaClusky's algorithm. **(10 Marks)**

b. For a given incomplete Boolean function, find a minimal sum and minimal product expression using MEV technique taking least significant bit as map entered variable.
$f(a, b, c, d) = \Sigma(1, 5, 6, 7, 9, 11, 12, 13) + \Sigma d(0, 3, 4)$. **(10 Marks)**

3 a. Implement the function using active low output dual 2 : 4 line decoder IC74139
i) $f_1(A, B, C) = \Sigma m(0, 1, 2, 5)$
ii) $f_2(A, B, C) = \pi M(1, 3, 4, 7)$. **(10 Marks)**

b. Design priority encoder with three inputs, with middle bit at highest priority encoding to 10, most significant bit at next priority encoding to 11 and least significant at least priority encoding 01. **(10 Marks)**

4 a. Define multiplexer and demulitplexer and draw block diagram. **(04 Marks)**

b. Design 4 : 1 multiplexer, draw the circuit using gates. **(06 Marks)**

c. Explain how will you implement the following function using implementation table,
$F(A, B, C, D) = \Sigma m(0, 1, 3, 4, 7, 10, 12, 14)$ with A, B, C as select lines. **(10 Marks)**

PART – B

5 a. Design full adder and draw the circuit using two input NAND gates. **(07 Marks)**

b. Design and draw the circuit of look ahead carry generator using gates. Draw the block diagram of 4–bit parallel adder using look ahead carry generator. **(10 Marks)**

c. Design single bit magnitude comparator and draw the circuit. **(03 Marks)**

6 a. Obtain the following for SR flip–flop :
   i) Characteristic equation
   ii) Excitation table
   iii) State diagram. **(06 Marks)**

b. With the help of a schematic diagram, explain how a serial shift register can be transformed into a i) ring counter ii) Johnson counter. **(04 Marks)**

c. Design mod6 synchronous counter using D–flip–flops. **(10 Marks)**

7 a. A sequential network has one input and one output the state diagram is shown in Fig. Q7(a). Design the sequential circuit using T flip-flops. **(10 Marks)**

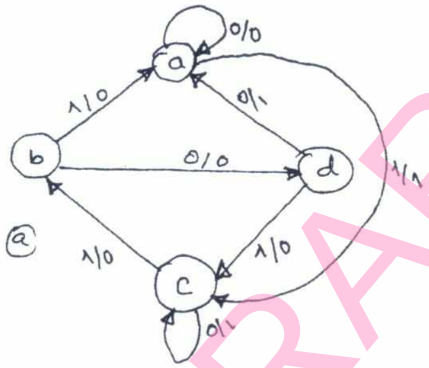

Fig. Q7(a)

b. Derive the transition equations, transition table, state table and state diagram for the following. **(10 Marks)**

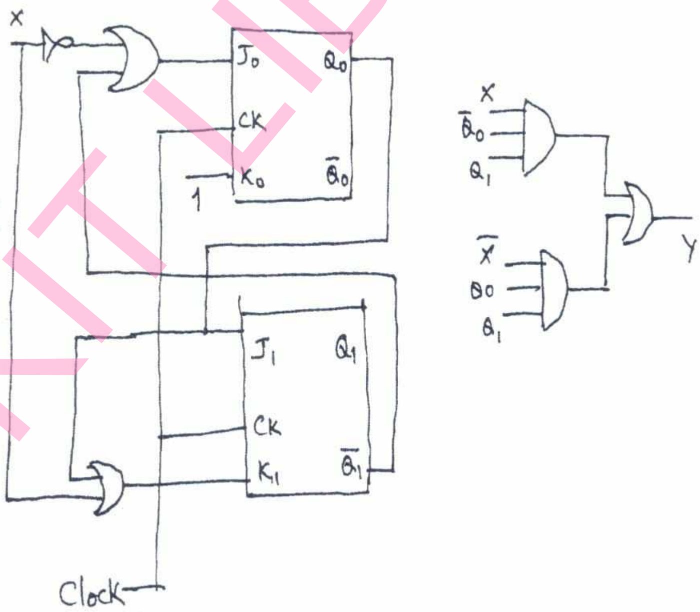

Fig. Q7(b)

8 Write notes on :

a. Mealy and Moore model

b. State machine notation. **(20 Marks)**

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Third Semester B.E. Degree Examination, June/July 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. Using source transformation find current through R_L in the circuit shown in Fig. Q1(a). **(06 Marks)**

b. Using mesh current method find current through 10Ω resistor in the circuit shown in Fig. Q1(b). **(07 Marks)**

c. Find all the nodal voltages in the circuit shown in Fig Q1 (c). **(07 Marks)**

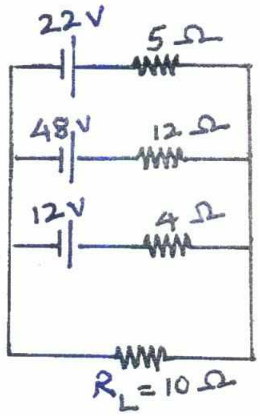


Fig. Q1(a)

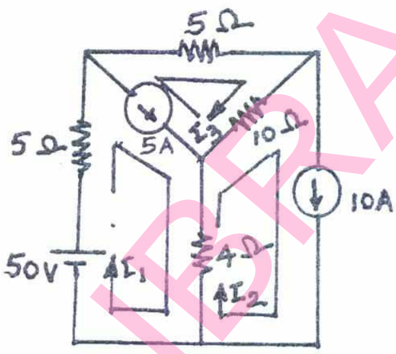


Fig. Q1(b)

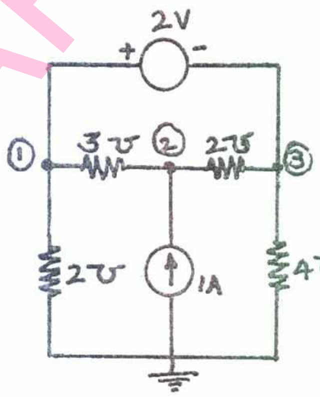


Fig. Q1(c)

2 a. With neat illustrations, distinguish between
   i) Oriented and Non-oriented graphs
   ii) Connected and un-connected graphs
   iii) Tree and co-tree. **(06 Marks)**

b. For the network shown in Fig. Q2(b), draw the oriented graph. By selecting braches 4, 5 and 6 as twigs, write down tie-set schedule. Using this tie-set schedule, find all the branch currents and branch voltages. **(14 Marks)**

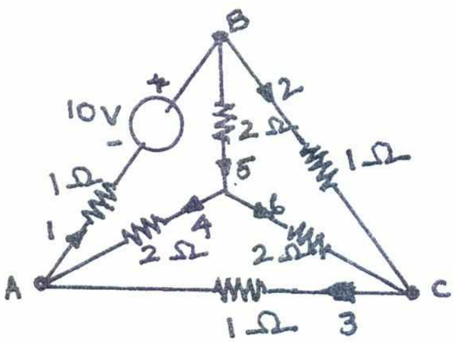


Fig. Q2(b)

3 a. State and illustrate superposition theorem. **(05 Marks)**

b. Using superposition theorem, find value of i in the circuit shown in Fig.Q3(b). **(08 Marks)**

c. Find the value of V_x in the circuit shown in Fig. Q3(c). Verify it using Reciprocity theorem. **(07Marks)**

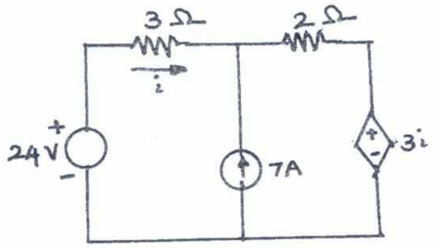


Fig.Q3(b)

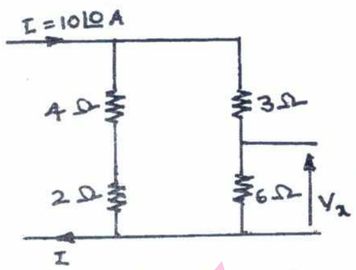
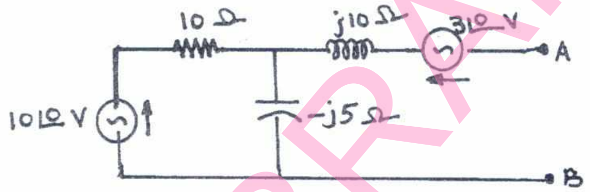


Fig. Q3(c)

4 a. Show that the power delivered to load, when the load impedance consists of variable resistance and variable reactance is maximum when the load impedance(Z_L) is equal to complex conjugate of source impedance (Z_g). **(10 Marks)**

b. Obtain Thevenin's equivalent network of the circuit shown in Fig. Q4(b) and thereby find current through 5Ω resistor connected between terminals A and B. **(10 Marks)**

Fig. Q4(b)



PART – B

5 a. With respect to series resonant circuit, define resonant frequency (f_r) and half power frequencies (f_1 and f_2). Also show that the resonant frequency is equal to the geometric mean of half power frequencies. **(10 Marks)**

b. A series circuit is energized by a constant voltage and constant frequency supply. Resonance takes place due to variation of inductance and the supply frequency is 300Hz. The capacitance in the circuit is 10μF. Determine the value of resistance in the circuit if the quality factor is 5. Also find the value of the inductance at half power frequencies. **(10 Marks)**

6 a. In the circuit shown in Fig. Q6(a), the switch K is changed from position A to B t = 0. After having reached steady state in position A. Find i, $\frac{di}{di}$, $\frac{d^2i}{dt^2}$ and $\frac{d^3i}{dt^3}$ at $t = 0^+$. **(10 Marks)**

b. In the circuit shown in Fig. Q6(b) switch K is opened at t = 0. Find i, ,$\frac{di}{dt}$, V_3 and $\frac{dV_3}{dt}$ at $t = 0^+$. **(10 Marks)**

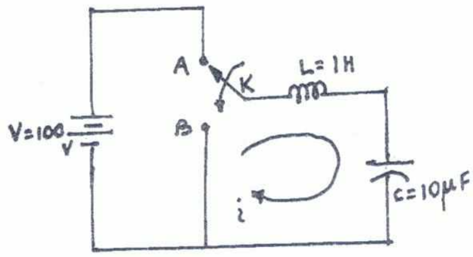


Fig. Q6(a)

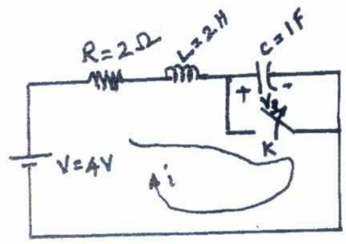


Fig. Q6(b)

7 a. Using convolution theorem find the inverse Laplace transform of following functions.

i) $F(s) = \dfrac{1}{(s-a)^2}$ and ii) $F(s) = \dfrac{1}{s(s+1)}$ **(10 Marks)**

b. Obtain the Laplace transform of the triangular waveform shown in Fig Q7(b). **(10 Marks)**

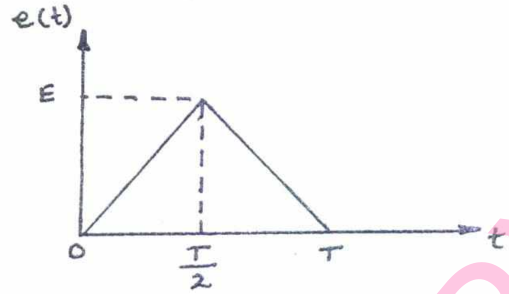


Fig. Q7(b)

8 a. Define h and T parameters of a two – port network. Also, derive the expressions for h parameters in terms of T parameters. **(10 Marks)**

b. Find Y and Z parameters for the network shown in Fig. Q8(b). **(10 Marks)**

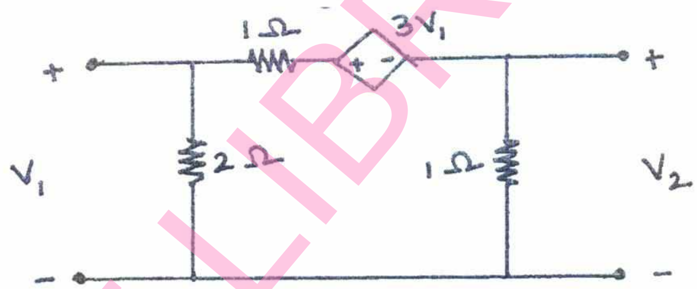


Fig. Q8(b)

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10EE35

Third Semester B.E. Degree Examination, June/July 2016
Electrical & Electronic Measurements & Instrumentation

Time: 3 hrs. Max. Marks:100

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

PART – A

1 a. The energy stored in a parallel plate capacitor per unit volume (energy density) is given by, $W = K \in^a V^b d^c$
where $\in$ = permittivity of medium
d = distance between plates
V = voltage between plates
K = constant of proportionality
Determine the values of a, b and c using LMTI system for the dimensional analysis. **(10 Marks)**

b. A Wheatstone's bridge circuit has ratio arms: 100 Ω and 10 Ω, standard resistance 4 Ω and the test-resistance 50 Ω. Calculate the unbalanced current in the galvanometer of internal resistance 20 Ω, when the supply voltage is 10 volts. Also find the value of unknown resistance corresponding to the null reading by galvanometer. **(10 Marks)**

2 a. Explain the method of measuring self inductance interms of a standard capacitor using Anderson bridge. **(10 Marks)**

b. A Bakelite sheet of 5 mm thickness is tested at 50 Hz between the electrodes 12 cm diameter. The Schering shown in Fig. Q2 (b) has an air capacitor C_2 of 106 pF, a non reactive resistance of R_4 of $\left(\frac{1000}{\pi}\right)\Omega$ in parallel with a variable capacitor C_4 and a non variable resistance R_3. Balance is obtained with $C_4 = 0.55\ \mu F$ and $R_3 = 270\ \Omega$. Determine the following: i) Capacitance, ii) Power factor, iii) Relative-permittivity of the sheet. **(10 Marks)**

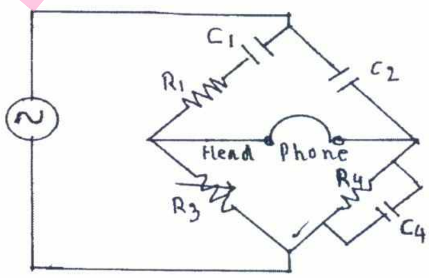

Fig. Q2 (b)

3 a. Draw the equivalent circuit and phasor diagram of a current transformer. **(08 Marks)**
b. Draw the equivalent circuit and phasor diagram of a potential transformer. **(08 Marks)**
c. Define actual ratio and nominal ratio for P.T. **(04 Marks)**

4 a. With a neat block diagram, explain the electronic energy meter and also enumerate its advantages. **(10 Marks)**
b. Explain the method of measuring three phase power using two wattmeter for star connected load (balanced). **(10 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.

PART – B

5 a. Classify the frequency meter based on the principle of operation and explain any one of those with a neat sketch. **(10 Marks)**

b. Draw the comparison between electronic meters and conventional analog meters. **(06 Marks)**

c. What are the advantages and disadvantages of an electronic multiplier? **(04 Marks)**

6 a. Draw the Lissajous patterns for same frequency different phase shifts and on what factors the shape of Lissajous figures depends on. Explain how frequency can be measured. **(10 Marks)**

b. Draw the front panel controls of dual trace oscilloscope and explain the various controls group. **(10 Marks)**

7 a. Explain the construction and working of LVDT. List the advantages and disadvantages of LVDT. **(12 Marks)**

b. With neat sketches, explain in brief the following:
i) Photo conductive cell.
ii) Photo voltaic cell. **(08 Marks)**

8 a. What are the objectives of data acquisition system and how are they classified? **(06 Marks)**

b. Explain the operation, basic construction, advantages and applications of X-Y recorders. **(14 Marks)**

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10EE36

Third Semester B.E. Degree Examination, June/July 2016
Electric Power Generation

Time: 3 hrs. Max. Marks:100

Note: 1. ***Answer FIVE full questions, selecting at least TWO questions from each part.***
2. ***Any missing data may be suitably assumed.***

PART – A

1 a. With block diagram explain the working of wind energy conversion system. **(08 Marks)**
b. With neat sketch, explain the working of fuel cell. **(06 Marks)**
c. With neat sketch, explain the concept of co-generation plant. **(06 Marks)**

2 a. With neat sketch, explain the methods of increase the thermal efficiency in gas turbine plant. **(08 Marks)**
b. With neat sketch, explain the working of biogeneration plant. **(06 Marks)**
c. Explain the advantages of distributed power generation system. **(06 Marks)**

3 a. Mention the factors to be considered for the selection of site for a hydro electric power plant. **(06 Marks)**
b. Write short notes on: i) Air pre heater ii) Condenser iii) Super heater and Reheater iv) Boiler. **(08 Marks)**
c. Explain the power station structure and control in hydro-electric power plant. **(06 Marks)**

4 a. Briefly explain: i) Nuclear fuels ii) Cladding and structural materials iii) Coolants iv) Control rod materials. **(08 Marks)**
b. What are the merits and demerits of nuclear power plant? **(06 Marks)**
c. Explain the various methods of nuclear disposal. **(06 Marks)**

PART – B

5 a. Define the following terms: i) Connected load ii) Demand factor iii) Load factor iv) Diversity factor v) Plant use factor vi) Plant utilization factor. **(06 Marks)**
b. The yearly load duration curve can be considered as a straight line from 300 MW to 80 MW for a certain power plant. Power is supplied with one generating unit of 200 MW capacity and two units of 100 MW capacity each. Calculate (i) Installed capacity (ii) Load factor (iii) Plant factor (iv) Plant utilization factor. **(08 Marks)**
c. A power station is to supply for regions of load whose peak loads are 10 MW, 5 MW, 8 MW and 7 MW. The diversity factor of the load at the station is 1.5 and average annual load factor is 0.6. Calculate maximum demand on the station and annual energy supplied from the station. **(06 Marks)**

6 a. Define power factor. What are the effects of low P.F? What are the methods of improving P.F.? **(06 Marks)**
b. Explain any three types of tariff. **(06 Marks)**
c. Explain the classification of substation according to service requirement and constructional features. **(08 Marks)**

7 a. Explain the necessity of current limiting reactor in power system. **(06 Marks)**
b. With neat sketch, explain an ungrounded system in power system. **(08 Marks)**
c. Define effective earthing. Explain the significance of effective earthing for present day operation of electrical equipment installation. **(06 Marks)**

8 Write short notes on:
a. Resonant grounding.
b. Neutral grounding.
c. Reactance grounding.
d. Earthing transformer. **(20 Marks)**

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MATDIP301

Third Semester B.E. Degree Examination, June/July 2016
Advanced Mathematics – I

Time: 3 hrs. Max. Marks:100

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

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

b. Find the modulus and amplitude of $1 + \cos\theta + i\sin\theta$. **(07 Marks)**

c. Find the cube root of $1 - i$. **(07 Marks)**

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

b. Find the n^{th} derivative of $\dfrac{6x}{(x-2)(x+2)(x-1)}$. **(07 Marks)**

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

3 a. Find the angle of intersection of the curves $r^2 \sin 2\theta = a^2$, $r^2 \cos 2\theta = b^2$. **(06 Marks)**

b. Find the nodal equation of the curve $r(1 - \cos\theta) = 2a$. **(07 Marks)**

c. Expand log (secx) upto the term containing x^4 using Maclaurin's series. **(07 Marks)**

4 a. If $u = x^3 - 3xy^2 + x + e^x \cos y + 1$, show that $u_{xx} + u_{yy} = 0$. **(06 Marks)**

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

c. Find $\dfrac{\partial(u, v, w)}{\partial(x, y, z)}$, where $u = x + y + z$, $v = y + z$, $w = z$. **(07 Marks)**

5 a. Obtain reduction formula for $\int \cos^n x \, dx$, where n is positive integer. **(06 Marks)**

b. Evaluate $\displaystyle\int_0^2 \frac{x^4}{\sqrt{4-x^2}}dx$. **(07 Marks)**

c. Evaluate $\displaystyle\int_{-c}^{c}\int_{-b}^{b}\int_{-a}^{a}(x^2 + y^2 + z^2)\,dz\,dy\,dx$. **(07 Marks)**

6 a. Prove that: i) $\Gamma(n+1) = n\,\Gamma(n)$ and ii) $\Gamma(n+1) = n!$ for a positive integer n. **(06 Marks)**

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

c. Show that $\displaystyle\int_0^{\pi/2} \frac{d\theta}{\sqrt{\sin\theta}} \cdot \int_0^{\pi/2} \sqrt{\text{Sin}\theta}\, d\theta = \pi$. **(07 Marks)**

7 a. Solve $\dfrac{dy}{dx} = (9x + y + 1)^2$. **(06 Marks)**

b. Solve $ye^{xy}\,dx + (xe^{xy} + 2y)\,dy = 0$. **(07 Marks)**

c. Solve $\dfrac{dy}{dx} + y\cot x = \cos x$. **(07 Marks)**

8 a. Solve $\dfrac{d^2y}{dx^2} - 6\dfrac{dy}{dx} + 9y = 5e^{-2x}$. **(06 Marks)**

b. Solve $(D^2 - 4D + 13)y = \cos 2x$. **(07 Marks)**

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

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