BTS – III – 11.13 – 1162

B. Tech. Degree III Semester Examination November 2013

IT/CS/EC/CE/ME/SE/EB/EI/EE/FT 1301 ENGINEERING MATHEMATICS II

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) Find the rank of the matrix.

$$\begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 6 \\ 3 & 4 & 5 & 6 & 7 \\ 4 & 5 & 6 & 7 & 8 \end{bmatrix}$$

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(b) Check whether the vectors $X_1 = (1,1,2)$, $X_2 = (1,2,5)$ and $X_3 = (5,3,4)$ are linearly dependent or not.

(c) Find the Laplace transform of $t^2\, u(t-3)$

(d) Evaluate $\int_0^\infty \frac{e^{-t} - e^{-3t}}{t}\, dt$

(e) Find the Fourier sine and cosine integrals of $f(x) = e^{-kx}$, for $x > 0, k > 0$

(f) Express $f(x) = x$ as a Fourier cosine series in $0 < x < 2$

(g) Find the work done by the force $\overline{F} = 3xy\,\overline{i} - y^2\,\overline{j}$ when it moves a particle along the curve $y = 2x^2$ in the xy plane

(h) Find (i) $\nabla^2\left(\frac{1}{r}\right)$ where $r = |\overline{r}|$ and (ii) $\nabla\left(\frac{1}{r}\,\overline{r}\right)$

PART B

(4 x 15 = 60)

II. (a) Test for consistency of the following system of equations and solve them if consistent: (8)

$$x_1 + x_2 - x_3 = 0$$
$$2x_1 - x_2 + x_3 = 3$$
$$4x_1 + 2x_2 - 2x_3 = 2$$

(b) Verify Cayley Hamilton theorem and hence find A^4 (7)

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

OR

(P.T.O.)

III. (a) For what values of k the equations $x+y+z=1, 2x+y+4z=k$, $4x+y+10z=k^2$ have a solution and solve them completely in each case. (10)

(b) Check whether $W=\{(a,b,o): a=b^2, a,b,\in R\}$ is a subspace or not (5)

IV. Find the inverse Laplace transform of

(i) $\dfrac{5S+3}{(S-1)(S^2+2S+5)}$ (5)

(ii) $\tan^{-1}\left(\dfrac{2}{S}\right)$ (5)

(iii) $\log\left(\dfrac{1+S}{S}\right)$ (5)

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OR

V. (a) Solve the equation : $y^{11}-3y^{1}+2y=4t+e^{3t}$ when $y(0)=1$, $y^{1}(0)=-1$ (8)

(b) Apply convolution theorem to evaluate $L^{-1}\left\{\dfrac{1}{S(S^2+4)}\right\}$ (7)

VI. (a) Find the Fourier transform of e^{-x^2} (8)

(b) Solve the integral equation:

$$\int_0^\infty F(x) Cos\, px\, dx = \begin{Bmatrix} 1-p & 0 \le p \le 1 \\ 0 & p > 1 \end{Bmatrix}$$ (7)

OR

VII. (a) Obtain the Fourier series for the function $f(x)=x^2, -\pi < x < \pi$. Hence show that (10)

(i) $1+\dfrac{1}{2^2}+\dfrac{1}{3^2}+........=\dfrac{\pi^2}{6}$

(ii) $1-\dfrac{1}{2^2}+\dfrac{1}{3^2}-\dfrac{1}{4^2}+......=\dfrac{\pi^2}{12}$

(iii) $1+\dfrac{1}{3^2}+\dfrac{1}{5^2}+.....=\dfrac{\pi^2}{8}$

(b) Find the finite Fourier Sine transform of $f(x)=2x \; in \; 0<x<4$ (5)

VIII. (a) Verify divergence theorem for $\overline{F}=x^2\overline{i}+z\overline{j}+yz\overline{k}$ over the cube formed by $x=\pm 1, y=\pm 1, z=\pm 1$ (9)

(b) Prove that $\nabla.(\nabla x \overline{A})=0$ for any vector function $\overline{A}$ (6)

OR

IX. (a) Verify Stoke's theorem for $\overline{F}=(2x-y)\overline{i}-yz^2\overline{j}-y^2z\overline{k}$ where S is the upper half of the sphere $x^2+y^2+z^2=1$ and C is the circular boundary in the XY plane. (8)

(b) Show that $\overline{F}=(y^2+2xz^2)i+(2xy-z)\overline{j}+(2x^2z-y+2z)\overline{k}$ is irrotational and hence find its scalar potential. (7)

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BTS – III– 11.13 – 1169

B.Tech. Degree III Semester Examination November 2013

EC 1302 PROBABILITY AND RANDOM PROCESS

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) If X is a Poisson variate such that $P(X=2)=9P(X=4)+90P(X=6)$, find the standard deviation.

(b) The joint density function of X and Y is given by

$$f(x,y)=\begin{cases} xe^{-x(y+1)} & ,x>0,y>0 \\ 0 & ,\text{elsewhere} \end{cases}$$

Are X and Y independent?

(c) Define Random Process. What is a wide sense stationary (WSS) process?

(d) If $X(t)=A+Bt$ where A and B are independent random variables with $E(A)=p$ and $E(B)=q$, $V(A)=\sigma_A^2$ and $V(B)=\sigma_B^2$, find auto correlation $R(t_1, t_2)$.

(e) Define:

(i) Power spectral density function

(ii) Cross power spectral density

(iii) Time average of random process

(f) The transition probability matrix (TPM) of the Markov Chain $\{x_n\}$, with $n = 1, 2, 3, \ldots$ having 3 states 1, 2, 3 is given by

$$P=\begin{bmatrix} 0.1 & 0.5 & 0.4 \\ 0.6 & 0.2 & 0.2 \\ 0.3 & 0.4 & 0.3 \end{bmatrix}.$$ Also given that

$P(X_0=1)=0.7$, $P(X_0=2)=0.2$ and $P(X_0=3)=0.1$.

Find $P(X_3=2, X_2=3, X_1=3, X_0=2)$.

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(g) Examine whether the function $Y(t)=x^3(t)$ is linear or not.

(h) Define (i) shot noise (ii) white noise

PART B

(4 x 15 = 60)

II. (a) Define Binomial distribution. Find its mean and variance. (7)

(b) The following table represents the bivariate distribution of (X,Y). Calculate (8)

$E(X), E(Y)$

Covariance and correlation between X and Y.

Also find $V(X/Y=1)$

Y \ X	0	1	2
0	0.01	0.01	0.02
1	0.22	0.10	0.43
2	0.07	0.08	0.06

OR

III. (a) Derive the mean and variance of Poisson distribution. (7)

(b) Let X be a random variable with probability density function (8)

$$(pdf)\ f(x)=\begin{cases} 2/3 \text{ when } x=1 \\ 1/3 \text{ when } x=2 \\ 0 \quad \text{elsewhere} \end{cases}$$

Find the moment generating function (mgf) and the central moments μ_2 and μ_3

(P.T.O.)

IV. (a) If $X(t) = A\cos t + B\sin t$ where A and B are independent random variables each of which assumes values -1 and 2 with probabilities 2/3 and 1/3 respectively. Show that $X(t)$ is a WSS process. (7)

(b) Prove that the sum of two independent Poisson processes is also a Poisson process. (8)

OR

V. (a) If $X(t)$ is a random process in which $C(\tau) = q\, e^{-\alpha|\tau|}$, show that $X(t)$ is mean ergodic. (7)

(b) Show that the process of $X(t)$ such that (8)

$$P\{X(t)=n\} = \begin{cases} \dfrac{(at)^{n-1}}{(1+at)^{n+1}} \; ; & n = 1.2.3,.... \\ \dfrac{at}{1+at} & ; n = 0 \text{ is evolutionary} \end{cases}$$

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VI. (a) If $R(\tau) = \begin{cases} 1 - \dfrac{|\tau|}{T} \; ; |\tau| < T \\ 0 \quad ; \text{otherwise,} \end{cases}$ find power spectral density (7)

(b) Let X_n be a Markov Chain with 3 states 0, 1, 2 and the transition probability matrix (8)

(7PM) is $P = \begin{bmatrix} 3/4 & 1/4 & 0 \\ 1/4 & 1/2 & 1/4 \\ 0 & 3/4 & 1/4 \end{bmatrix}$. Also given that

$P[X_0 = i] = \frac{1}{3}; \; i = 0,1,2.$ Find

(i) $P[X_2 = 2, X_1 = 1 / X_0 = 2]$ (ii) $P[X_3 = 1, X_2 = 2, X_1 = 1, X_0 = 2]$

(iii) $P[X_2 = 2, X_1 = 1, X_0 = 2]$ (iv) $P[X_2 = 2 / X_1 = 1]$

OR

VII. (a) If the TPM of a Markov Chain is $\begin{bmatrix} 0 & 1 \\ 1/2 & 1/2 \end{bmatrix}$, find the steady-state distribution of the chain. (6)

(b) A fair die is tossed repeatedly. If $X(n)$ denote the maximum of the numbers occurring in the first n tosses, find the probability matrix P of the Markov Chain $\{X_n\}$, $P(X_2 = 6)$ and P^2. (9)

VIII. (a) If a system is such that its input $X(t)$ and its output $Y(t)$ are related by a convolution integral $Y(t) = \int_{-\infty}^{\infty} h(u) \times (t-u)\, du$, $h(t)$ being a unit impulse function, show that it is a linear time invariant system. (8)

(b) A linear time invariant (LTI) system has an impulse response $h(t) = e^{-\beta t} u(t)$. Find the output autocorrelation function $R_{yy}(\tau)$ corresponding to an input $X(t)$. (7)

OR

IX. (a) Show that if the input to a time invariant stable linear system is a wide sense stationary (WSS) process, then the output $Y(t)$ given by (7)

$y(t) = \int_{-\infty}^{\infty} h(u) \times (t-u)\, du$ where $h(t)$ is a unit impulse function is also a WSS process.

(b) If $\{N(t)\}$ is a band limit white noise such that the power spectral density $S_{NN}(w)$ is given by $S_{NN}(w) = \begin{cases} \dfrac{No}{2} \; for \; |w| < w_B, \\ 0 \text{ elsewhere} \end{cases}$ find the auto correlation function. (8)

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BTS – III – 11.13 – 1181

B.Tech. Degree III Semester Examination November 2013

EC/EI 1303 NETWORK THEORY

(2012 Scheme)

Time : 3 Hours | Maximum Marks : 100

PART A

(Answer ***ALL*** questions)

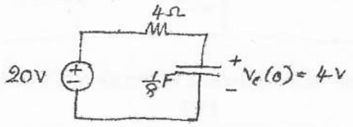
$(8 \times 5 = 40)$

I. (a) Explain passive and active circuit elements with example.

(b) State and prove maximum power transfer theorem.

(c) Define time constant. Write the time constant of RC network with necessary equation.

(d) Determine the current $i(t)$ for $t \geq 0$ if $V_c(0) = 4V$ for the circuit shown in figure.



(e) Write Y parameter equations and draw its equivalent model.

(f) What is attenuators? Draw 'T' type attenuator.

(g) Synthesis driving point impedance of RL network.

(h) What is separation property of poles and zeroes?

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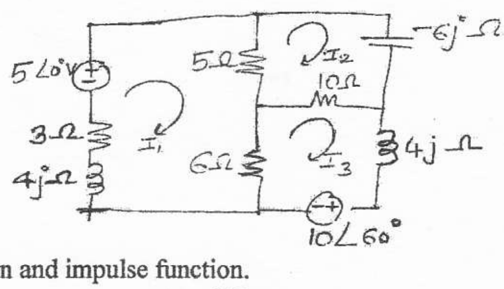
PART B

$(4 \times 15 = 60)$

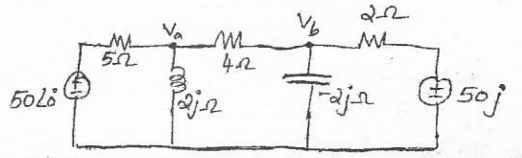
II. (a) Write the mesh equations of the network shown in figure and find the voltage across the capacitor. (10)



(b) Explain step function and impulse function. (5)

OR

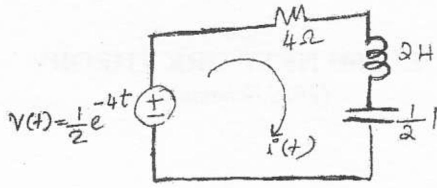
III. (a) Determine the node voltages with respect to the ground of the circuit shown in figure by node analysis and then find current through 4Ω. (10)



(b) For the circuit shown in figure, determine the frequency at which the circuit resonates, Q-factor and bandwidth. (5)

(P.T.O.)

IV. (a) Determine the current $i(t)$ for $t \geq 0$. If the initial voltage across the capacitor and initial current through the inductor are both zero. (10)

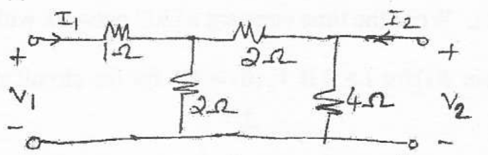


(b) Explain the transfer function and impulse function in circuit analysis. (5)

OR

V. Derive the complete solutions for the current of series RL circuit with sinusoidal input $V(f) = 100\,\cos(10^3 t + \pi/2), R = 20\Omega, L = 0.1H$. (15)

VI. (a) Find the 'h' parameters of the network shown (10)



(b) Explain cascade connections of two 2-port network with neat diagram. (5)

OR

VII. Design a m-derived low pass filter having cutoff frequency of 1KHZ, design impedance of 400Ω and resonant frequency of 1100Hz draw both T & π diagram. (15)

VIII. (a) State necessary and sufficient conditions for positive real function. Check the positive realness of the function $Z(S) = \dfrac{S+3}{S+1}$ (10)

(b) Test whether the polynominal (5)
$P(s) = S^4 + S^3 + 3S^2 + 2S + 12$ is Hurwitz.

OR

IX. Synthesize the Foster first and second forms of LC driving point impedance (15)

$$Z(s) = \frac{(S^2+1)(S^2+9)}{S(S^2+4)}$$

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B. Tech. Degree III Semester Examination November 2013

EB/EC 1304 DIGITAL ELECTRONICS

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 x 5 = 40)

I. (a) (i) Perform the following conversions

$(101)_{16} = (\quad)_2 = (\quad)_8$

(ii) Find the 4-bit result using 2's complement arithmetic

$(4)_{10} - (5)_{10}$

(iii) $(89)_{10} = (\quad)_{BCD} = (\quad)_{excess\ 3}$

(iv) (1) $(1101)_{gray} = (\quad)_{binary}$

(2) $(1101)_{binary} = (\quad)_{gray}$

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(b) Reduce the following expression

$F_{(A,B,C)} = ABC + A\bar{B}C + \bar{A}\bar{B}\bar{C} + B\bar{C}$

(i) using Boolean theorems
(ii) using K map

(c) Design a full subtractor using basic logic gates.

(d) Design a 4 input priority encoder with the help of the truth table.

(e) Convert SR to T FF.

(f) Draw the circuit of a serial adder and explain.

(g) Define the following terms with respect to a logic gate.
(i) Propagation delay
(ii) Power dissipation
(iii) Noise margin
(iv) Fan in
(v) Fan out.

(h) Draw and explain the circuit of a tri-state inverter logic gate.

PART B

(4 x 15 = 60)

II. (a) Obtain the minimal expression using Quine-McClusky method. (10)

$F_{(A,B,C,D)} = \sum m(1,5,6,12,13,14) + d(2,4)$

(b) Convert to POS (3)

$Y_{(A,B,C)} = A\bar{C} + BC + \bar{A}\bar{B}$

(P.T.O.)

(c) Correct the error if any in the 7 bit even parity hamming code "1111110" received in the format $D_7 D_6 D_5 P_4 D_3 P_2 P_1$ (2)

OR

III. (a) Reduce using K map and realize using NAND gates only. (10)

$$F_{(A,B,C,D,E)} = \sum m(2,9,13,18,19,23,25,27,29,31)$$

(b) An air conditioning system in an office is turned on under any of the following conditions (3)

- If temperature (T) exceeds 78° F on weekends.
- If humidity (H) is high
- If there is at least one person in the room on week days (W)

Write the logic expression for controlling the air-conditioning unit.

(c) Implement using 2 input NOR gates only (2)

$$Z = (a+\bar{b})(cd+\bar{e})$$

IV. (a) Draw the logic diagram of a 4 bit carry look ahead adder and explain how this speeds up addition process (10)

(b) Design a circuit for an active low 2 to 4 decoder with an active low enable input ($\bar{E}$) (3)

(c) Realize using 4:1 multiplexer $\delta(A,B,C) = \sum m(3,4,6,7)$ (2)

OR

V. (a) Explain the BCD addition process and design a BCD adder using 4 bit binary adders. (10)

(b) Write the program table and implement using a PLA (5)

$$P_{1(A,B,C)} = \sum m(0,1,3,5)$$

$$P_{2(A,B,C)} = \sum m(0,3,5,7)$$

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VI. (a) Design a 3 bit up down synchronous counter using TFFs. (10)

(b) Draw the circuit of a bit Ring/Johnson counter with mode control. Explain with the help of waveforms. (5)

OR

VII. (a) Draw and explain the circuit of a 3 bit binary multiplier. (10)

(b) Design a 3 bit asynchronous counter that counts 0-1-2-3-6-7 (3)

(c) Draw the circuit of a 3 bit PISO shift register. (2)

VIII. (a) Explain the circuit of a 2 input TTL NAND gate. (10)

(b) Compare totempole and open collector output configurations of TTL (3)

(c) Bring out the differences between (2)

(i) V_{IH} & V_{OH}

(*ii*) I_{IL} & I_{IH}

OR

IX. (a) Explain the different techniques for interfacing TTL to CMOS and CMOS to TTL (10)

(b) Draw and explain the circuit of CMOS inverter. (5)

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BTS – III – 11.13.1213

B.Tech. Degree III Semester Examination November 2013

EC/EI 1305 SOLID STATE ELECTRONICS

(2012 Scheme)

Time : 3 Hours Maximum Marks : 100

PART A

(Answer *ALL* questions)

$(8 \times 5 = 40)$

I. (a) Discuss the postulates of quantam mechanics

(b) Explain the Fermi-Dirac distribution function applied to semiconductors

(c) Discuss the different types of breakdown that occurs in the diode.

(d) Briefly explain the different types of P-N junction diodes based on fabrication process.

(e) Explain the operation of a JFET as a VVR device?

(f) Explain the principle of operation of a mosfet device.

(g) Write notes on base width modulation and punch through effect

(h) Explain the function of transistor as a switch with suitable diagram.

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PART B

$(4 \times 15 = 60)$

II. (a) Derive the expression for electron and hole concentration at equilibrium. (10)

(b) A Ge sample is doped with $5x10^{13}$ arsenic atoms/cm^3. Determine the carrier concentration and fermi level position at 300^0K (n_i for Ge = $2.5x10^{13}$ cm^3 at 300^0K) (5)

OR

III. (a) Obtain the Schrodinger wave quation of a particle in potential well. (10)

(b) An-type Si bar, 0.1cm long and 100 μm^2 in cross sectional area has a major carrier concentration of $5x10^{15}$ cm^{-3} and electron mobility is 1300 cm^2/V at 300^0K. What is the resistance of the bar? (5)

IV. Derive the ideal diode equation. (15)

OR

V. (a) Derive an expression for depletion layer width of a P-N junction diode. (10)

(b) Plot the V-I characteristics of A Ge & Si diode. Explain. (5)

VI. What is a mos capacitor? Explain the C-V characteristics of an ideal mos system with suitable diagram. Obtain the expression for the threshold voltage also. (15)

OR

VII. (a) Explain the principle of operation of JFET. (5)

(b) Derive the expression for IDSS. (5)

(c) Discuss the V-I characteristics of a Mosfet. (5)

VIII. (a) Explain the V-I characteristics of a transistor in CE configuration with suitable diagrams (9)

(b) Explain the various current components of a PNP transistor with suitable diagrams. (6)

OR

IX. (a) Draw Ebers - Moll Model of PNP transistor and write the Ebers-Moll equations. Explain the terms involved. (10)

(b) Write notes on Emitter crowding and Emitter injection efficiency (5)

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BTS – III – 11.13 – 1231

B.Tech. Degree III Semester Examination November 2013

EC/EI 1306 ELECTRONIC CIRCUITS I

(*2012 Scheme*)

Time : 3 Hours　　　　　　　　　　　　　　　　　　　　Maximum Marks : 100

PART A

(Answer *ALL* questions)

(8 × 5 = 40)

I. (a) Draw the block diagram of a DC power supply and briefly explain each block.

(b) Explain the principle of operation of an RC differentiator with circuit diagram and mathematical expressions.

(c) What is the need of biasing? Explain the stabilization of operating point.

(d) Compare the 'h' parameter equivalent of a transistor CE connection with 'r' parameter model.

(e) Compare FET with BJT.

(f) Draw the drain characteristics of FET. Explain the working of FET as a voltage variable resistor.

(g) Explain the working of transistor as a switch.

(h) Compare the different types of power amplifiers in terms of operating cycle and efficiency.

PART B

(4 × 15 = 60)

II. Draw and explain a full-wave bridge rectifier. Derive the expression for the ripple factor of a shunt capacitor filter. What are the advantages of bridge over centre-tap rectifier? (15)

OR

III. (a) Explain the working of a voltage doubler with the help of a neat circuit diagram. (7)

(b) Describe the operation of a transistorized series voltage regulator. (8)

IV. (a) Briefly explain the different methods of coupling. (5)

(b) What is an emitter follower? Derive the expressions for its input impedance, output impedance, voltage gain and current gain. Discuss its applications. (10)

OR

V. Draw and explain a single stage CE RC coupled amplifier. Draw its frequency response and explain why the frequency response decline in gain at high and low frequencies. (15)

VI. (a) Explain different JFET biasing. (7)

(b) Draw the circuit of a common source amplifier. Derive the expression for voltage gain at low frequencies. (8)

OR

VII. (a) Draw the V-I characteristics of a MOSFET and explain the three regions of operation. (8)

(b) Explain a source follower amplifier circuit. (7)

VIII. (a) Explain Miller effect and derive the expressions for miller input and miller output capacitance. (8)

(b) Draw and explain the high frequency ac equivalent model for a BJT amplifier and determine f_{H_i} and f_{H_0} (7)

OR

IX. What is cross-over distortion in class B power amplifiers? How can it be eliminated? Explain a complementary push-pull transformerless power amplifier with neat circuit diagram. (15)

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