SE. (Sem -III) (Rev-2007) 22/12/2016

Numerical Techniques. ETRX-OTR

QP CODE : 542802

(OLD COURSE)

(3 Hours) **Total Marks : 100**

N.B. (1) Question No. **1** is **compulsory.**
(2) Attempt any **four** out of remaining **six** questions.
(3) Make **suitable** assumptions if **required** and **justify** the **same.**

1. **(a)** Find absolute, relative and percentage error in following numbers. Determine number of significant digits. **5**

i) $a = 123.41769543$ $\bar{a} = 123.41$
ii) $b = 0.0053102500$ $\bar{b} = 0.0051$
iii) $c = 450550$ $\bar{c} = 450552$

(b) Define the operators $\Delta, \nabla, \delta, \mu \& E$. Prove that **5**

i) $2\mu\delta = \Delta + \nabla$ ii) $E = 1 + \Delta$

(c) Using Picard's method solve **5**

$\frac{dy}{dx} = 1 + xy$ such that $y = 0$ when $x = 0$.

(d) Derive the equation for Regula – falsi method using geometrical interpretation. **5**

2. **(a)** List the bracketing methods and open methods and find the real root of the equation $x^3 - 4x - 9 = 0$ using Newton Raphson method correct to three decimal places. **10**

(b) Solve the following equations by Gauss - Seidel method. **10**
$27x + 6y - z = 85$, $6x + 15y + 2z = 72$, $x + y + 54z = 110$.

3. **(a)** From the following table find the number of students who obtained marks less than 45. **10**

Marks	30-40	40-50	50-60	60-70
No. of students	31	42	51	35

(b) Using Newton's divided difference formula, find the value of **f(9)** from the following table. **10**

x	5	7	11	13	17
$f(x)$	150	392	1452	2366	5202

[TURN OVER

4. (a) Write a program for Lagrange's interpolation method and using this formula, find the value of y when $x = 10$ from the following table. 10

x	5	6	9	11
y	12	13	14	16

(b) The result of measurement of electric resistance R of a copper bar at various temperatures t^0C are listed below: 10

t	19	25	30	36	40	45	50
R	76	77	79	80	82	83	85

Find a relation $R = a + bt$

5. (a) The velocity of the train which starts from rest is given by the following table, the time being reckoned in minutes from the start and speed in km/hour. 10

Time	3	6	9	12	15	18
Velocity	22	29	31	20	4	0

Estimate approximately the distance covered in 18 minutes by Simpson's 3/8th rule.

(b) Solve $\frac{dy}{dx} = x + y^2$ with $x_0 = 0$, $y_0 = 1$ by Euler's modified formula find the value of y when $x = 0.5$ taking $h = 0.25$. 10

6. (a) Solve $\frac{dy}{dx} = x^2 + 2y$ with initial conditions $y(1) = 2$ and find y at $x = 1.2$, $x = 1.4$ by Runge - Kutta Method of Fourth Order taking $h = 0.2$. 10

(b) Solve the following set of equations using Gauss Elimination method. 10

$2x + y + z = 10$, $3x + 2y + 3z = 18$, $x + 4y + 9z = 16$.

7. (a) Explain the propagation of errors. 5

(b) Using Adams – Bashforth method, obtain the solution of $\frac{dy}{dx} = x - y^2$ at $y(0.8)$, given values 10

x	0	0.2	0.4	0.6
y	0	0.0200	0.0795	0.1762

(c) Write a short note on Golden section search. 5

22/12/2016

S.E Sem III OLD
ETRX
Control System

Q.P. Code : 546600

(3 Hours) **[Total Marks : 100]**

Note: 1) Question No. **1** is **compulsory**.
2) Attempt **any four** out of remaining six.
3) Assume suitable data wherever necessary.
4) **Figures** to the **right** indicate **marks**.

1. Attempt **any four** from the following :- **20**
   a) With suitable example, show how to find GM and PM from polar plot?
   b) Draw the step responses of a standard second order undamped, underdamped and critically damped system.
   c) Differentiate between Open Loop and Close Loop system.
   d) State the Mason's Gain formula with example.
   e) Define stability. Explain various types of stability.

2. a) Find the transfer function of the block diagram shown in figure 1 by using Block diagram reduction method. **10**

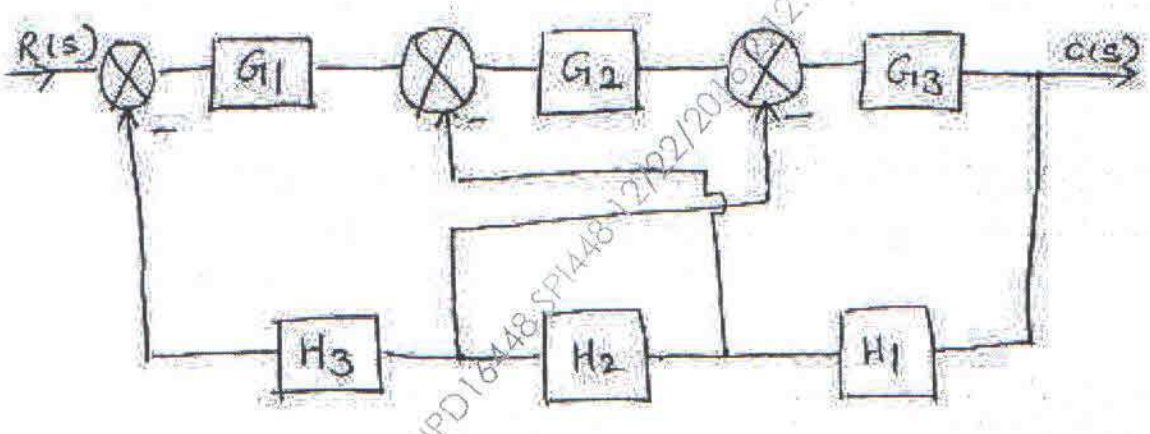

Figure 1

   b) Verify the answer of part (a) of this question using signal flow graph technique. **10**

3. a) Sketch the root locus for a given unity feedback control system whose open loop transfer function is **10**

$$G(s)=\frac{K(S+2)}{S(S+4)\ (S^2+2S+2)}$$

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b) Sketch the Bode plot and determine GM and PM for the transfer function **10**

$$G(s) = \frac{242(S+5)}{S(S+1)\ (S^2+5S+121)}$$

4. a) Explain the effect of addition of open loop zeros on Root Locus. **10**

b) Test the stability of the system with the following characteristic equation by Routh's test **10**

$S^5 + 2S^4 + 3S^3 + 6S^2 + 2S + 1 = 0$

5. a) Obtain the state transition matrix for a given system matrix **10**

$$A = \begin{bmatrix} 0 & 1 \\ -2 & -3 \end{bmatrix}$$

b) Sketch the polar plot for the system having transfer function **10**

$$G(s) = \frac{1}{S(S+2)\ (S+10)} \qquad H(S) = 1$$

6. a) Draw the Nyquist plot for a given open loop transfer function and test the stability. Find GM and phase crossover frequency. **10**

$$G(s) = \frac{10}{S^2(S+2)} \qquad H(S) = 1$$

b) Determine the output response of second order control system given by **10**

$$\frac{C(s)}{R(s)} = \frac{25}{s^2+6s+25}$$

Find its rise time, peak time, settling time and peak overshoot if subjected to unit step input.

7. Write short note on **any two** from the following: **20**

a) Co-relation between time domain and frequency domain specifications

b) Synchros

c) Continuous controller modes

OLD Sem III (OLD) [redacted] ETRX

25 NOV 2016 [redacted] Electronics

Engg. Maths - III **QP CODE : 546301**

(3 HOURS) **MARKS:100**

N.B. (i) Question no. ONE is compulsory.

(ii) Attempt any FOUR questions out of the remaining six questions.

(iii)Figures to right indicate full marks.

Q. 1 (a) If $\{f(k)\} = \{2^0, 2^1, 2^3, \ldots\}$ find $Z\{f(k)\}$ 5

(b) Find the Laplace transform of $\sin^5 t$ 5

(c) If $f(x) = 2x$ in $(0, 2\pi)$ find the values of a_4, b_{10}. 5

(d) Find k such that $\frac{1}{2}\log(x^2 + y^2) + i\tan^{-1}\frac{kx}{y}$ is analytic 5

Q.2 (a) Evaluate $\int_0^\infty e^{-2t} \sinh t \frac{\sin t}{t} dt$ 6

(b) Express the matrix A as the sum of symmetric and skew symmetric matrices 6

where $A = \begin{bmatrix} 1 & 5 & 6 \\ 12 & 4 & 3 \\ 7 & 1 & 3 \end{bmatrix}$

(c) Find a cosine series of period 2π to represent $\sin x$ in $0 \le x \le \pi$ 8

Q.3 (a) Evaluate $L[t \cos 3t \sinh 4t]$ 6

(b) Find non-singular matrices P & Q s.t. PAQ is in Normal form . Also find rank of A 6

$A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 5 & 3 \\ 1 & 3 & 2 \end{bmatrix}$

(c) Evaluate by Green's theorem $\int_c \bar{F}.d\bar{r}$ Where $\bar{F} = -xy(x\hat{i} - y\hat{j})$ and C is $r = a(1 + \cos\theta)$ 8

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Q.4 (a) Obtain complex form of Fourier series for $f(x)=e^{ax}$ in $(-\pi,\pi)$ 6

(b) Determine the linear dependence or independence of vectors $[2,-1,3,2]$, $[1,3,4,2]$, & $[3,-5,2,2]$ Find the relation between them if dependent 6

(c) (i) Find the inverse Laplace Transformation by using convolution theorem $\frac{s^2}{(s^2+a^2)^2}$. (ii) Find the inverse Laplace Transformation of $\tan^{-1}\left(\frac{2}{s^2}\right)$ 8

Q.5 (a) Find the imaginary part of the analytic function whose real part is e^{2x} (xcos2y-ysin2y) 6

(b) For what value of λ, the following system of equations possesses a non-trivial solution? Obtain the solution for real values of λ.
$3x_1+x_2-\lambda x_3=0, 4x_1-2x_2-3x_3=0, 2\lambda x_1+4x_2+\lambda x_3=0$ 6

(c) Using Fourier Cosine integral prove that $e^{-x}\cos x=\frac{2}{\pi}\int_0^\infty \frac{(\omega^2+2)}{(\omega^4+4)}\cdot\cos\omega x\, d\omega$ 8

Q.6 (a) Find the Fourier Series of $f(x)=x^2$ in the interval $(0,2\pi)$. 6

(b) Find the bilinear transformation which maps the points 2, i, -2 onto the points 1, i, -1 6

(c) Solve $(D^2-3D+2)y=4e^{2t}$, with $y(0)=-3$ and $y'(0)=5$ 8

Q.7 (a) Find inverse Z-transform of $F(z)=\frac{z}{(z-1)(z-2)}$, $|z|>2$ 6

(b) Find the analytic function f(z) = u+iv such that $u-v=e^x(cosy-siny)$ 6

(c) Show that the set of functions $\sin\left(\frac{\pi x}{2L}\right), \sin\left(\frac{3\pi x}{2L}\right), \sin\left(\frac{5\pi x}{2L}\right), \ldots$ is orthogonal over $(0,L)$. 8

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Sem III Etrx (old) Basic Electronics Ckts 2/12/16

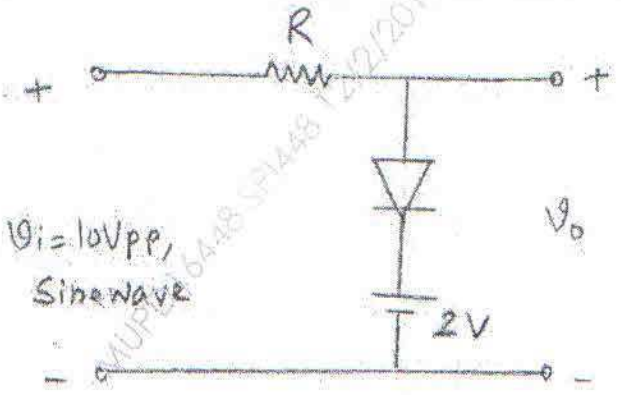
QP Code : 546400

(3 Hours) **[Total Marks : 100**

N.B. : (1) Question No. **1** is compulsory
(2) Answer **any four** out of remaining **six** questions.
(3) Assume any suitable data wherever required.

1. Answer any four of the following :-
   (a) Derive the condition for zero temperature drift biasing in JFET. **5**
   (b) Draw and explain negative clamper circuit. **5**
   (c) Explain the phenomenon of thermal runaway in BJT. **5**
   (d) Compare CE BJT and CS FET amplifiers. **5**
   (e) Compare " L" and "C" filter. **5**

2. (a) Draw the circuit of full wave rectifier with "LC" filter and explain its working. Derive expression for ripple factor. **10**
   (b) For the clipper circuit shown below sketch the waveform of output voltage and justify it. **10**



3. Design a single stage RC coupled CE amplifier to meet the following specifications : **20**
   V_o=2v, $|A_v|$ =90, S=8, F_L = 20Hz. Determine A_v, Z_i and Z_o for the designed circuit. Choose a suitable transistor with proper justification from the data sheet.

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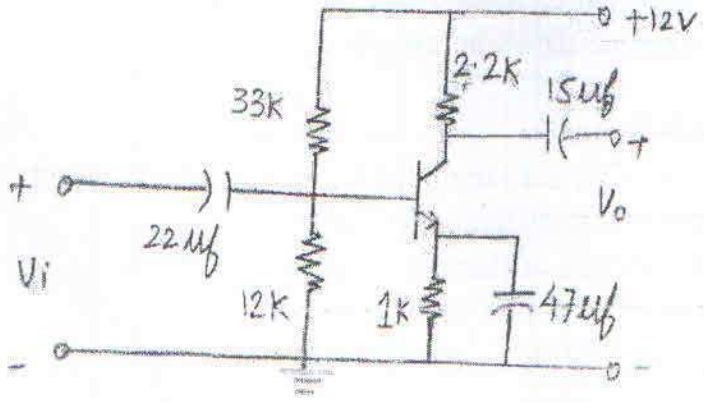
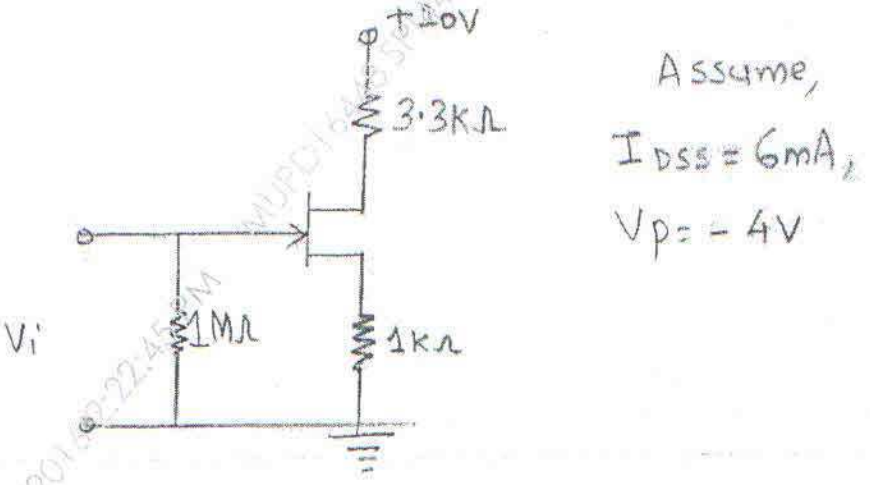
4. (a) For the circuit shown below determine I_B, I_C, V_{CE}, V_{RE}, A_V and R_I. Assume $\beta = 90$. **10**



(b) Define Transistor Biasing. State and compare various types of biasing circuits of BJT as a voltage amplifier. **10**

5. (a) Draw neat circuit diagram of CS FET amplifier and explain its working. Deriver the expressions for Z_I, Z_O and A_V. **10**

(b) For the circuit shown below, determine V_{GSQ}, I_{DQ} and V_{DSQ}. **10**



6. Design a single stage RC coupled CS amplifier to meet the following specifications: **20**

$V_O = 2.5V$, $|Av| = 10$, $F_L = 20Hz$. Use BFW11.

Determine A_V, Z_I, $V_{O(max)}$ and Z_O for the designed circuit.

Sem III Etrx (Old) Basic Electronics Ckts 2/12/16

QP Code : 546400

7. Write short notes on **any three** of the following :- 20
   (a) Photodiode and photovoltaic cell.
   (b) Various biasing schemes for E-MOSFET.
   (c) Hybrid π equivalent circuit of BJT.
   (d) Comparison of CE, CB and CC amplifiers.

DATA SHEET

Transistor type	Pdmax @ 25°C Watts	Icmax @ 25°C Amps	V_{cb} volts d.c.	V_{ceo} volts d.c.	V_{ceo} (Sus) volts d.c.	V_{ces} (Sus) volts d.c.	V_{cex} volts d.c.	V_{ebo} volts d.c.	T_j max °C	D.C. current gain min	typ.	max.	Small Signal h_{fe} min.	typ.	max.	V_{sx} max.	θ_{j-c} °C/mW	Derate above 25°C mW/°C
2N 3055	115·5	15·0	1·1	100	60	70	90	7	200	20	50	70	15	50	120	1·8	1·5	0·7
ECN 055	50·0	5·0	1·0	60	50	55	60	5	200	25	50	100	25	75	125	1·5	3·5	0·4
ECN 149	30·0	4·0	1·0	50	40	—	—	8	150	30	50	110	33	60	115	1·2	4·0	0·3
ECN 100	5·0	0·7	0·6	70	60	65	—	6	200	50	90	280	50	90	280	0·9	35	0·03
BC147A	0·25	0·1	0·25	50	45	50	—	6	125	115	180	220	125	220	260	0·9	—	—
2N 525(PNP)	0·225	0·5	0·25	85	30	—	—	—	100	35	—	65	—	45	—	—	—	—
BC147B	0·25	0·1	0·25	50	45	50	—	6	125	200	290	450	240	330	500	0·9	—	—

Transistor type	hie	hoe	hre	θja
BC 147A	2·7 K Ω	18μ ℧	1·5 × 10^{-4}	0·4°C/mw
2N 525 (PNP)	1·4 K Ω	25μ ℧	3·2 × 10^{-4}	—
BC 147B	4·5 K Ω	30μ ℧	2 × 10^{-4}	0·4°C/mw
ECN 100	50 Ω	—	——	——
ECN 149	15 Ω	—	——	——
ECN 055	12 Ω	—	——	——
2N 3055	6 Ω	—	——	——

BFW 11—JFET MUTUAL CHARACTERISTICS

-Vgs volts	0·0	0·2	0·4	0·6	0·8	1·0	1·2	1·6	2·0	2·4	2·5	3·0	3·5	4·0
Ios max. mA	10	9·0	8·3	7·6	6·8	6·1	5·4	4·2	3·1	2·2	2·0	1·1	0·5	0·0
Ios typ. mA	7·0	6·0	5·4	4·6	4·0	3·3	2·7	1·7	0·8	0·2	0·0	0·0	0·0	0·0
Ios min. mA	4·0	3·0	2·2	1·6	1·0	0·5	0·0	0·0	0·0	0·0	0·0	0·0	0·0	0·0

N-Channel JFET

Type	V_{os} max. Volts	V_{oc} max. Volts	V_{cs} max. Volts	P_d max. @25°C	T_j max.	I_{oss}	Y_{fs} (typical)	$-V_p$ Volts	r_d	Derate above 25°C	θ_{j-c}
2N3822	50	50	50	300 mW	175°C	2 mA	3000 μ ℧	6	50 KΩ	2 mW/°C	0·59°C/mW
BFW 11 (typical)	30	30	30	300 mW	200°C	7 mA	5600 μ ℧	2·5	50 KΩ	——	0·59° C/mW