THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.301 ENGINEERING MATHEMATICS-II (ABCEFHMNPRSTU)

MODEL QUESTION PAPER

Time: 3 hours Maximum marks: 100

PART-A

*Answer **all** questions. **Each** question carries 4 marks*

1. A particle moves so that its position vector is given by

$\vec{r} = coswt\ \hat{\imath} + sinwt\ \hat{\jmath}$, show that the velocity $\vec{V}$ of the particle is perpendicular to $\vec{r}$.

2. If $f(x) = x\ ,\ o < x < \frac{\pi}{2}$

$= \pi - x\ ,\ \frac{\pi}{2} < x < \pi$. Show that $f(x) = \frac{4}{\pi}\left(sinx - \frac{sin3x}{3^2} + \frac{sin5x}{5^2} - \cdots\right)$

3. Find the cosine transform of $f(x) = sinx$ in $0 < x < \pi$.

4. Solve the partial differential equation if $\frac{\partial z}{\partial x} = 6x + 3y\ ; \frac{\partial z}{\partial y} = 3x - 4y$.

5. State the assumptions involved in the derivation of one dimensional Heat equation.

PART-B

*Answer **one full** question from **each** module. **Each** question carries **20** marks.*

MODULE-I

6. a) Find the constants a and b so that the surfaces $5x^2 - 2yz - 9x = 0$ and $ax^2y + bz^3 = 4$, may cut orthogonally at the point $(1, -1, 2)$.

b) If φ is a scalar point function, use Stoke's theorem to prove that $Curl(grad\ \varphi) = 0$.

c) Evaluate by Green's theorem in the plane for $\int_C (y - sinx)dx + cosx\ dy$ where C is the boundary of the triangle whose vertices are (0,0), $(\frac{\pi}{2}, 0)$ and $(\frac{\pi}{2}, 1)$.

7. a) If $\vec{r} = x\,\hat{\imath} + y\,\hat{\jmath} + z\,\hat{k}$ prove that $\nabla r^n = nr^{n-2}\,\vec{r}$ where $r = |\vec{r}|$.

b) Show that $\vec{F} = e^x\left[(2y + 3z)\hat{\imath} + 2\hat{\jmath} + 3\hat{k}\right]$ is irrotational and find its scalar potential.

c) Using divergence theorem, evaluate $\iint_S F.n\hat{}\ ds$ where $\vec{F} = 4x\hat{\imath} - 2y^2\hat{\jmath} + z^2\hat{k}$ and S is the surface bounding $x^2 + y^2 = 4, z = 0$ and $z = 3$

MODULE-II

8. a) Obtain the Fourier series of the function $f(x) = \left(\frac{\pi - x}{2}\right)^2$ in $(0,2\pi)$

b) Find the Fourier transform of $f(x) = 1 \;, |x| < a$

$= 0 \,, |x| \geq a$

Hence evaluate $\int_0^\infty \frac{sinx}{x} dx$

9. a) Find the Fourier series of $f(x) = -x + 1 \;, -\pi \leq x \leq 0$

$= x + 1 \quad , \quad 0 \leq x \leq \pi$

b) Find the Fourier cosine transform of $f(x) = e^{-4x}$ and

hence show that $\int_0^\infty \frac{cos2x}{x^2+16} dx = \frac{\pi}{8} e^{-8}$

MODULE-III

10. a) Solve the pde $pxy + pq + qy = yz.$

b) Solve the pde $(D^2 - DD' + 2D'^2)z = e^{3x+4y} + \sin(x - y)$

11. a) Solve the partial differential equation $x(y^2 - z^2)p - y(z^2 + x^2)q = z(x^2 + y^2)$

b) Solve the pde $(D^2 + DD' - 6D'^2)z = \; ycosx$

MODULE-IV

12. a) Using the method of separation of variables, solve $\frac{\partial u}{\partial x} - 2\frac{\partial u}{\partial t} = u$ given that

$u = 3e^{-5x} + 2e^{-3x}$ when $t = 0$.

b) A string of length l is fixed at both the ends. The midpoint of the string is taken to a height b and then released from rest in that position. Find the displacement of the string.

13. a) Solve $\frac{\partial u}{\partial t} = \alpha^2 \frac{\partial^2 u}{\partial x^2}$ subject to the condition, $u(0,t) = 0 = u(\pi, t)$ and

$u(x, 0) = \pi x - x^2$ in $(0,\pi)$

b) A rod of length l has its ends A and B kept at 0^0C and 100^0C respectively until steady conditions prevail. The temperature at A is suddenly raised to 25^0C and at the same time that B is lowered to 75^0C and the end temperatures are thereafter maintained. Find the temperature function $U(x,t)$.

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.302 SIGNALS AND SYSTEMS (AT)

MODEL QUESTION PAPER

Time: **3 Hours** Maximum Marks: **100**

PART A

*Answer **all** questions. Each question carries 2marks.*

1. Define the following continuous functions.
(a) Signum function (b) Sync function

2. Determine the odd and even part of the signal, $x(t) = (1+t^3) \cos^3 10t$

3. Find whether the signal given by x (n) = 5cos (6-n) is periodic

4. What are the conditions for distortionless transmission of a signal?

5. Write down the relationship between Laplace Transform and Fourier Transform.

6. Write down the Drichlet conditions for existence of Fourier Transform of a continuous time signal.

7. Explain the term aliasing.

8. Write down the properties of Hilbert Transform.

9. Write a note on ROC of Z transform.

10. What is meant by correlation in Z transform?

(10 x 2Marks=20 Marks)

PART B

*Answer any **one** question from each module. Each full question carries 20 Marks*

MODULE – I

11. Plot the signals

(a) y(t) = u(t+1)-2 u(t-1) + u (t-3) (6 Marks)

(b) y(t) = x1(t)+x2(t), where $x1(t) = \begin{cases} 1; & 0 < t < 1 \\ 2; & 1 < t < 2 \\ 1; & 2 < t < 3 \end{cases} \quad x2(t) = \begin{cases} t; & 0 < t < 1 \\ 1; & 1 < t < 2 \\ 3-t; & 2 < t < 3 \end{cases}$

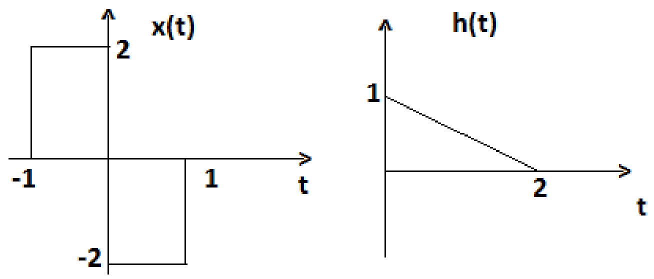
(6 Marks)

(c) Check whether the following signals are Energy signals or power, Also determine energy / power.

(i) $x(t) = A \cos(\omega_0 t + \theta)$ (ii) x(t) = u(t+1) (8 Marks)

12. (a) Determine the convolution of signals **$x_1(t) = \cos t\, u(t)$, $x_2(t) = t u(t)$**. (4 Marks)

(b) Graphically determine the convolution of signals

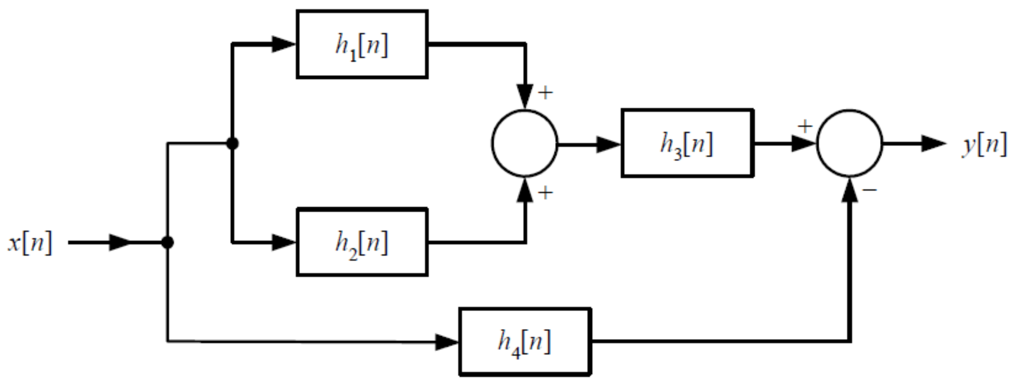


(8 Marks)

(c) Check for shift variance, linearity, causality the systems represented by

$Y(t) = 3x(t^2)$ (3 Marks)

(d) Obtain the overall impulse response of the system shown below. (5 Marks)



MODULE - II

13. (a) Find LT of $x(t) = e^{2t}\,(u(t) – u(t-4))$ (4 Marks)

(b) Verify initial value theorem for the function **$x(t) = 2- e^{5t}$** (4 Marks)

(c) Find the inverse Laplace Transform of $\log\left[\frac{1+s}{s^2}\right]$ (4 Marks)

(d) Define Parseval's theorem for Continuous time Fourier Series. (2 Marks)

(e) Find the complex exponential Fourier series representation of the signal given by

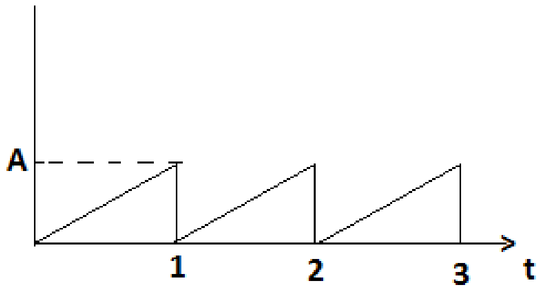
$x(t) = \cos \omega_0 t$ (6 Marks)

14. (a) Plot Magnitude spectrum and Phase spectrum of the signal $\mathbf{x(t) = e^{-at} u(t)}$.

(6 Marks)

(b) Expand the function x(t) shown, by trigonometric Fourier series over interval (0,1).

(6 Marks)



(c) Write down the time convolution property of Fourier Transform (4 Marks)

(d) State and prove convolution theorem of Fourier series. (4 Marks)

MODULE - III

15. (a) State and explain the Sampling Theorem. (4 Marks)

(b) What are the different sampling techniques? Explain in detail. (8 Marks)

(c) A band limited signal x(t) is sampled by a train of pulses of width τ and period T. Determine the spectrum of sampled signal and sketch it. Also find expression for sampled signal. (8 Marks)

16. (a) Write down four properties of Hilbert Transform. (6Marks)

(b) Explain the pre envelope of Continuous time signal. (5 Marks)

(c) Write a note on Discrete Hilbert Transform. (3 Marks)

(d) Explain aliasing with help of figures. How it is eliminated. (6 Marks)

MODULE - IV

17. (a) What is the relation between DTFT and Z transform. (3 Marks)

(b) Determine Z transform of the function given by $x(n) = \begin{cases} 0, n \geq 0 \\ a^n, n < 0 \end{cases}$

(6Marks)

(c) Determine Z transform and ROC of the signal x(n) = u(n) – u (n-8) (6 Marks)

(d) Find DTFT of the sequence $\mathbf{x(n) = -a^n u(-n-1)}$ (5 Marks)

18. (a) Find the Inverse Z transform of the signals

(i) $X(Z) = \frac{1}{1-15\,z^{-1}+0.5z^{-2}}$ for ROC $|z| > 1$ (4 Marks)

(ii) $X(Z) = \frac{5z^{3}-29\,z^{2}+8z+60}{z^{2}-7z+10}$ (4 Marks)

(b) Write down properties of ROC of Z transform. (4 Marks)

(c) Derive the convolution property of Z transform. (4 Marks)

(d) Determine the discrete time Fourier transform of x(n)=an u(n) for -1<a<1

(4 Marks)

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.303 NETWORK ANALYSIS (AT)

MODEL QUESTION PAPER

Time: **3 Hours** Maximum:100 Marks

PART A

*Answer **all** questions. Each question carries 2marks.*

1. What is a dual network?
2. State superposition theorem.
3. Define impulse and step function.
4. What is complex frequency?
5. List 2 properties of driving point function.
6. Obtain Laplace transform of $x(t) = \cos \omega t$ from fundamentals.
7. Define Q factor & selectivity.
8. Explain dot rule for complex circuits.
9. State two properties of RL driving point impedance function.
10. What is causality? Give its significance.

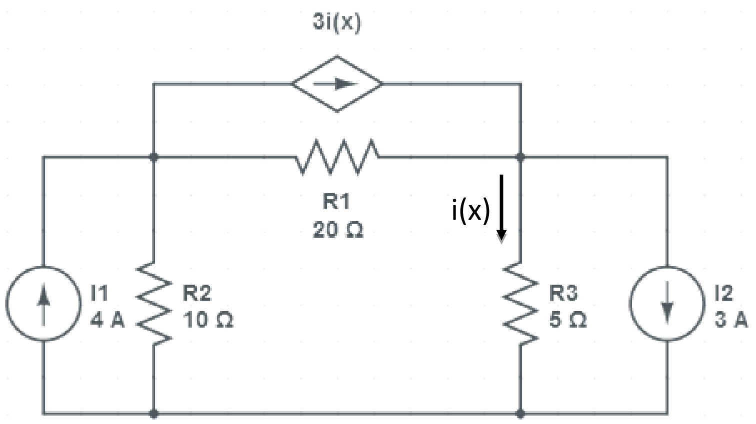
[10x2 = 20 marks]

PART B

*Answer any **one** question from each module. Each full question carries 20 marks*

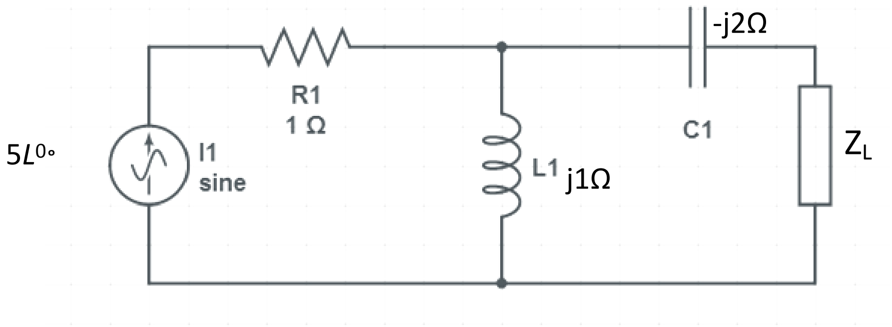
MODULE - I

11. (a)Using node analysis, determine i_x



(b) Draw the waveforms of unit impulse, step and ramp. Write down their mathematical expressions and the relationship between them.

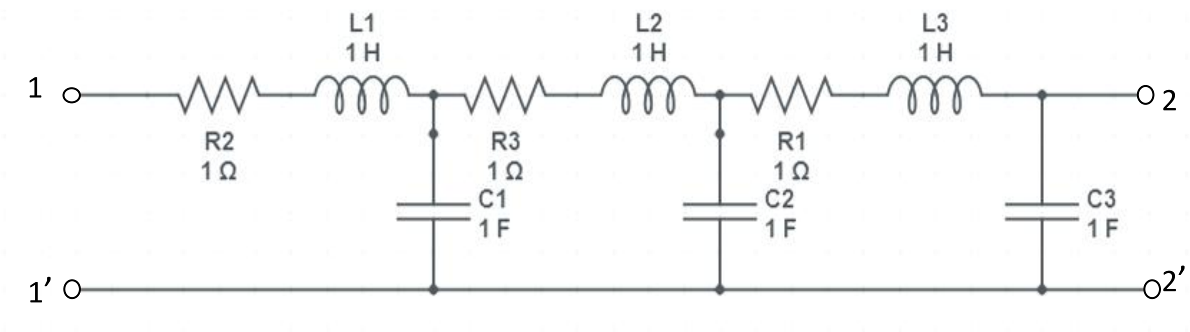
12. (a) In the network shown below, the load impedance is a complex quality. Find Z_L for the maximum power transfer. Also find the amount of maximum power transferred to the load.



(b) Explain (i) Graph (ii) Tree (iii) Cut-set matrix

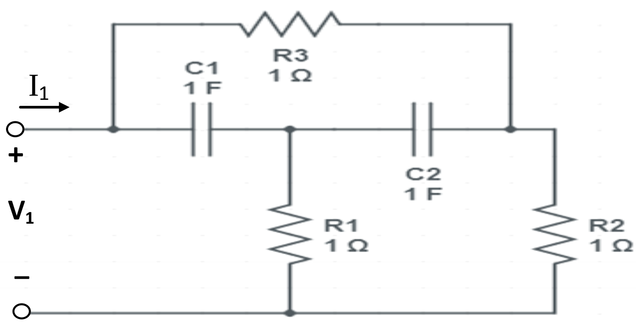
MODULE - II

13. (a) Find the open circuit driving point impedance of the following ladder network.



(b) Obtain Laplace transform of a Gate pulse of width 2 sec and height 10V. Also prove initial value theorem.

14. (a) For the circuit shown, obtain the driving point admittance Y_{11} (s) in Laplace domain.



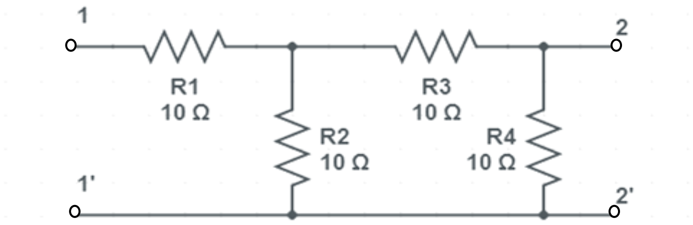
(b) Draw pole-zero plot and hence obtain V(t) for the following network function

$$V(s) \quad = \quad \frac{4(s+2)\,s}{(s+1)\;(s+3)}$$

MODULE - III

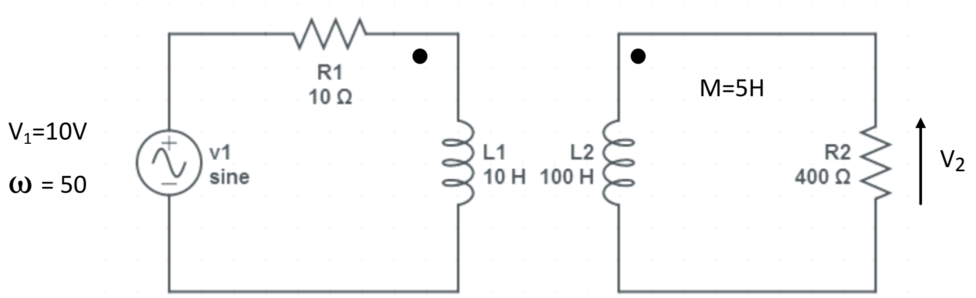
15. (a) Find the h – parameter for the network. Check whether the network is

(i) Reciprocal (ii) Symmetric



(b) Show that the resonant frequency of an RLC circuit is the geometric mean of the lower and upper half power frequencies.

16. (a) For the coupled circuit, find the ratio of output voltage to source voltage.



(b) Define image and characteristic impedance. Obtain image impedance of a T network.

MODULE - IV

17. (a) What are the characteristics of a positive real function ?

(b)Prove that the polynomial $s^4 + s^3 + 2s^2 + 3s + 2$ is not Hurwitz.

18. (a) Synthesize the first and second Foster networks for the impedance.

$$Z(s) \quad = \quad \frac{(s+1)\,(s+4)}{(s+3)\,(s+5)}$$

(b) Realize the RC impedance function by a Cauer form and a Foster form.

$$Z(s) \quad = \quad \frac{(s+2)\,(s+5)}{(s+3)\,(s+1)}$$

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.304 BASIC INSTRUMENTATION (A)

MODEL QUESTION PAPER

Time: 3 Hrs. Max. Marks: 100

Part A

*Answer **all** questions. Each question carries 2 marks.*

1. Differentiate between bridge sensitivity and current sensitivity in a Wheatstone's bridge
2. Distinguish between Q-factor of an inductor and D-factor of a capacitor.
3. Explain how LVDT is used for the measurement of displacement.
4. Draw a bridge circuit for the measurement of unknown inductance suitable for inductors with low Q-factor.
5. Draw the five standard schematic symbols for synchros and identify all connections.
6. State the advantages of using 400 Hz synchros over 50 Hz synchros.
7. What is a frequency synthesizer? Give two applications
8. Define deflection factor and sensitivity for a CRT.
9. What are active probes to feed signals to Oscilloscopes?
10. Sketch the CRO display when the sine waves of equal amplitudes fed to the vertical and horizontal inputs are in phase, anti phase and in phase quadrature.

(2 Marks x 10 = 20 Marks)

Part B

*Answer any **one** full question from each Module. Each full question carries 20 Marks*

MODULE - I

11. (a) Draw a relevant bridge circuit to measure the values of equivalent circuit elements (Lp and Rp) of a inductor. Derive expressions for them.

(b) A Hay bridge operating at a supply frequency of 100 kHz is balanced when the components are C_1 = 0.1 μF, R_1 = 1.26 kΩ, R_3 = 75 Ω and R_4 = 500 Ω. Calculate the inductance and resistance of the measured inductor. Also determine the Q-factor of the coil.

OR

12. (a) Draw the circuit diagram of Wheatstone bridge and derive the expression for bridge sensitivity.

(b) A Maxwell inductance bridge uses a standard capacitor of C_3 = 0.1 μF and operates at a supply frequency of 100 Hz. It is balanced when R_1 = 1.26 kΩ, R_3 = 470 Ω and R_4 =

500 Ω. Calculate the inductance and resistance of the measured inductor and determine its Q-factor.

MODULE - II

13. Explain in detail, with neat sketches about the working of the following transducers:

a) Hall effect transducer

b) Magneto- strictive transducer

c) Proximity transducer

OR

14. Explain the operation of a basic synchro transmitter and a receiver. Distinguish between torque and control synchros.

MODULE - III

15. (a) Draw a basic Q-meter circuit and explain the operation of a Q-meter.

(b) The signal generator frequency of a Q-meter is set to 1.25 MHz. The Q of a coil is measured as 98 when C=147 pF. Determine the coil inductance and resistance.

OR

16. (a) Sketch the block schematic of a dual – slope integrator VDM and explain its working.

(b) A digital frequency meter uses a time base of 1 MHz generator frequency divided by six decade counters. Determine the meter indication when input frequency is 5 kHz and the time base output is selected at sixth decade counter.

MODULE - IV

17. (a) Sketch the basic construction of a Cathode Ray Tube (CRT) and explain its working.

(b) A 1 kHz triangular wave with a peak value of 10 V is applied to the vertical plates of a CRT. A 1 kHz saw tooth of amplitude 20 V is applied to the horizontal plates. The vertical and horizontal deflection sensitivities are 0.4 cm/V and 0.25 cm/V. Determine the waveform displayed.

OR

18. (a) Sketch the deflection systems of a dual trace oscilloscope and explain.

(b) Calculate the value of adjustable capacitance required to compensate a 10:1 probe when input capacitance is 30 pF and the co-axial cable capacitance is 100pF. Also calculate the probe input capacitance as seen from the source.

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.305 FUNCTIONAL ELECTRONICS (A)

MODEL QUESTION PAPER

Time: 3 Hrs. Max. Marks: 100

Part A

*Answer **all** questions. Each question carries 2 marks.*

1. Draw a RL circuit which can function as integrator. Deduce the condition for it
2. Sketch the small signal h-parameter model for BJT
3. Draw a CE amplifier and write equation for its DC load line
4. What is Body effect?
5. Draw the bias circuits for MOSFET.
6. Mention the features of negative feedback.
7. What are Barkhausen Criterion for sustained oscillations?
8. Draw the circuit of a UJT Oscillator
9. Why Class C amplifiers are more efficient than Class A amlifiers?
10. Draw the circuit of a BJT switch. Mention how the speed can be improved

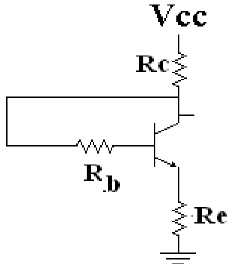
(2 Marks x 10 = 20 Marks)

Part B

*Answer any **one** full question from each Module. Each full question carries 20 Marks*

MODULE - I

11. (a) Define stability factors in BJT amplifiers.



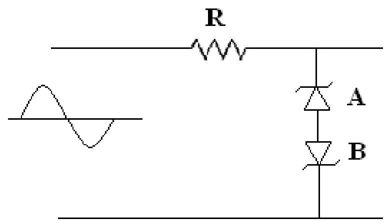
Derive temperature stability factor of the above bias circuit

(b) Draw the output characteristics of a CE amplifier. Consider a CE amplifier without emitter bypass capacitor. Deduce expression for DC load line and sketch it.

OR

12. (a) Using h –parameter analysis, analyse current gain, voltage gain and input impedance of BJT amplifier in CE mode. How do the results differ in presence and absence of emitter bypass capacitor?

(b) Sketch the transfer function for the clipping circuit shown below. The Zener diodes A and B are made of silicon and their cut in voltages are 5.2 V and 4.8 V respectively.



MODULE - II

13. Using low frequency small signal model derive an expression for Ai, Av, Zin and Zo of a common source MOSFET Amplifier.

OR

14. Using low frequency small signal model derive an expression for Ai, Av and Zo of a common gate MOSFET Amplifier.

MODULE – III

15. (a) What is miller effect? How the effect is minimized in Cascode MOSFET amplifier?

(b) Deduce the short circuit current gain in CS mode using high frequency equivalent circuit

OR

16. (a) Deduce expressions for gain, input impedance and output impedance in presence of feedback in terms of open loop gain and feedback factor in all feedback topologies

(b) What is kind of feedback present in a CS amplifier without a source bypass capacitor? Establish the effect in gain and discuss about change in Z_{in} and Z_{out} compared to open loop case.

MODULE - IV

17. (a) Draw the circuit of astable multivibrator using BJT and deduce an expression for its period of oscillation

(b) Draw the circuit for a Wein bridge oscillator. Deduce expression for its period of oscillation.

OR

18. (a) Show that the efficiency of a transformer coupled Class A amplifier is 50%.

(b) Calculate the minimum power rating of the transistor to be used in a Class B push pull amplifier designed for a power output of 4 Watts.

THIRD SEMESTER B.TECH DEGREE EXAMINATION

(2013 Scheme)

13.306 DIGITAL CIRCUIT DESIGN (A)

MODEL QUESTION PAPER

Time: 3 Hrs. Max. Marks: 100

Part A

*Answer **all** questions. Each question carries 2 marks.*

1. Write canonical POS form of XY + YZ
2. Draw a full adder using Half adders and a OR gate
3. Draw a 2 input ex-or gate using minimum number of 2 input NAND gates.
4. Realize a NAND gate using 2x1 MUX
5. What is figure of merit of a logic family? Give its value with unit for Standard TTL family
6. Write VHDL description for a NAND gate
7. Distinguish between Mealy & Moore machines.
8. Distinguish between PAL & PLA
9. Draw the circuit for CMOS NAND gate
10. Obtain a OR GATE from 1 x 4 DEMUXs

(2 Marks x 10 = 20 Marks)

PART B

*Answer any **one** full question from each Module. Each full question carries 20 Marks*

MODULE - I

11. (a) Reduce the following Boolean expression using K Map

F = A’ + AB + ABD’ + AB’D’ + C

(b) Realize a full subtractor using 4x1 MUXs.

OR

12. (a) Using Quine Mc Cluskey method find prime implicants and reduced form of

F = SIGMA m(1,2,3,5,6,7,8,9,12,13.15)

(b) Realize a full adder using 1X4 DEMUXs.

MODULE - II

13. (a) Design synchronous decade counter using TFFs and a realize asynchronous decade counter using DFFs. Compare the design and performance.

(b) What is race condition in a JK FF? How can it be avoided?

OR

14. (a) Draw the circuit diagram of 555 astable multi vibrator. Design it for a frequency 10 kHz and duty ratio 0.5

(b) Design a counter to divide incoming clock with a duty ratio 0.5 by SIX using Johnson counter. Mention which FF in the Johnson counter gives the output and what happens to the duty ratio.

MODULE – III

15. For the state table of the machine given below find the set of maximal compatibles using the merger table method.

PS	NS, Z			
	Io	I 1	I2	I3
A	C,0	-	C,0	-
B	A, -	B,1	C, -	-
C	-	C, 0	-, 1	D,0
D	F,0	-	E,1	C,-
E	F,0	-	A,-	C,1
F	-	B,1	-,0	B,1

OR

16. The state table of a machine is given. Find the equivalence partition and corresponding reduced machine in standard form.

PS	NS, Z	
	X=0	X=1
A	D,0	A.1
B	F,1	C,1
C	D,0	F,1
D	C, 0	E,1
E	C,1	D,1
F	D,1	D,1

MODULE - IV

17. (a) Draw the internal circuit diagram for a standard TTL NAND gate and explain its working.

(b) Suggest how a standard TTL can be changed to a low power Schottky TTL. What are the merits?

OR

18. (a) Explain the meaning of following voltage and current specifications of a TTL NAND GATE. Give values for Standard TTL family

V-IH, V-IL, V-OH, V-OL, I-IH, I-IL, I-OH & I-OL.

(b) Calculate the fan out and noise margin if

V-IH=2.0V, V-IL=0.7 V, V-OH=3.0V, V-OL=0.3V,

I-IH=16mA, I-IL, I-OH & I-OL=450 µA.

(c) Compare TTL, ECL and CMOS families in terms of propagation delay, power dissipation and noise margin.

****