Total No. of Questions : **08** Roll No. : 0701..................................

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : EC & EE)

MA-3402 / MA-3302 MATHEMATICS - III

Time : Three Hours ***Maximum Marks : 70***
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) Find the Laplace transform of the functions :

(i) $f(t) = t^2 cos3t.$ (ii) $g(t) = \frac{e^{-t} sint}{t}.$

(b) Find the Inverse Laplace transform of the functions :

(i) $F(s) = ln\left(\frac{s+c}{s+d}\right), c, d$ are constants. (ii) $G(s) = \frac{6+s}{s^2+6s+13}.$

2(a) Solve the initial value problem $y'' + 2y' - 3y = 3,\ y(0) = 4,\ y'(0) = -7.$

(b) Solve the initial value problem : $y' + 6y + 5\int_0^t y(\tau)d\tau = 1 + t, y(0) = 1.$

3(a) (i) Find the Fourier transform of the function $f(t) = \begin{cases} 0, & t < 0, \\ e^{-at}, & t \geq 0, \end{cases}$ $a > 0.$

(ii) Find the inverse Fourier transform of the function $\mathscr{F}(\omega) = \frac{e^{-i\omega}}{2(1+i\omega)}.$

(b) Find the solution of the differential equation $y' - 2y = H(t)e^{-2t},\ -\infty < t < \infty$ using Fourier transforms, where $H(t) = u_0(t)$ is the unit step function.

4(a) The temperature distribution $u(x,t)$ in a thin homogeneous, infinite bar can be modelled by the initial boundary value problem $\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2},\ -\infty < x < \infty, t > 0,\ u(x,0) = f(x), u(x,t)$ is finite as $x \to \pm\infty$. Find $u(x,t),\ t > 0.$

(b) In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body.

(i) What is the probability that mathematics is being studied?

(ii) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl?

(iii) Find the probability that the student is a boy.

5(a) A random variable X has the following probability function :

x	1	2	3	4	5
$p(x)$	c	c	$3c$	$c^2 + c$	$6c^2$

Find the value c. Evaluate $P(X < 3)$ and $P(1 < X < 4)$. Determine the distribution function of X. Find the mean and variance of X.

(b) Two players A and B play tennis games. Their chances of winning a game are in the ratio 3:2 respectively. Find A's chance of winning at least two games out of four games played.

6(a) The frequency of the accidents per shift in a factory is shown in the following table :

Accident per shift	0	1	2	3	4	Total
Frequency	192	100	24	3	1	320

Calculate the mean number of accident per shift. Fit a passion distribution and calculate theoretical frequencies.

(b) If $X \sim N(\mu, \sigma^2)$, then show that $E(X) = \mu$ and $Var(X) = \sigma^2$.

7(a) Fit a second degree parabola to the following data :

x	1.0	1.5	2.0	2.5	3.0	3.5	4.0
y	1.1	1.3	1.6	2.0	2.7	3.4	4.1

(b) Calculate the regression equations of X on Y and Y on X from the following data and estimate X when $Y = 25$:

X	10	12	13	17	18	20	24	30
Y	5	6	7	9	13	15	20	21

Calculate coefficient of correlation also.

8(a) Two random samples of sizes 9 and 6 gave the following values of the variable :

Sample 1	15	22	28	26	18	17	29	21	24
Sample 2	8	12	9	16	15	10			

Test the difference of the estimates of the population variances at 5% level of significance ($F_{0.05} = 4.82$).

(b) A book has 700 pages. The number of pages with various numbers of misprints is recorded below. At 5% significance level are the misprints distributed according to Poisson law.

No. of misprints (X)	0	1	2	3	4	5
No of pages with X misprints	616	70	10	2	1	1

(Given $\chi^2_{0.05} = 5.99$).

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Total No. of Questions : **08** Roll No. : 0701.......................................

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Elx. & Communication Engineering)

EC-3401 / EC-3301 ELECTRONIC DEVICES

Time : Three Hours *Maximum Marks : 70*
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a)	Describe the valence band, conduction band and forbidden energy gap with the help of energy level.	*07*
(b)	What do you meant by mobility, resistivity, drift and diffusion,	*07*
2(a)	Explain the formation of depletion layer or potential barrier in a pn junction.	*07*
(b)	Discuss the behaviour of a pn junction under forward and reverse biasing.	*07*
3(a)	Draw the circuit diagram of a half-wave rectifier and explain its working.	*07*
(b)	State applications of LEDs. Why should you prefer LEDs over conventional incandescent lamps?	*07*
4(a)	Explain how zener diode maintains constant voltage across the load.	*07*
(b)	Define the current gain α and current gain β of a transistor. Show that : $\alpha = \beta/(\beta + 1)$ or $\beta = \alpha/(1-\alpha)$.	*07*
5(a)	How will you draw d.c. load line on the output characteristics of a transistor? What is its importance?	*07*
(b)	Draw the Ebers-Moll model for a NPN transistor. Also give the equations for emitter current and collector current.	*07*
6(a)	List the advantages and disadvantages of FET over BJT.	*07*
(b)	Explain the construction and working of MOSFET.	*07*
7(a)	Explain how : (i) a diode (ii) a resister and (iii) a capacitor can be constructed in monolithic integrated circuit?	*07*
(b)	Outline the process sequence of fabrication of MOSFET's.	*07*
8(a)	What is solar-cell? Give two applications of solar-cell.	*07*
(b)	Describe the transistor action.	*07*

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Total No. of Questions : **08** Roll No. : 0701...

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Elx. & Communication Engineering)

EC-3402 / 3302 DIGITAL SYSTEM DESIGN

Time : Three Hours *Maximum Marks : 70*
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What do you mean by the XS-3 code and gray code? What are their applications? ***07***

(b) Reduce the expressions : (i) (AB' + A' +AB)' (ii) A[B+C'(AB+AC')'] ***07***

2(a) What is Look-ahead carry adder? How does the look-ahead carry adder speed up the addition process? ***07***

(b) How do you compare serial and parallel adder? ***07***

3(a) What do you mean by a level-triggered flip-flop? How does it differ from edge triggered flip-flop? ***07***

(b) Distinguish between combinational and sequential circuits. List some application of sequential circuits. ***07***

4(a) List the drawback and advantages of dynamic RAM and the SRAM. ***07***

(b) Compare the following : (i) TTL and MOS (ii) Bipolar and CMOS. ***07***

5(a) Explain the different modelling styles in VHDL (data-flow, behavioral and structural) with examples. ***07***

(b) Describe the synthesis process in VLSI design flow. How does synthesis translate HDL code into gate-level implementation? ***07***

6(a) What are the rules of BCD addition and subtraction explain with a suitable example? ***07***

(b) Draw a schematic circuit of a T flip-flop. Give its truth table and explain its operation. ***07***

7(a) Explain asynchronous and synchronous counters? ***07***

(b) How do you convert an SOP form to a POS form and vice versa? ***07***

8(a) With the help of suitable example write a procedure to reduce K-Map? ***07***

(b) Describe the operation performed by the following logic circuit : ***07***

(i) Comparator (ii) Decoder (iii) Multiplexer.

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Total No. of Questions : **08** Roll No. : 0701....................................

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Elx. & Communication Engineering)

EC-3403 / EC-3303 SIGNAL & SYSTEMS

Time : Three Hours ***Maximum Marks : 70***

Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What is discrete time signals? What is meant by frequency domain analysis of discrete time signals?

(b) Distinguish between energy signal and power signal.

2(a) Explain the following properties of the system :

(i) Homogeneity (ii) Causality (iii) Realizability

(b) Discuss about the stability of Linear shift invariant system.

3(a) Test the stability of the LTI system whose impulse response is given as :

$$h(t) = e^{4t}\, u(t)$$

(b) What is meant by convolution of the signal? List and explain the properties of the convolution.

4(a) Perform the convolution of the causal signals mentioned by -

$$x_1(t) = e^{-2t}u(t), \qquad x_2(t) = e^{-5t}u(t)$$

(b) Discuss about the application of signal and systems in various field of engineering.

5(a) What is meant by Fourier series? Also discuss about conditions of existence of Fourier series.

(b) Explain the following properties of Fourier transform :

(i) Linearity (ii) Time shifting (iii) Frequency shifting

6(a) Draw and represent the following standard discrete time signals :

(i) Unit step signal (iii) Ramp Signal (iii) Exponential Signal.

(b) How will you define the Laplace transform? Also discuss about the periodicity property of Laplace Transform.

7(a) Determine the Z-Transform and their ROC of the discrete time signal given by -

$$x(n) = (0.5)^n\ u(n)$$

(b) What do you understand by Aliasing? Discuss about its effect on signal Transmission.

8(a) Explain the following terms (**any two**) :

(i) Convolution property of Fourier transform
(ii) Parseval's Theorem
(iii) ROC in Z-Transform

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Total No. of Questions : **08** Roll No. : 0701....................................

B.Tech THIRD SEMESTER EXAMINATION JUNE-2025

(Branch : Elx. & Communicatioin & Engineering)

EC-3404 NETWORK THEORY

Time : Three Hours *Maximum Marks : 70*
Min. Pass Marks : 22

Note : Attempt any five questions. Each question carries equal marks.

1(a) What is incidence matrix? Write down its properties. Explain incidence matrix by using an example. ***07***

(b) Calculate the effective (total) inductance of the series connected mutually coupled coils as shown in ***fig.1***. ***07***

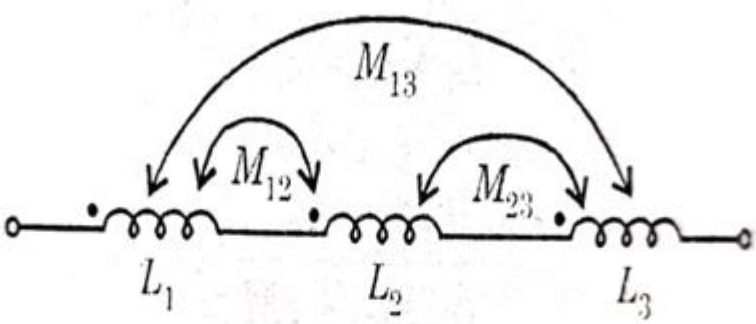

Fig.1

2(a) Determine Thevenin's and Norton's equivalent circuit as seen at terminal a-b for the network shown in ***fig.2***. ***07***

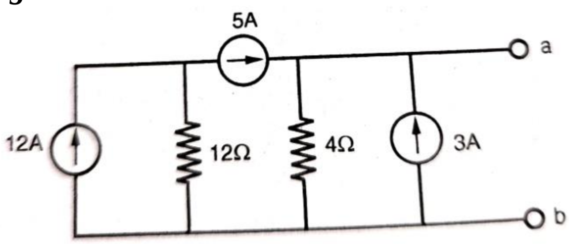

Fig.2

(b) State and prove maximum power transfer theorem. ***07***

3 Write short notes on **any two** of the following : ***14***

(i) Millman's theorem
(ii) Exponential form of Fourier series analysis
(iii) Initial & final value theorem

4(a) In the network of the ***fig.3***, k is changed from position a to b at t = 0. Solve for ***07***

i, $\frac{di}{dt}$ & $\frac{d^2i}{dt^2}$ at t = 0 + if R = 1000Ω, L = 1H, C = 0.1μf and v = 100V.

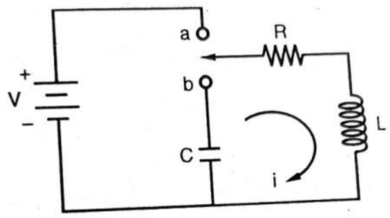

Fig.3

P.T.O.

4(b) The waveform shown in ***fig.4*** is nonrecurring. Write an equation for this waveform v(t). ***07***

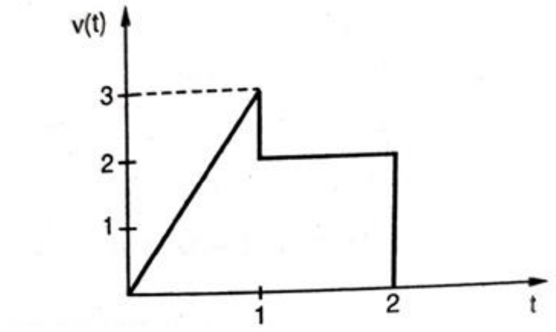

Fig.4

5(a) Define and explain 'open circuit impedance parameter' of two port networks. ***07***

(b) Write a note about series and parallel resonant circuits. ***07***

6(a) What is half wave symmetry? Explain within the help of an example. ***07***

(b) For the network shown in ***fig.5***, calculate Z & Y parameters. ***07***

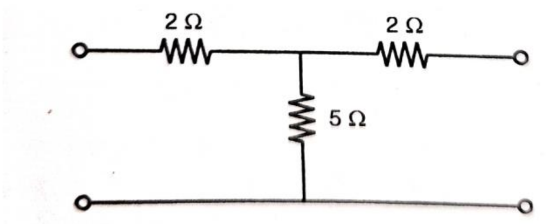

Fig.5

7(a) Define Fourier transform. Explain in detail any three properties of Fourier transform. ***07***

(b) Write a short note on 'Stability criterion in poles and zeroes'. ***07***

8 In the network shown in ***Fig.6***, the switch k is moved from position a to position b at t = 0. Solve for the current i(t), using the Laplace transformation method. ***14***

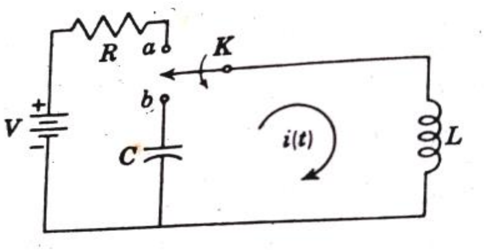

Fig.6

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