3RD SEM./ AE & IE/ ELE.& MECH./ EEE/ELE./ EE(INST. & CONT./ ETC & COMM./E & TC. / 2024(W)

TH1 ENGINEERING MATHEMATICS-III

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer All questions 2 x 10

a. Define the rank of a matrix. Find the rank of the matrix $\begin{pmatrix} 5 & 3 \\ 2 & 4 \end{pmatrix}$.

b. Find the modulus and amplitude of the complex number $\sqrt{3}+i$.

c. Find the complementary function of $(D^2 + 3D - 10) = 6e^{4x}$

d. Form the partial differential equation from $z = ax + by + a^2 + b^2$, by eliminating arbitrary constant.

e. Find $L(t+1)^2$.

f. Define odd function with an example.

g. Find the period of the function $\cos(3x + 5) + 7$.

h. Evaluate $\Delta(x + cosx)$ by taking the interval difference as unity.

i. State Trapezoidal Rule .

j. Change into a+ib form $\frac{2-5i}{3-2i}$.

2. Answer **Any Six** Questions 5 x 6

a. If $x + \frac{1}{x} = 2\cos\theta$ then show that $x^n - \frac{1}{x^n} = 2isin\, n\theta$.

b. Determine the rank of the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 3 & 4 & 5 \\ 4 & 6 & 8 \end{bmatrix}$.

c. Solve $((D^2 - 4D + 4)y = e^x + sin2x$.

d. Find Laplace Transform of $tcos^2t$.

e. Find the fourier expansion of $f(x) = x$ $in - \pi < x < \pi$.

f. Using Newton Raphson method ,find a real root of $x^3 - x - 2 = 0$ *in three steps.*

g. Evaluate $\int_0^1 \frac{dx}{1+x^2}$ using Trapezoidal rule taking $h=\frac{1}{4}$.

Answer **Any Three** Questions

3. a. Investigate for what values of λ *and* μ the simultaneous equations $x + y + z = 6,\ x + 2y + 3z = 10,\ x + 2y + \lambda z = \mu$ have (i) no solution, (ii) a unique solution, (iii) an infinite number of solution 7

b. If $1, \omega, \omega^2$ are the three cube roots of unity , prove that $(1 - \omega + \omega^2)^5 + (1 + \omega - \omega^2)^5 = 32$. 3

4. Solve $x^2(y - z)p + y^2(z - x)q = z^2(x - y)$. 10

5. a. Find the Inverse Laplace Transform of $F(S) = \frac{S^2+S-2}{S(S+3)(S-2)}$. 5

b. Find the root of the equation $x^4 - x - 10 = 0$ using Bisection method correct to two decimal places. 5

6. a. Use Lagrange's interpolation formula to fit a polynomial to the given data 5

x	-1	1	2
f(x)	7	5	15

b. Find the Laplace transform of f(t) defined as 5

$$f(t) = \begin{cases} e^t, & 0 < t < 5 \\ 3, & t > 5 \end{cases}$$

7. a. Obtain the Fourier series for $f(x) = \begin{cases} 1, & 0 < x < \pi \\ 0, & \pi < x < 2\pi \end{cases}$ 7

b. Convert $-1 + i\sqrt{3}$ into polar form. 3

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TH2 CIRCUIT THEORY

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1 & 2
Figures in the right hand margin indicates marks

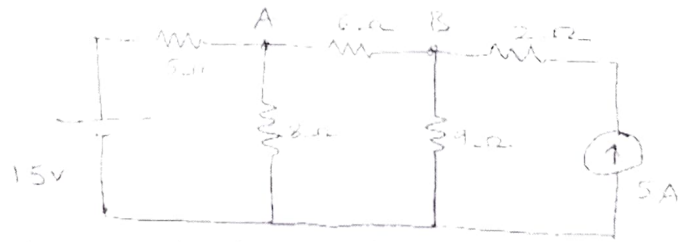
1. Answer **All** questions 2 x 10

a. State Norton Theorem.
b. Mention the conditions for series resonance.
c. Write the voltage equation of a two-port network in the following parameter forms:
   (i) ABCD Parameter
   (ii) Hybrid Parameter
d. Draw power triangle and level the three sides.
e. Differentiate between active power and reactive power.
f. Define time constant of a RL circuit.
g. How can you find the form factor of an alternating quantity (current or voltage)?
h. Find the voltage drop across 13 Ω resistor in the below figure.

i. For a series RL circuit if the resistance is 184 Ω and inductive reactance is 144 Ω, then find
   (i) Impedance (ii)Phase angle between Voltage and Current
j. Define attenuator .Write few of it's applications.

2. Answer **Any Six** Questions 5 x 6

a. Find the voltages at nodes A and B in the network shown below. 2.5+2.5



b. Using Thevenin's theorem find the current through 6Ω resistor. 5

c. State Maximum Power Transfer Theorem. Derive the mathematical expression for maximum power. 2+3

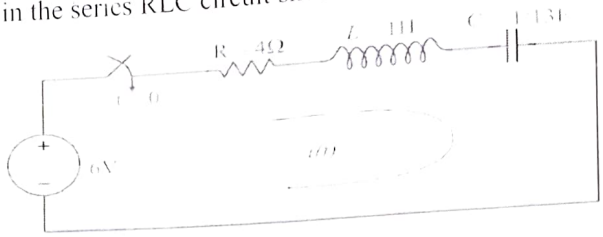
d. Derive the expression for Delta connected resistances in terms of Star connected resistances. 5

e. The voltage and current in a circuit with 50Hz supply are represented as follows. 1+1+1+2
$v = 280 \sin \omega t$ & $i = 14.14 \sin (\omega t - \pi/6)$.
Find (i) RMS value of current
(ii) Average value of voltage
(iii) Power consumed in the circuit

f. Draw the phasor diagram of current and voltage. 5

g. Compare series resonance and parallel resonance. 5

Find the current in the series RLC circuit shown below.

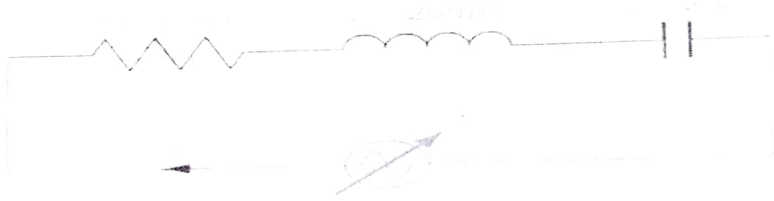


Answer **Any Three** Questions 10

3. Classify different type of filters with their frequency response. 5+5

4. Discuss transient state and steady state of a second order system.

5. Calculate the **resonant frequency**, the **current at resonance**, the **voltage** across the inductor and capacitor at resonance, the **Q** factor and the **BandWidth** of the given circuit. Draw the corresponding current waveform for all frequencies. 2+2+2+1+1+2



6. Find z parameter of the network. 10

7. A RLC series circuit with a Resistance of 10Ω, Inductance of 0.2H and Capacitance of 50μF is supplied with 200V variable frequency AC supply. Find **Current**, **Impedance**, **Power Factor** and **Active Power** at 5+5
(i) 60 Hz , (ii) 100 Hz.

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TH3 Digital Electronics

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right-hand margin indicates marks

1. Answer **All** questions 2 x 10

a. Convert the given binary number $(10011001.101)_2$ to decimal and octal number system.
b. Draw the symbol and truth table of Ex-OR gate.
c. Find the 2's complement and gray code equivalent of a binary number $(11001100)_2$.
d. Mention the number of selection lines, input lines and output lines present in
   I. 4x1 multiplexer
   II. 1x4 demultiplexer
e. Write the truth table of 4:2 encoder.
f. Define race around condition in sequential circuits.
g. Specify which type of registers are used to design a ring counter. How many number of such registers are required to implement a 5-bit ring counter.
h. Define modulus of a counter.
i. List different electronic components present inside a counter type ADC.
j. Implement NAND gate using CMOS logic.

2. Answer **Any Six** Questions 5 x 6

a. Simplify the Boolean expression $Y = \overline{(A\bar{B} + \bar{C})(A + C) + BC}$ and implement it using basic logic gates.
b. Implement 4-bit binary to gray code converter.
c. Write the truth table of a full adder and obtain the Boolean expression for sum and carryout using k-map.
d. With neat logic diagram explain the function of 2: 4 Decoder.
e. Differentiate between combinational and sequential logic circuits.
f. Describe the working of a SISO shift register with the help of a suitable logic diagram.
g. Define the following parameters
   (i) Resolution of ADC 2.5
   (ii) Noise Margin 2.5

Answer **Any Three** Questions

3. i) Minimize the following Boolean function using K-map 6
$$F(A, B, C, D) = \sum m(0,2,3,5,7,9,10) + d(1,12,13)$$
ii) Implement the minimized expression with NAND gates only. 4

4. Implement all logic gates i.e. NOT, OR, AND, NAND, NOR, Ex-OR, Ex-NOR using 5
i) only NAND gates 5
ii) only NOR gates

5. Design a 3-bit digital comparator and implement it using basic logic gates. 10

6. Design a 4-bit binary ripple up counter and explain its working with a neat timing diagram. 10

7. With a neat circuit diagram, explain the working of a weighted resistor type Digital to Analog Converter (DAC). 10

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TH4 ELECTRONICS MEASUREMENT & INSTRUMENTATIONS

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x 10

a. Define the following static characteristics of an Instrument/Measuring System: Accuracy and Reproducibility.

b. Draw the diagram of a De-Sauty Bridge.

c. Specify any two applications of Q-Meter.

d. Differentiate between Senor and Transducer.

e. List the main parts of a Cathode Ray Tube(CRT).

f. State the basic principle of working of a Thermocouple.

g. Mention the types of Analog Multimeter.

h. How do thermistors differ from RTDs?

i. Enumerate the types of error in an Instrument.

j. What is a Spectrum Analyser?

2. Answer **Any Six** Questions 5 x 6

a. Mention the types of display devices used in indicating instruments.

b. How does a Digital Tachometer works?

c. List the advantages and disadvantages of PMMC type instruments.

d. Discuss the working of Schering Bridge. Derive the condition for finding out value of unknown Capacitance.

e. Explain the working principle of LVDT.

f. How automatic zeroing is achieved in Digital Instruments?

g What are the two ways that the DAS are used to measure and record analog signals?

Answer **Any Three** Questions

3. Explain with a neat diagram the principle of working of capacitive transducers for pressure measurement. 10

4. Differentiate between Moving coil Instruments and Moving iron Instruments. 10

5. Explain the principle of operation of Ramp type Digital Voltmeter(DVM). 10

6. Explain how CRO can be used to measure following parameters. 10

(1) frequency and phase by Lissajous pattern

(2) rms value of a sine wave

7. Write short notes on 5+5

(a) Q meter

(b) Function Generator

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TH5 Environmental Studies

Full Marks: 80 **Time- 3 Hrs**

Answer any five Questions including Q No.1& 2
Figures in the right-hand margin indicates marks.

1. Answer **All** questions. 2 x 10
   a. Define ecosystem.
   b. What do you mean by option values?
   c. What is noise pollution?
   d. What do you mean by sustainable development?
   e. What is population explosion?
   f. Define non-renewable natural resources with a suitable example.
   g. Define food chain.
   h. What are genetics and species?
   i. What do you mean by water salinity?
   j. What is soil erosion?

2. Answer **Any Six** Questions 5 x 6
   a. Explain in brief man-wildlife conflicts.
   b. Explain some measures of controlling thermal pollution.
   c. Write down a short note on changes caused by agriculture.
   d. What is the need of public awareness for the environment?
   e. Define and explain food web with suitable examples.
   f. Explain pond ecosystem.
   g. Explain the effects of construction of dams on tribal people.

Answer **Any Three** Questions

3. (a) What is air pollution? What are the various sources of air pollution? 5
   (b) Explain the effects of extraction of minerals on the environment. 5

4. (a) Define and explain rainwater harvesting. 5
   (b) Write down a short note on ozone layer depletion. 5

5. (a) Explain the need and benefits of family welfare program. 5
   (b) What are human rights? 5

6. (a) Explain the role of individual in prevention of pollution. 5
   (b) Explain flood disaster management. 5

7. (a) Explain energy flow in an ecosystem. 5
   (b) Explain the need and use of alternative energy sources. 5