Data Structure & Algorithm
Code: IT302
Contacts: 3L +1T
Credits: 4

Module -I.
Linear Data Structure[8] Introduction (2L): Concepts of data structures: a) Data and data structure b) Abstract Data Type and Data Type. Algorithms and programs, basic idea of pseudo-code. Algorithm efficiency and analysis, time and space analysis of algorithms – order notations. Array (2L): Different representations – row major, column major. Sparse matrix - its implementation and usage. Array representation of polynomials. Linked List (4L): Singly linked list, circular linked list, doubly linked list, linked list representation of polynomial and applications.

Module -II:
Linear Data Structure [7] [Stack and Queue (5L): Stack and its implementations (using array, using linked list), applications. Queue, circular queue, dequeue. Implementation of queue- both linear and circular (using array, using linked list), applications. Recursion (2L): Principles of recursion – use of stack, differences between recursion and iteration, tail recursion. Applications - The Tower of Hanoi, Eight Queens Puzzle.

Module –III:
Nonlinear Data structures [15] Trees (9L): Basic terminologies, forest, tree representation (using array, using linked list). Binary trees - binary tree traversal (pre-, in-, post- order), threaded binary tree (left, right, full) - non-recursive traversal algorithms using threaded binary tree, expression tree. Binary search tree- operations (creation, insertion, deletion, searching). Height balanced binary tree – AVL tree (insertion, deletion with examples only). B- Trees – operations (insertion, deletion with examples only). Graphs (6L): Graph definitions and Graph representations/storage implementations – adjacency matrix, adjacency list, adjacency multi-list. Graph traversal and connectivity – Depth-first search (DFS), Breadth-first search (BFS) – concepts of edges used in DFS and BFS (tree-edge, back-edge, cross-edge, forward-edge), applications. Minimal spanning tree – Prim's algorithm

Module – IV
Searching, Sorting:[10L] Sorting Algorithms (5L): Bubble sort and its optimizations, insertion sort, shell sort, selection sort, merge sort, quick sort, heap sort (concept of max heap), radix sort. Searching (2L): Sequential search, binary search, interpolation search. Hashing (3L): Hashing functions, collision resolution techniques.

Suggested Text / Reference Books:
1. "Data Structures And Algorithm using C", Amitiva Nag, J.P.Singh
2. "Fundamentals of Data Structures of C" by Ellis Horowitz, Sartaj Sahni, Susan Anderson-freed.
3. "Data Structures in C" by Aaron M. Tenenbaum.
4. "Data Structures" by S. Lipschutz.
5. "Data Structures Using C" by Reema Thareja.
6. "Data Structure Using C", 2/e by A.K. Rath, A. K. Jagadev.
7. "Introduction to Algorithms" by Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein.

Paper Name: Mathematics-III (Discrete Mathematics and Graph theory)
Paper Code: M301
Contacts:3L+1T
Credits:4

Module I:
Introduction to Propositional Calculus: Propositions, Logical Connectives, Conjunction, Disjunction, Negation and their truth table. Conditional Connectives, Implication, Converse, Contrapositive, Inverse, Biconditional statements with truth table, Logical Equivalence, Tautology, Normal forms- CNF, DNF and related examples.

Module II:
Order, Relation and Lattices: POSET, Hasse Diagram, Minimal, Maximal, Greatest and Least elements in a POSET, Lattices and its properties, Principle of Duality, Distributive and Complemented Lattices. 10L

Module III:
Counting Techniques: Permutations, Combinations, Binomial coefficients, Pigeon- hole Principle, Principles of inclusion and exclusions;

Module IV:
Recurrence relations: Formulation/Modelling of different counting problems in terms of recurrence relations, Solution of linear recurrence relations with constant coefficients (upto second order) by (i) The iterative method (ii) Characteristic roots method (iii) Generating functions method.

Module V:
Graph Coloring: Chromatic Numbers and its bounds, Independence and Clique Numbers, Perfect Graphs-Definition and examples, Chromatic polynomial and its determination, Applications of Graph Coloring. Matchings: Definitions and Examples of Perfect Matching, Maximal and Maximum Matching, Hall's Marriage Theorem (Statement only) and related problems.

Suggested Text / Reference Books:
Texts: 1. Russell Merris, Combinatorics, Wiley-Interscience series in Discrete Mathematics and Optimisation
2. N. Chandrasekaran and M. Umaparvathi, Discrete Mathematics, PHI
3. Gary Haggard, John Schlipf and Sue Whitesides, Discrete Mathematics for Computer Science, CENGAGE Learning
4. Gary Chartrand and Ping Zhang – Introduction to Graph Theory, TMH

References:
1. J.K. Sharma, Discrete Mathematics, Macmillan
2. Winfried Karl Grassmann and Jean-Paul Tremblay, Logic and Discrete Mathematics, PEARSON.
3. S. K. Chakraborty and B. K. Sarkar, Discrete Mathematics, OXFORD University Press.
4. Douglas B. West, Introduction to graph Theory, PHI

Paper Name: Digital Electronics
Paper Code: IT301(EC)
Contacts:3L+1T

Credits:4

Number systems and arithmetic (Fixed and floating point), Combinational logic analysis and design: logic minimisation methods, Combinational logic circuits: adder, subtractor, multiplexer, demultiplexer, encoder, decoder, comparator; Logic families (TTL, ECL, CMOS, BICMOS), Delay, Hazards. Sequential logic design: latches and flip-flops (SR,D,JK,T), Setup and Hold time , Clock frequency, Finite state machine design, ASM charts, state minimization, state assignment, synthesis using D-FF and JK-FF, counters, shift registers, MSI devices as state machines, Memory cells.

Suggested Text / Reference Books:

1. J.F.Wakerly, Digital Design Principles and Practices, PH, 1999.
2. D.D. Givone, Digital Principles and Design, TMH, 2002
3. M. Raffiquzzman & Rajan Chandra, Modern Computer Architecture, Galgotia Publications, 1990.
4. David Patterson and John Hennessy, Computer Organization and Design, Elsevier, 2007.
5. MALVINO LEACH

Paper Name: Numerical Methods Paper
Code: IT303
Contacts:3L+1T
Credits:3

Module 1
Approximation in numerical computation: Truncation and rounding errors, Fixed and floating-point arithmetic, Propagation of errors [2]

Module 2
Basic concept of C Programming Language: Datatype, Variable, Control Statements, Arrays, Functions. [5]

Module 3
Interpolation: Newton forward/backward interpolation, Lagrange's and Newton's divided difference Interpolation. [6]

Module 4
Numerical solution of Algebraic equation: Bisection method, Regula-Falsi method, Newton-Raphson method, Secant's method. [6]

Module 5
Numerical Differentiation & Integration: Numerical Differentiation, Numerical Integration using Trapezoidal rule, Simpson's 1/3 rule, Expression for corresponding error terms. [6]

Module 6
Numerical solution of a system of linear equations: Gauss elimination method, Gauss- Jordan method, Matrix inversion, LU Factorization method, Jacobi iterative method, Gauss-Seidel iterative method. [8] Module 7 Numerical solution of ordinary differential equation: Euler's method, Modified Euler's method, Taylor's Series, Runge-Kutta methods, Predictor-Corrector methods.[9]

Suggested Text / Reference Books:
Text Books:
1. Dutta & Jana: Introductory Numerical Analysis, Shreedhar Prakashani.
2. Sastry: Introductory Methods of Numerical Analysis, PHI.
3. Let us C: Kanetkar, Yash Publication.

Reference Books:
1. Dey & Gupta: Numerical methods, TMH.
2. Mollah & Chakrabarty: Computing Systems, JBBL.
3. Sinha & Dinda: Numerical & Statistical Methods with Programming in C, Scitech.

Paper Name: PHYSICS-II
Paper Code: PH(IT) 301
Contacts:3L+1T
Credits:4

Module 1:
Quantum Mechanics-II, Quantum Computation and Communication 1.01: Vector space & Heisenberg representation: Elements of linear vector spaces- The idea of n- dimensional vector space, use of 'bra-ket' notation, linear independence, basis, inner product, norm of a vector; Hilbert space, Ortho normality; Matrix representation of bra & kets; linear operators; Pauli matrices; Definitions of Hermitian, Inverse and Unitary operators; Commutators; Tensor products. 4L
1.02: Quantum Computation & Communication: Idea of 'qubit' and examples of single qubit logic gates- Classical bits, Qubit as a two level system; Bloch vector representation of state of qubit; Polarization states of photon and measurements; Pauli gates, Phase shift gate, Quantum gates as rotations in Bloch sphere; concept of entanglement. Bell's inequality- the paradox, joint state of entangled particles; Two-qubit controlled gates; entanglement generation Quantum circuit for transforming computational basis to Bell basis; Quantum Teleportation (Basic idea) 6L

Module 2:
PHYSICS OF SEMICONDUCTORS & ENERGY BAND THEORY:
2.01: Applications of Schrödinger's equation – Finite Potential Barrier, WKB approximation (qualitative) -connection with semiconductor diode- tunneling effect. 3L
2.02: Free electron theory- Free electron theory-Drude model (qualitative), Ohm's law, Wideman Franz law, Electron scattering and resistance, relaxation time, diffusion length, mean free path. 2L
2.03: Band Theory: Introduction to Band theory (mention qualitatively improvement over free electron theory)- Kronig-Penny model (Use Schrodinger picture to obtain Energy-band (E-k) diagram), formation of allowed and forbidden energy bands, Concept of effective mass – electrons and holes, crystal momentum, Density of states (qualitative), Energy bands of metal, insulator, semiconductor, magneto-resistance, magnetostriction, Piezoelectric effect, Hall effect-applications. 3L
2.04 : Semiconductors and insulators: Direct & indirect band gaps, Fermi-Dirac distribution function (temperature dependence qualitative discussions). Fermi level for intrinsic and extrinsic semiconductors (dependence on temperature and doping concentration viz. p type, n-type), Diffusion and drift current (qualitative). Generation and re-combination, quasi-Fermi energy level (basic concepts) band diagram of p-n, Schotkey diode, BJT and MOS-capacitors-principle of operation, Flat band and threshold voltages. 5L

Module 3:
SOLID STATE ELECTRONIC & OPTO ELECTRONIC DEVICES 3.01: SOLID STATE ELECTRONICS DEVICES: Classification of different types of diode on the basis of doping concentration: rectifier diode (qualitative idea), Zener diode (qualitative idea), tunnel diode, IMPATT diode (importance of negative resistance), PNPN transistors - simple working principle, I-V characteristics, triggering-operating principle & application. 3L

3.02: Field effect transistors: Basic principles of p and n channel MOSFETS, CMOS, NMOS and VLSI MOSFETSapplications. 2L

3.03 Sensor & Detectors: Semiconductor sensors and Detectors-Applications-Charge Coupled device (CCD). 1L

3.04: OPTO ELECTRONIC DEVICES: Basic background of photonic devices, Photoconductivity, Optical devices, Importance of reverse current in optical detectors, photo-diodes, photo voltaic effects (solar cells), Light Emitting Diode (as direct band gap material), avalanche and photodiode, Photo-transistors (Basic idea & application), LDR-operation & applications. 3L

Module 4:

Storage & Display devices: 4.01: Storage devices: Magnetic field and Magnetization; Magnetic susceptibility, Paramagnetism, Concept of magnetic moment, Bohr Magneton, Curie's Law; Ferromagnetism, phenomenon of hysteresis-hysteresis loss, Hard ferromagnets, applications of permanent magnets; Comparison and applications of Soft ferromagnets (Permalloys, Ferrites). Magnetic resonance, NMR and MRI (qualitative discussions related to applications).
4L

4.02: Different Magnetic storage devices-Hard disc (examples related to computers compared with semiconductor storage viz. Pendrive), Optical storage-CD, DVD, Blu-ray Disc. 2L

4.03: Display devices: Operation and application of CRT, Liquid crystal display (LCD, LED, Plasma display, Thin film transistor display).

ANALOG & DIGITAL ELECTRONIC CIRCUIT:

1. Study of Ripple and Regulation characteristics of full wave rectifier with and without capacitor filter.

2. Study of Zener diode as voltage regulator.

3. Construction of two stage R-C coupled amplifier & study of its gain and Bandwith.

4. Study of class A, C & Push pull amplifier.

5. Realisation V-I & I-V converter using Operational Amplifier.

6. Study of timer circuit using NE 555 and configuration of Monostable and Astable Multivibrator.

7. Study of DAC & ADC

8. Realisation of basic gates using Universal logic gates.

9. Realisation of RS-JK & D filpflop using logic gates.

10. Design of Combinational circuit for BCD to decimal conversion to drive 7-segment display using Multiplexer.

11. Realisation of Synchronous Up/Down counter.

12. Construction of simple Decoder & Multiplexer circuits using logic gates.

13. Construction of adder circuit using Shift register & Full adder.

NUMERICAL METHODS:

1. Assignments on Newton forward /backward, Lagrange's interpolation.

2. Assignments on numerical integration using Trapezoidal rule, Simpson's 1/3 rule, Weddle's rule.

3. Assignments on numerical solution of a system of linear equations using Gauss elimination and Gauss-Seidel iterations.

4. Assignments on numerical solution of Algebraic Equation by Regular-falsi and Newton Raphson methods.

5. Assignments on ordinary differential equation: Euler's and Runga-Kutta methods.

6. Introduction to Software Packages: Matlab / Scilab / Labview / Mathematica.

ELECTRIC CIRCUIT THEORY LABORATORY:

1. Transient response of R-L and R-C network: simulation with PSPICE /Hardware

2. Transient response of R-L-C series and parallel circuit: Simulation with PSPICE/ Hardware

3. Determination of Impedance (Z) and Admittance (Y) parameter of two port network: Simulation / Hardware.

4. Frequency response of LP and HP filters: Simulation / Hardware. 5. Frequency response of BP and BR filters: Simulation /Hardware. 6. Generation of Periodic, Exponential, Sinusoidal, Damped Sinusoidal, Step, Impulse, Ramp signal using MATLAB in both discrete and analog form. 7. Determination of Laplace transform and Inverse Laplace transform using MATLAB. 8. Amplitude and Phase spectrum analysis of different signals using MATLAB. 9. Verification of Network theorem using SPICE

2015

B. TECH. (3rd Sem)

(EE)

Paper Name : Analog Electronic Circuits

Paper Code : EC(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

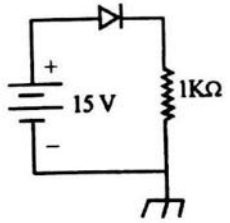
(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

i)



Considering zero forward Resistance of the

diode. What is the load current ? (V_D=0.7 V)

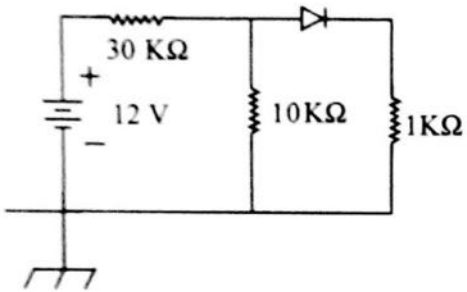
a) 0 mA,

b) 14.3 mA

c) 15 mA

d) 50 mA

ii)



If V_D=0.7V, R_f=0Ω maximum then what is the diode current?

a) 3 mA

b) 3.2 mA

c) 2.3 mA

d) 4 mA

iii) **If line frequency is 50 Hz, then the output frequency of a full wave bridge rectifier is**

a) 100 Hz

b) 50 Hz

c) 25 Hz

d) 0 Hz

iv) To achieve 40 V output of a regulator, what is the approximate rms value of secondary voltage?

a) 0 V

b) 14.4 V

c) 28.3 V

d) 56.6 V

v) In a zener diode based shunt regulator, if the polarities of the zener diode are interchanged then what is the output voltage ? (V_Z=6.2 V)

a) 6.2 V

b) 0.7 V

c) 1.4 V

d) 12.4 V

vi) In a fixed bias transistor configuration if base resistance is open then the Q point is

a) in the middle

b) at the upper end

c) at the lower end

d) out of load line.

vii) The output voltage of a CE amplifier is

a) Amplified

b) Inverted

c) 180° of phase with the input

d) All of the above.

viii) In an enhancement mode n-channel MOSFET, what is the condition for saturation?

a) $V_{GS} \leq V_{Th}$

b) $V_{GS} - V_{Th} \leq V_{DS}$

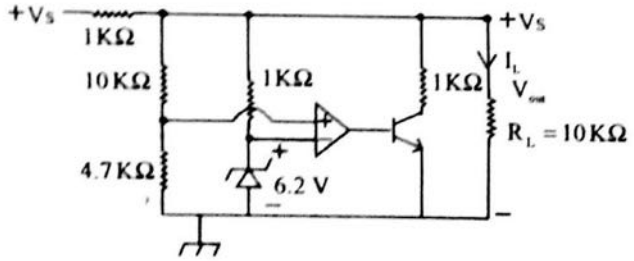
c) $V_{GS} - V_{Th} > V_{DS}$

d) $(V_{GS} - V_{Th})^2 \leq V_{DS}^2$.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : $5 \times 3 = 15$

2. 

For this circuit what is the value of V_{out} and I_L? Is the circuit short circuit protected ? 3+2

3. In a CE amplifier, $h_{ie} = 1K\Omega$, $h_{fe} = 100$, $h_{re} = 0$, $h_{oe} = 0.01\Omega^{-1}$ then calculate the transresistance of the circuit for

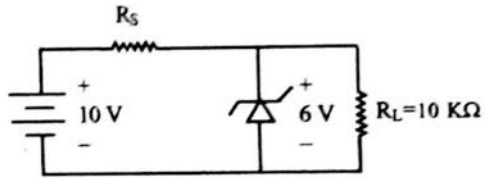
i) $R_L = 10\ K\Omega$,

ii) $R_L \to \infty$ 3+2

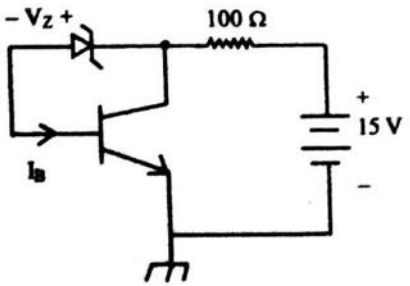
4. In a CE amplifier, if collector resistance and collector to Base resistance are 1 KΩ and 10 KΩ respectively then calculate I_{CQ} if V_{CC} = 5 V and β = 100. 5

5. In a common source, MOS amplifier if g_m (Transconductance) = 10 mAV – 1 and R_L = 10 KΩ then what is output amplitude if input amplitude is 10 mV ? 5

6. For this circuit, if I_Z=15.4 mA then how much is I_{SC} (short circuit current) through RS ? 5



7. For this circuit, if V_Z = 2.4 V and β = 100 then calculate I_B. 5

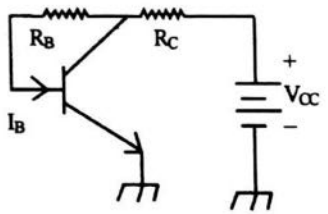


GROUP - C

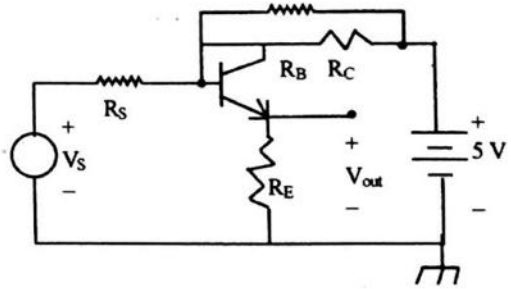
(Long Answer Type Questions)

Answer any **one** of the following : $15 \times 1 = 15$

8. For this CE amplifier, $R_B = 10\ K\Omega$, $R_C = 1\ K\Omega$, $V_{CC} = 5\ V$, Draw the load line. Calculate I_B if $\beta = 100$ and $I_{CO} = 10\ nA$ at 300 K. Plot I_B vs. R_B neglecting I_{CO}. Calculate the transconductance if $V_T = 25\ mV$. What is the value of I_{CO} at 127°C ? 3+3+3+3+3



9.



Draw the low frequency hybrid equivalent model of a CE amplifier and explain how the parameters are extracted from the characteristic graphs. Why are the parameters (h_{re} and h_{oe}) taken to be negligibly small practically ? For the circuit shown here, if $R_S = R_C = R_E = 1K\Omega$ and $R_B = 100\ K\Omega$, then calculate V_{out}/V_S. 3+4+3+5

10. Write short notes on the following topics :

    i) **Switching Regulators and their applications**

    ii) **Effect of the Gate-Source and the Drain-source voltage on the drain current of an n channel enhancement mode MOSFET.**

8+7

PART - B

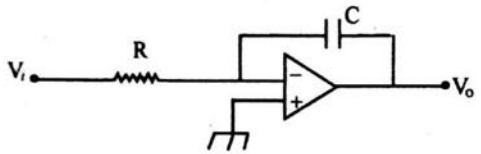
(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : $1 \times 5 = 5$

i) The circuit shown is



a) an integrater

b) an adder

c) a differentiator

d) a buffer.

ii) A differential amplifier essentially consists of

a) two input and two output terminals

b) only resistors and transistors

c) two transistors

d) two CE amplifiers having their emitters directly coupled to each other.

iii) A push-pull amplifier

a) reduces odd harmonics in the output

b) is the first stage of an audio amplifier

c) reduces even harmonics in the output

d) uses single transistor.

iv) The main purpose of using transformer coupling in a class-A amplifier is to make it more

a) efficient

b) less costly

c) less bulky

d) distortion free.

v) A monostable multivibrator

a) has no stable state

b) has one stable state

c) has two stable state

d) has no energy storage element.

vi) The width of the output pulse of a monostable multivibrator is given by

a) RC

b) $\sqrt{2}$ RC

c) 0.69 RC

d) None of the above.

vii) Ideal operational amplifier has input impedance of

a) 1MΩ

b) ∞

c) zero

d) 1Ω.

viii) The range of frequencies over which the PLL can acquire lock with the input signal is called

a) put-in range

b) capture range

c) hold

d) lock-in range.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Draw the current to voltage converter circuit using OPAMP and explain / derive the expression for the output voltage. 5

3. Explain the operation of Astable multivibrator using suitable circuit with IC 555 timer. 5

4. Distinguish between class A, class B, class AB and class C power amplifier. 5

5. Explain the function of tank circuit in tuned amplifier. 5

6. Explain the operation a logarithmic amplifier using OPAMP. 5

7. Explain how OPAMP can be used as comparator ? 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. a) Draw the circuit of a class-B push-pull power amplifier and Explain its operation. 5

b) Derive an expression for its maximum conversion efficiency. 5

c) For the above power amplifier, V_{CC} = 50 V, the signal swings the collector voltage down to V_{min} = 10V. The dissipation in both transistors in total is 40 W. Find the total power and conversion efficiency. 5

9. a) Explain the VCO with neat block diagram. Give its typical connection diagram and its output wave forms. 8

b) Draw schematic diagram of Subtractor using OPAMP. Derive the expression for its output voltage. 7

10. a) Define following parameters with respect to OPAMP : 8

i) input bias current

ii) input offset current

iii) input offset voltage

iv) output offset voltage

b) Explain the operation of Schmitt trigger circuit using OPAMP. 7

2015

B. TECH. (3rd Sem)

(EE)

Paper Name : Circuit Theory and Networks

Paper Code : EE-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

1

PART - A
(Marks : 35)
GROUP - A
(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : $1\times5=5$

i) Inverse Laplace transform of $\frac{1}{(s-a)}$ is

a) cos(at)

b) sin(at)

c) e^{-at}

d) e^{at}.

ii) Laplace transform of unit ramp function is

a) $\frac{1}{s}$

b) 1

c) $\frac{1}{s^2}$

d) None of these.

iii) Unit of 'A'-parameter is

a) ohm

b) mho

c) unitless

d) None of these.

iv) Maximum power transfer takes place at an efficiency of

a) 50%

b) 75%

c) 100%

d) None of these.

v) If $V_{Th} = 20\,V$, $R_{Th} = 8$ ohm and $R_L = 2$ohm, then load current will be

a) 10 amp

b) 6 amp

c) 4 amp

d) 2 amp.

vi) If $f(t) = e^{-\theta t}\cos(\omega t), \theta$ being a constant, the Laplace Transform of the function is given by

a) $\frac{s}{(s+\theta)^2+\omega^2}$

b) $\frac{s+\theta}{(s+\theta)^2+\omega^2}$

c) $\frac{s+\theta}{s^2+\omega^2}$

d) $\frac{\omega}{(s+\theta)^2+\omega^2}$.

vii) A two port network is defined by the relation $V_1 = 2V_2 + 4(-I_2)$; $I_1 = 4V_2 + 3(-I_2)$.

Then 'C'-parameter is

a) 1 mho

b) 2 mho

c) 3 mho

d) 4 mho.

viii) A two port network is defined by the relation $V_1 = 2I_1 + I_2$; $V_2 = 4I_1 + 3I_2$. Then Z_{12} is

a) 2Ω

b) 1Ω

c) 3Ω

d) 4Ω

ix) The Thevenin's equivalent resistance R_{Th} for the given network at terminals A and B of Fig.1 is

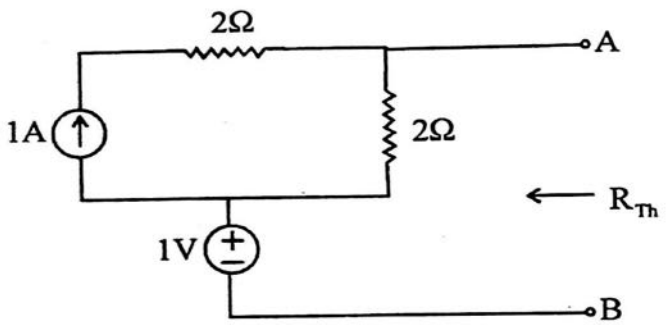


Fig.-1

a) 1Ω

b) 2Ω

c) 4Ω

d) infinity.

x) A function in Laplace domain is given by $F(s)=\frac{2}{s(s+3)}$, its final value is

a) $\frac{2}{3}$

b) $\frac{1}{3}$

c) 2

d) 0.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Find the Z-parameters in terms of transmission parameters. 5

3. Find the initial and final values by initial and final value theorem of a function given by $F(s)=\frac{2(s+2)}{(s+4)(s+6)}$. 5

4. Find the current through 2Ω resistor of the network shown in Fig.-2 by using superposition theorem in the given circuit:

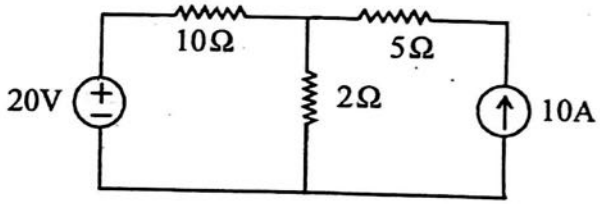


Fig.-2

5

5. A function in s-domain is given by

$$F(s)=\frac{50}{(s^2+2s+2)}$$

Find the Inverse Laplace Transform. 5

6. Find the 'A' and 'C'-parameters for the network shown in Fig.-3:

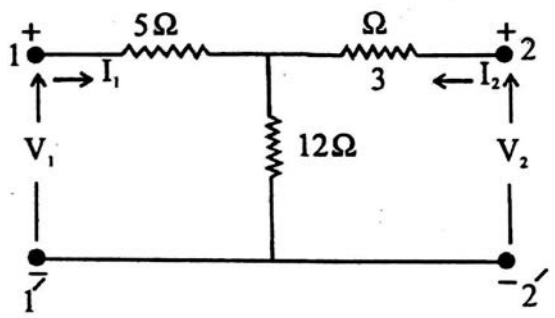


Fig.-3

5

7. Derive the step response of R–L series circuit using Laplace Transformation with considering initially de-energization. 5

8. Show that under what condition of maximum power transfer, the load resistance, must be equal to the internal or Thevenin's equivalent resistance of that circuit? 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

9. a) Find out Y-parameters in terms of hybrid parameters.

   b) Find Y-parameters for the network shown in the Fig.4. 5+10=15

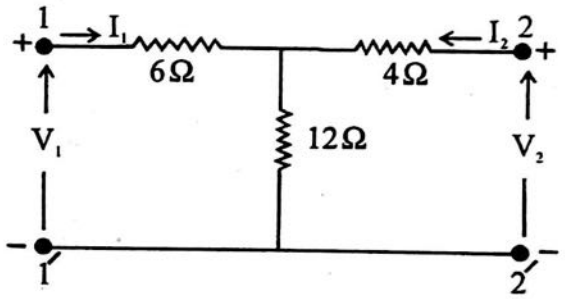


Fig.-4

10. a) Find out the Laplace Transform of the following functions:

   i) Ramp function

   ii) Exponential function (decreasing)

   b) The circuit as shown in Fig.-5 was in steady state with the switch in position '1'. Find the current i(t) for t > 0, if the switch is moved from position '1' to '2' at t = 0. 8+7=15

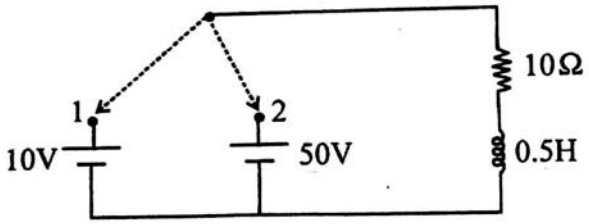


Fig.-5

11. a) Write down the statement of superposition Theorem and explain it with suitable example.

b) Find the current through 10Ω resistor as shown in Fig.-6 using Thevenin's Theorem.

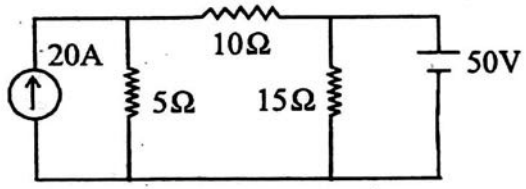


Fig.-6

5+10=15

PART-B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

i) The dot convention is used to define the sign of
   a) self-inductance of the coils
   b) mutual inductance of the coils
   c) direction of current flow in the coils
   d) None of these.

ii) In the magnitude plot of a high-pass filter, at what frequency does the peak of the magnitude characteristic occur
   a) at resonant frequency
   b) below resonant frequency
   c) above resonant frequency
   d) at any frequency.

iii) The tie-set matrix gives the relation between
   a) branch currents and link currents
   b) branch voltages and link currents
   c) branch currents and link voltages
   d) None of these.

iv) An ideal filter should have

a) zero attenuation in the pass band

b) infinite attenuation in the pass band

c) zero attenuation in the attenuation band

d) None of these.

v) When two inductive coils are connected in series, opposing form, then the equivalent inductance of the coil will be

a) $L_1 + L_2 + M$

b) $L_1 + L_2 - M$

c) $L_1 + L_2 + 2M$

d) $L_1 + L_2 - 2M$

vi) The Fourier series expansion of a periodic function with half wave symmetry contains only

a) sine terms

b) cosine terms

c) odd harmonics

d) even harmonics.

vii) The Fourier transform of Signam function is given by

a) $j\pi f$

b) $\frac{1}{j\pi f}$

c) $\frac{1}{j\pi f} + \pi\delta(f)$

d) $j\pi f + \pi\delta(f)$.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Detine mutual inductance. Derive an expression for the mutual inductance between two magnetically coupled coils having self-inductances L_1 and L_2 respectively. 5

3. Draw the circuit diagram of a first order high-pass filter and find out the expression of the cut-off frequency. 5

4. Consider an oriented graph illustrated below in Figure 1, determine the total number of possible tree. 5

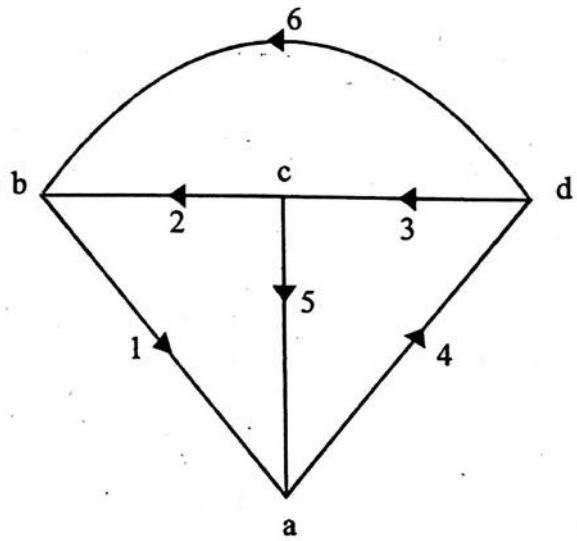


Figure-1

5. Find the Fourier transform of a unity impulse function $\delta(t)$. 5

6. Explain under what condition, an RC series circuit behaves as low-pass filter. 5

7. Prove that the coefficient of mutual inductance M between two coils of self inductances L_1 and L_2 is given by $K = \frac{M}{\sqrt{L_1 L_2}}$. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. a) Explain odd symmetry and even symmetry of periodic waveforms.

   b) Find the Fourier series for the square wave shown in Figure 2.

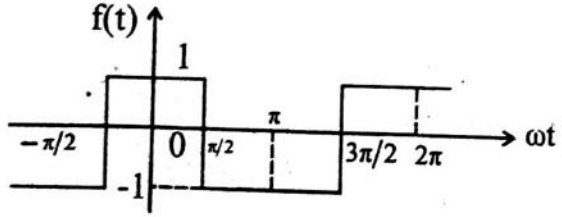


Figure-2

   c) Find the Fourier transform of an exponential voltage waveform given by

$$v(t) = Ve^{-at}, \text{ for } t \geq 0$$
$$= 0, \quad \text{for } t < 0$$

3+7+5=15

9. a) What is tree? Discuss with a suitable example.

   b) A graph is shown in Figure 3 below. Find the tie-set and cut-set matrices and obtain the KCL and KVL equation.

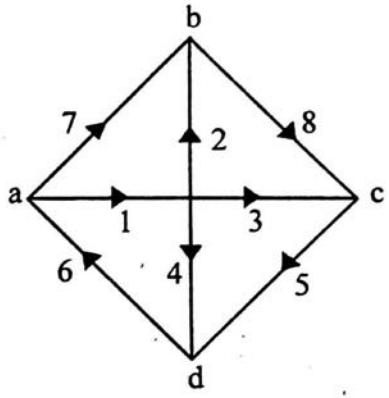


Figure - 3

   c) Define incidence matrix of a graph and draw the oriented graph from the reduced incidence matrix.

$$[A]=\begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & -1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & -1 & 0 \end{bmatrix}$$

4+6+5=15

10. a) Draw the circuit diagram of a first order low-pass filter and find out the expression of the cut-off frequency.

b) Draw and explain the characteristics of band-pass and band-stop filter.

c) The circuit shown in the Figure 4 is a second-order low-pass filter. Analyze the circuit and find the cut-off frequency.

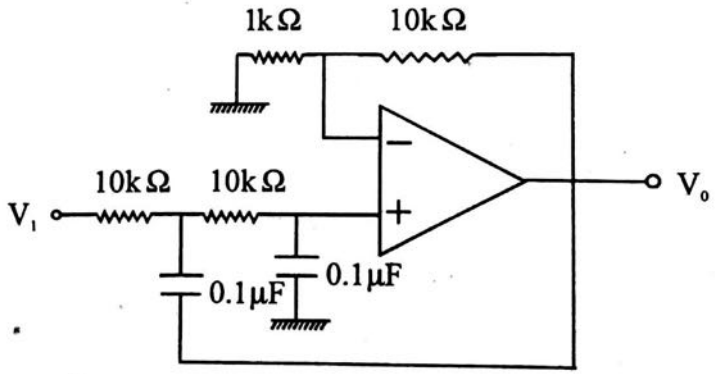


Figure- 4

5+4+6=15

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Numerical Methods and Computer Programming

Paper Code : CS(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Missing data if any, may be assumed judiciously.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

   i) In Newton's forward interpolation, the intervals

   a) should be equally spaced

   b) should be not equally spaced

   c) may be equally spaced

   d) both (a) and (b).

[Turn over]

ii) Round-off the number 0.0063945 correct up to four significant digits.

a) 0.0064

b) 0.0063

c) 0.006395

d) 0.006394

iii) If 'a' is the actual value and 'e' is the estimated value, the formula for relative error is

a) a/e

b) |a–e|/e

c) (a–e)/e

d) |a–e|/a.

iv) In trapezoidal rule, the area under the curve approximated by

a) a rectangle

b) a parabola

c) a trapezium

d) a square

v) The operator ++ is a

a) unary operator

b) binary operator

c) ternary operator

d) null operator.

vi) The order of error in Simpson's $\frac{1}{3}$ rule is

a) h^2

b) h^3

c) h^4

d) h

vii) If f(0)=12, f(3)=6 and f(4)=8, then the linear interpolation function f(x) is

a) $x^2-3x+12$

b) x^2-5x

c) x^3-x^2-5x

d) $x^2-5x+12$

viii) Which of the following is true?

a) $E=1-\Delta$

b) $E=1+\Delta$

c) $\Delta=1+E$

d) $E=\frac{1}{\Delta}$

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: $5\times3=15$

2. What are absolute error and significance error? Discuss with suitable examples. $2\frac{1}{2}\times2=5$

3. Show that $\Delta-\nabla=\Delta\nabla$. 5

4. Evaluate $\int_0^1 \sqrt{1-x^3}\,dx$ taking n=5. 5

5. Calculate f(0.12), given

x	−1	0	2	5
f(x)	9	5	3	15

5

6. Write a C programme for Simpson's $\frac{1}{3}$rd rule to evaluate $I=\int_a^b x\,dx$ taking n as the number of subintervals. 5

7. Evaluate f(1.2) using the following table: 5

x	0	1	2	3	4
f(x)	1	1.5	2.2	3.1	4.3

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. a) Evaluate $\int_4^{5.2} \ln x\,dx$ using Simpson's $\frac{1}{3}$rd rule and compare the result with the exact value. Take h=0.1. 6

b) What do you understand by graphical interpretation of Trapezoidal rule? Deduce the error expression for Trapezoidal rule. 5+4

9. a) Establish the expression for Newton's divided difference formula. 7

b) Find the equation of the cubic curve that passes through the points (0,–5), (1,–10), (2,–9), (3,4) and (4,35).

Calculate the value of f(0.4) and f(3.6). 4+2+2

10. a) Write a C program for Newton's Forward Interpolation formula. 10

b) Prove that $\Delta[\log(ax+b)]=\log\left(1+\frac{ah}{ax+b}\right)$. 5

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

11. Choose the correct alternative for any **five** of the following : 1×5=5

i) While solving a system of linear equations, which of the following approach is economical for the computer memory?

a) Direct
b) Iterative
c) Analytical
d) Graphical

ii) Gauss-Seidel method is also known as method of_____.

a) Successive displacement
b) Iterations
c) False position
d) None of the given choices

iii) Sparse matrices arise in computing the numerical solution of_____.

a) Ordinary differential equations
b) Partial differential equations
c) Linear differential equations
d) Non-linear differential equations

iv) What is the meaning of the iteration in numerical methods?

a) Successive approximation to the exact value
b) Repetition of the formula
c) Desired accuracy
d) None of the above

v) For solving the system of large simultaneous equations _____ method is generally preferred.

a) Matrix Inversion
b) Cramer's rule
c) Gauss-Seidel
d) Gauss elimination

vi) The degree and order of the differential equation $(d^3y/dx^3)^2 + xy\,(dy/dx)\,y^2 = 0$ are

a) 2, 3
b) 2, 2
c) 3,2
d) 3,3

vii) If the determinant of a matrix A is not equal to zero, then the system of equations will have

a) a unique solution
b) many solutions
c) infinite many solutions
d) None of the given choices

viii) Which method you will prefer for getting the initial guess value in Newton-Raphson method?

a) Any numerical method

b) Bisection method

c) Iterative method

d) None of the above.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following. 5×3=15

12. Solve the following problem using LU decomposition: 5

$3.0x_1 - 0.1x_2 - 0.2x_3 = 7.85$

$0.1x_1 + 7.0x_2 - 0.3x_3 = -19.37$

$0.3x_1 - 0.2x_2 + 10.0x_3 = 71.4$

13. Find a root of $3x + \sin(x) - \exp(x) = 0$ between 0 and 0.5 using Regula-Falsi method. 5

14. Prove that Newton-Raphson iteration formula for $\frac{1}{N}$, is $x_{n+1} = x_n(2 - Nx_n)$. 5

15. Find the root of the equation $x^3 - x - 4 = 0$ using method of Bisection up to accuracy 0.01. 5

16. Solve the equation $\frac{dy}{dx} = x + y$, with initial condition $y(0)=1.0$ and $h=0.1$, using Predictor-Corrector method to find $y(0.4)$. 5

17. Describe the Gauss elimination method of reducing a square matrix to upper triangular matrix. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

18. a) What are meant by order and degree of a differential equation? Discuss initial value problem in solving a differential equation.

b) Solve the equation $\frac{dy}{dx} = \frac{(y + xy)}{x}$, given the initial condition $y(1.0)=2.718$. Find $y(1.2)$, taking step size of 0.1 and accuracy 0.001. Use modified Euler's method. (2+3)+10

19. a) Use Taylor method to solve the equation $\frac{dy}{dx} = x^2 + y^2$ for $x = 0.25$ and given $y(0) = 1$.

b) Discuss the advantage and disadvantage of Regula-Falsi method. 10+5

20. a) Derive Newton-Raphson formula from Taylor's expansion of f(x) in the neighbourhood of the root of f(x).

b) Give a geometrical interpretation of Newton-Raphson method.

c) Write down the various steps involved in calculating the root of f(x) = 0 by Newton-Raphson method. 5+5+5

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Analog Electronic Circuits

Paper Code : EC(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Missing data, if any, may be suitably assumed.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP : A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

   i) For an n channel depletion MOSFET, threshold voltage is

      a) zero

      b) positive

      c) negative

      d) undefined

ii) The unit for transconductance is

a) A/V

b) V/A

c) AV

d) dimensionless

iii) In a MOSFET, the notation v_{GS} equals

a) $V_{GS} + V_{gs}$

b) $V_{GS} + v_{gs}$

c) $V_G + V_S$

d) $v_G + v_s$

iv) In a npn BJT, V_{CE} equals

a) $V_C + V_E$

b) $V_{BC} + V_{BE}$

c) $V_{BC} + V_{EB}$

d) $V_{CB} + V_{BE}$

v) Biasing a BJT (BE & BC junctions) in the active mode means

a) both junctions forward biased

b) both junctions reversed biased

c) BE & BC junctions forward & reverse biased respectively

d) reverse of (c).

vi) In a n-channel enhancement MOSFET, the substrate (body) is

a) n-type

b) p-type

c) intrinsic

d) oxide.

vii) In a CE BJT, h_{FE} is defined as

a) I_B / I_C

b) V_{CE/I_B}

c) I_C / I_B

d) V_{CE} / V_{BE}

viii) In a dc power supply, the filter

a) reduces dc

b) reduces dc+ac

c) reduces ac

d) eliminates ac.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. On a BJT output characteristic, show the active, saturation and cutoff regions. 5

3. State the objective of voltage regulation. 5

4. The output equation for a MOSFET CS biasing circuit is $V_{DD}=I_DR_D+V_{DS}$. Plot the dc load line on the output characteristic of the transistor. 5

5. Draw the ac equivalent circuit of a MOSFET and state the significance of model parameters. 5

6. For an enhancement MOSFET, what is channel length modulation? 5

7. What defines a Q point of a transistor, for both BJT and MOSFET in an amplifier? 5

8. Draw a circuit diagram of a biasing circuit for a BJT. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

9. a) Draw the circuit diagram of a npn BJT amplifier.

   b) For the above, draw the dc and ac circuits separately. 7+8

10. a) Draw the circuit diagram of a voltage divider bias circuit for a CS MOSFET amplifier. Draw the Thevenin equivalent circuit and write the input equation.

   b) The MOSFET drain current in the saturation region is given by $i_D = K(V_{GS} - V_t)^2$ where $K = \frac{1}{2}\mu_n Cox$. For small signal operation show that the transconductance

$$g_m = \frac{i_d}{v_{gs}} = 2K(V_{GS} - V_t).$$ 8+7

11. a) Graphically show amplifier action for a BJT.

   b) Graphically show amplifier action for a MOSFET.

   c) Draw the circuit of a voltage regulator. 5+5+5

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

12. Choose the correct alternatives for any **five** of the following : 1×5=5

i) In the analysis of a power amplifier we prefer

a) equivalent circuit analysis

b) graphical method using load line

c) both (a) and (b)

d) None of these.

ii) Operational amplifiers are used to amplify

a) ac signals only

b) dc signals only

c) both ac and dc signals

d) None of these.

iii) A class B push-pull amplifier has an ac output of 10 watts. The dc power drawn from the power supply under ideal condition is

a) 10 watts

b) 12.5 watts

c) 15 watts

d) 20 watts

iv) An astable multivibrator generates

a) traingular waveform

b) sinusoidal waveform

c) square waveform

d) None of these.

v) For PLL

a) capture range is greater than lock range

b) capture range is less than lock range

c) capture range is equal to lock range

d) no relationship among them

vi) A monostable multivibrator is frequently used

a) in memory and timing circuits

b) for producing triangular waves

c) in counting circuits

d) for regeneration of distorted waves.

vii) The OP-AMP comparator circuit uses

a) positive feedback

b) negative feedback

c) regenerative feedback

d) no feedback.

viii) The feedback path in an OP-AMP differentiator consists of

a) a resistor

b) a capacitor

c) a resistor and a capacitor in series

d) a resistor and a capacitor in parallel.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

13. Draw and explain the working principle of Schmitt trigger circuit using OP-AMP. 5

14. Explain the operation of a transformer coupled class A power amplifier. 5

15. Derive the maximum efficiency of a class B push-pull amplifier. What is the major drawback of class B operation and how it can be avoided? 3+2=5

16. With the help of a neat circuit diagram, describe the function of an OP-AMP as a three input adder. 5

17. A CE transistor power amplifier operates with quiescent values of V_{CQ}=6V and I_{CQ}=50 mA. The output signal voltage varies from 1V to 11V and the output signal current varies from 10 mA to 90 mA. Find—

    i) the dc input power to the transistor

    ii) the ac output power delivered to the load

    iii) the collector dissipation

    iv) the effciency of the active device. 5

18. If v_1 and v_2 are two voltages (with respect to ground), how would you construct an OP-AMP circuit to get the voltage $v_0=2v_1-v_2$? 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

19. a) Draw the functional block diagram of 555 Timer.

    b) Explain the operation of astable multivibrator using 555 timer.

    c) Derive the expression of frequency of the output waveform of the astable multivibrator using 555 Timer.

    d) How can you modify the above circuit for 50% duty cycle? 4+5+4+2=15

20. a) What is the cross-over distortion found in a class B amplifier? How it can be avoided?

    b) In which respect class B push-pull amplifier is better than a class A amplifier?

    c) What do you mean by conversion efficiency of a power amplifier? How does the effciency alter as the operation change from class A to class C through class AB and Class B? 5+3+7=15

21. Write short notes on any **three** of the following: 5×3=15

a) Free running oscillator using OP-AMP

b) Special features of power amplifiers as compared to voltage and current amplifiers

c) Basic characteristics of VCO

d) Operation of a monostable multivibrator.

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Circuit Theory & Networks

Paper Code : EE-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP-A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

i) The final value theorem is used to find the

a) Steady state value of the system output

b) Initial value of the system output

c) Transient behavior of the system output

d) None of the above

ii) Maximum power is transferred when magnitude of the load impedance is equal to the

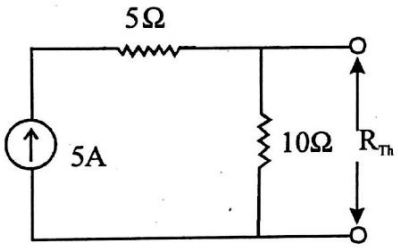
a) magnitude of the source impedance

b) magnitude of the source resistance

c) magnitude of the source reactance

d) None of the above

iii) The Thevenin's equivalent resistance of the following circuit is

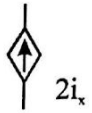


a) 10Ω

b) 5Ω

c) 10/3Ω

d) 5/3Ω.

iv) The symbol refers to 

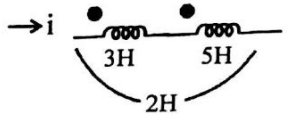
a) A voltage controlled voltage source

b) A current controlled voltage source

c) A current controlled current source

d) A voltage controlled current source

v) The effective inductance of the following circuit is



a) 8H

b) 10H

c) 4H

d) 12H

vi) Which of the following element is a passive element?

a) transistor

b) voltage source

c) current source

d) capacitor

vii) The inverse Laplace transform of the function $1/(S+a)^2$ is

a) e^{-at}

b) te^{-at}

c) t

d) 1

viii) The Laplace transform of the first derivative of a function f(t) is

a) F(S)/S

b) SF(S)–f(0)

c) F(S)–f(0)

d) F′(S)

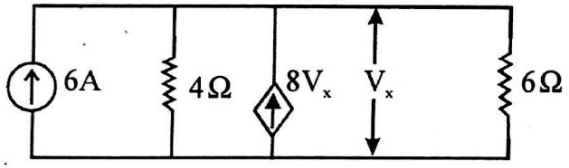
GROUP-B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. State and prove 'Maximum Power Transfer' theorem for an ac circuit. 2+3

3. Find v_x in the circuit shown in Fig. 1. Also obtain the numerical value of the dependent source.



5

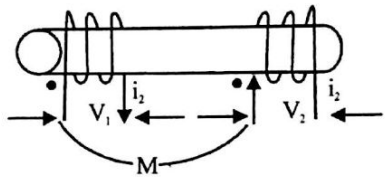
Fig. 1

4. Verify the final value theorem for the function $f(t)=6(1-e^{-t})$. 5

5. Expand the following function into partial fraction and find the inverse Laplace transform of the function.

$F(S)=(S+4)/(S^2+3S+2)$ 5

6. a) Using the dot convention, write the voltage equations for the coils shown in Fig.2.



2

Fig. 2

b) When two identical coupled coils are connected in series, the inductance of the combined circuit is 80 mH. When the connection of one of the coils is reversed, the inductance is 20 mH. Find the coupling coefficient between the coils. 3

GROUP-C
(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

7. a) Solve the following differential equation using Laplace transform.

$$x''(t)+9x'(t)=0;\ x(0)=0,\ x'(0)=3$$

b) The circuit in Fig.3 was in steady state with the switch at position 1. Find the current at time t=0 when the switch is moved from position 1 to position 2.

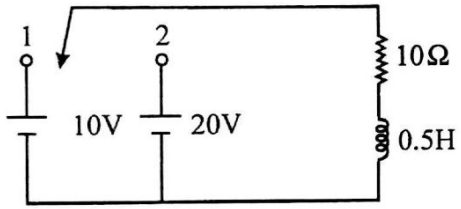


Fig.3

5+10

8. State and explain Norton's theorem. Find Norton's equivalent circuit at terminal x-y for the network shown in Fig. 4. 5+10

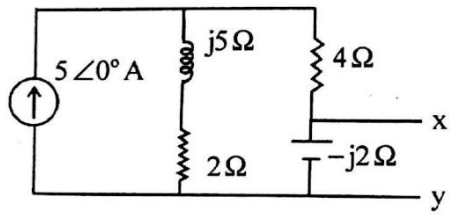
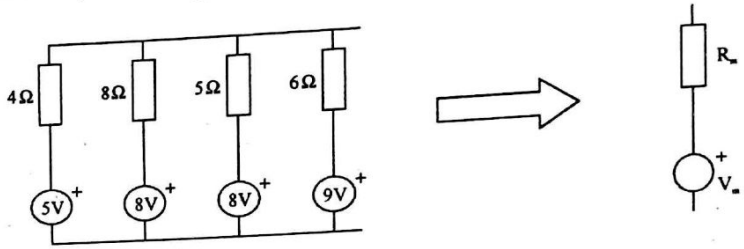


Fig. 4

9. a) Find V_m and R_m using Millman's theorem.



b) Define lumped and distributed network. What is an impulse function?

c) A coil of 100turns is wound uniformly over an insulator ring with a mean circumference 2 m and a uniform sectional area of 0.025cm². If the coil is carrying a current of 2A, calculate (a) the mmf of the circuit (b) magnetic field intensity (c) flux density (d) the total flux. 5+(4+1)+5

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

10. Choose the correct alternatives for any **five** of the following : 1×5=5

i) The h-parameters h_{11} and h_{12} are obtained by
   a) shorting output terminals
   b) opening input terminals
   c) shorting input terminals
   d) opening output terminals

ii) Which parameters are widely used in transmission line theory?
   a) Z parameters
   b) Y parameters
   c) ABCD parameters
   d) h parameters

iii) When compared to a first order low pass filter, a second order low pass filter has
   a) lower voltage gain
   b) high voltage gain
   c) faster drop in filter response
   d) higher cut-off frequency.

iv) An ideal filter should have
   a) zero attenuation in the pass band
   b) infinite attenuation in the pass band
   c) zero attenuation in the attenuation band
   d) None of these

v) A network has seven nods and five independent loops. The number of branches in the network is
   a) 13
   b) 12
   c) 11
   d) 10

vi) Relative to a given fixed tree of a network
   a) link currents from an independent set
   b) branch currents from an independent set
   c) branch voltages from an independent set
   d) both (a) and (c)

vii) A current consists of a fundamental component of amplitude I_1 and a third harmonic of amplitude I_3. The rms value of current will be
   a) $(I_2 + I_3)/\sqrt{2}$
   b) $(I_1 + I_3)/2\sqrt{2}$
   c) $\sqrt{I_1^2 + I_3^2}$
   d) $\sqrt{(I_1^2 + I_3^2)/2}$

viii) Fourier transform $F(j\omega)$ of an arbitrary signal has the property

a) $F(j\omega) = F(-j\omega)$

b) $F(j\omega) = -F(-j\omega)$

c) $F(j\omega) = F^*(-j\omega)$

d) $F(j\omega) = -F^*(-j\omega)$

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

11. Define tie-set matrix. With the help of a suitable example, explain the term 'tie-set matrix' using the network analysis.

12. Draw and explain the characteristics of ideal and actual low pass and band pass filters.

13. Find the ABCD parameters interims of the Y-parameters of a two-port network.

14. Draw the circuit diagram of a first order high-pass filter and find out the expression of the cut-off frequency.

15. Find the Fourier transform of a unity step function *u(t)*.

16. Find the y-parameters of the circuit given in figure 1.

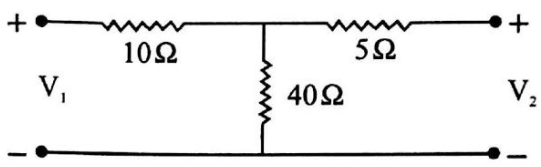


Figure 1

GROUP-C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

17. a) Find the condition of reciprocity and symmetry for hybrid parameters of a 2-port network.

b) What is the cascade condition between two 2-port network? Explain with a diagram.

c) Find the hybrid parameters of the circuit given in figure 2. [5+3+7]

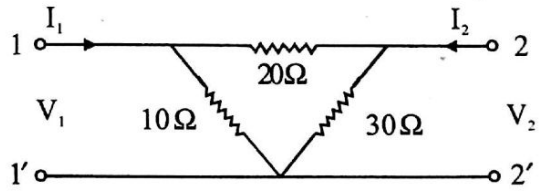


Figure 2

18. a) Determine the Fourier expansion of the triangular waveform shown in figure 3 below.

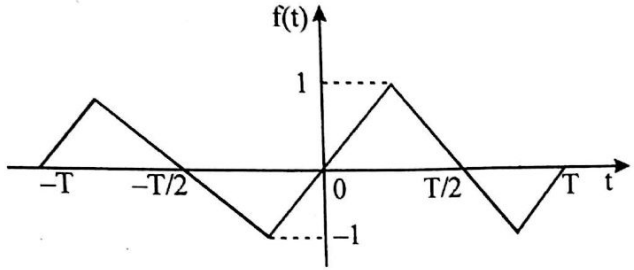


Figure 3

b) Determine the Fourier transform and sketch the amplitude spectrum of the function given below

$f(t) = e^{-a|t|}$ all value of t. 8+7

19. a) What is tree? Discuss with a suitable example.

b) A graph is shown in Figure 4 below. Find the tie-set and cut-set matrices and obtain the KCL and KVL equation.

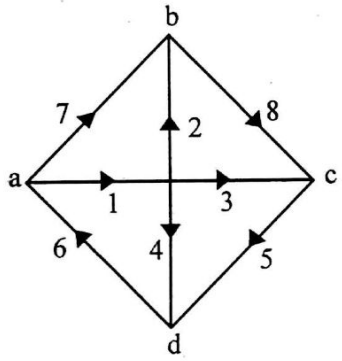


Figure - 4

c) Define incidence matrix of a graph and draw the oriented graph from the reduced incidence matrix

$$[A] = \begin{bmatrix} 1 & 0 & 0 & -1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 1 & -1 & 0 & 1 \\ 0 & 0 & 1 & 0 & 1 & -1 & 0 \end{bmatrix}$$

[4+6+5]

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Electrical and Electronics Measurement

Paper Code : EE-302

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Missing data if any, may be suitably assumed.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternative for any **five** of the following : 1×5=5

   i) An electrodynamic instrument can measure

   a) a.c.

   b) d.c.

   c) eddy current

   d) both a.c. and d.c.

ii) In spring control, the control torque is a function of angular position, θ as

a) $K\theta$

b) $K\theta^2$

c) $K\theta^3$

d) $K\theta^4$

iii) The deflecting torque in a PMMC instrument is a function of current

a) I^{-1}

b) I^0

c) I^1

d) I^2

iv) Moving iron instruments can be used for measuring

a) direct current and voltage

b) alternating current and voltage

c) radio frequency current

d) both (a) and (b).

v) High resistances are provided with a guard terminal. This guard terminal is used to

a) bypass the leakage current

b) guard the resistance against stray electrostatic fields

c) guard the resistance against overheads

d) None of these.

vi) Kelvin's double bridge is used for measurement of

a) medium resistance

b) low resistance

c) high resistance

d) both (a) & (c)

vii) A Wheatstone bridge cannot be employed for measurement of very low resistance as it introduces error an account of

a) contact resistance

b) resistance of connecting leads

c) thermo-electric emfs

d) All of these.

viii) Schering bridge is used to measure

a) capacitance

b) frequency

c) resistance

d) inductance.

ix) A swamping resistance is connected in ammeter to reduce

a) effect of temperature changes in ammeter

b) effect of eddy current in ammeter

c) effect of air friction in ammeter

d) None of these.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. A permanent magnet moving coil instrument has a coil of dimensions 18mm×15mm. The flux density in the air gap is 1.8×10^{-3} Wb/m^2 and the spring constant is 0.14×10^{-6} N−m/rad. Determine the number of turns required to produce an angular deflection of 95° when a current of 6 mA is flowing through the coil. 5

3. Design universal shunt to increase the ammeter range. 5

4. Find out the self-inductance of an unknown inductor by Maxwell's inductance capacitance bridge and also find the internal resistance of this unknown inductor. 5

5. Draw the circuit of a Wheatstone bridge and derive the conditions of balance. 5

6. Derive the expression for torque when the electrodynamometer type wattmeter is used on a.c. 5

7. Describe the substitution method for measurement of medium resistances. 5

8. Find out the capacitance of an unknown capacitor by Schering Bridge. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

9. Explain methods for extending the range of –

   a) an ammeter;

   b) a voltmeter. $7\frac{1}{2}\times2=15$

10. (a) With simple sketches, explain the principle of the operation of a moving iron instrument of

      i) attraction type and

      ii) repulsion type.

    (b) Derive the expression of instantaneous deflecting torque of electrodynamometer type instrument. 10+5=15

11. The four arms of a bridge network are made up as follows:

    Arm AB, a resistor of 60Ω in parallel with an inductor of 0.2H; across arm BC, a resistor of 1000Ω; across arm CD, an unknown resistor R in

parallel with an unknown capacitor C; across arm DA, a resistor of 100Ω. A 50 Hz voltage supply is applied across AC. Find R and C, when a vibration galvanometer connected across BD is undeflected. 15

12. a) Draw the circuit of a Kelvin's Double Bridge used for measurement of low resistances and derive the condition for balance.

    b) Classify the resistances from the point of view of measurements. What are the methods used for measurement of different types of resistances? 7+8=15

13. Write the short notes on the following (any **two**): $7\frac{1}{2}\times2=15$

    a) Anderson's bridge

    b) Induction type energy meter

    c) Permanent magnet moving coil instrument

    d) Wien's bridge.

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

14. Choose the correct alternatives for any **five** of the following : 1×5=5

    i) A potentiometer is basically a
    - a) deflection type device
    - b) null type device
    - c) deflection as well as null type device
    - d) digital device.

    ii) The ratio and phase angle errors in potential transformers may be reduced by
    - a) increasing exciting current
    - b) increasing resistance and leakage reactance in the transformer
    - c) by not employing turns compensation
    - d) None of the above.

    iii) Turns compensation to C.T. is provided mainly to reduce
    - a) power loss
    - b) phase angle error
    - c) ratio error
    - d) both ratio and phase angle error.

iv) A function of transducer is to convert

a) mechanical energy to electrical energy

b) any form of energy to electrical energy

c) one form of energy to other form of energy

d) electrical energy to other form of energy.

v) The gauge factor of a strain gauge is

a) $\frac{\Delta L/L}{\Delta R/R}$

b) $\frac{\Delta R/R}{\Delta L/L}$

c) $\frac{\Delta R/R}{\Delta D/D}$

d) $\frac{\Delta R/R}{\Delta \rho/\rho}$.

vi) Time base of CRO is used to generate

a) sawtooth voltage

b) sinusoidal voltage

c) pulse signal

d) step signal.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

15. Explain the effects of the following on the characteristics of PT:

a) Burden of load

b) p.f. of burden.

16. Explain briefly the working principle of DC Crompton's potentiometer.

17. What are the different types of a.c. potentiometer? What is the function of phase shifter in polar type AC potentiometer?

18. Explain the advantages of DVM over an analog meter.

19. Explain how unknown load can be measured using strain gauge.

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

20. a) Draw the characteristics curves of RTD and thermistor and explain their differences. 5

b) For what type of liquid electromagnetic flow meter is used? Explain the principle of operation of such flow meter. 5

c) Explain the principle of operation of RAMP type DVM. 5

21. a) How calibration of wattmeter on AC can be done using AC potentiometer? Explain. 6

b) A Crompton's potentiometer consists of a resistance dial having 15 steps of 10Ω each and a series connected slide wire of 10Ω is divided into 100 divisions. If the working current of the potentiometer in 10mA and each division of slide wire can be read accurately up to 1/5 of its span, calculate the resolution of the potentiometer in volt. 6

c) Mention three application areas of CRO. 3

22. a) Draw and explain the block diagram of a laboratory grade signal generator. 7

b) Draw and explain the phasor diagram of potential transformer. Calculate the ratio error. 8

2015

B. TECH (3rd Sem)

(EE)

Paper Name: Electrical and Electronics Measurement

Paper Code : EE-302

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

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Separate answer booklet to be used for PART-A and PART-B.

PART–A

(Marks : 35)

GROUP–A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following: 1×5=5

   i) Dead Zone of an Instrument is

      a) The time required by an instrument to begin to respond to a change in measured

      b) The time required by an instrument to warm up initially

c) The largest change of input quantity for which there is no output of the instruments.

d) All of the above.

ii) The Measured value of a capacitor is 205.5 μF, whereas its true value is 202.4 μF. The relative error is

a) 1.53%

b) 1.73%

c) 1.87%

d) 1.94%.

iii) The shunt resistance in an ammeter is usually

a) less than the Meter resistance

b) equal to Meter resistance

c) More than Meter resistance

d) of any value.

iv) A current of 6 A is same as

a) 6 Joule/second

b) 6 Coulomb/second

c) 6 Watt/second

d) None of the above.

v) Resistance can be Measured with the help of

a) Wattmeters

b) Voltmeters

c) Voltmeters or ammeters

d) Ohm meters.

vi) The Rectifier Instrument is not free from

a) Temperature error

b) Wave Shape error

c) Frequency error

d) All of the above.

vii) An Instrument Transformer is used to extend the range of

a) Electrostatic Instrument

b) Induction Instrument

c) Moving Coil Instrument

d) Any of the above.

viii) The pressure coil of a Dynamo-meter type wattmeter is

a) Highly resistive

b) Highly Inductive

c) Purely resistive

d) Purely Inductive.

ix) In a 3-phase Power Measurement by two wattmeter Method, both the wattmeters had identical readings. The power factor of the load was

a) Unity

b) .8 lagging

c) .8 leading

d) zero.

GROUP–B

(Short Answer Type Questions)

Answer any **three** of the following: $5\times3=15$

2. A moving-coil instrument has a resistance of 5Ω and gives a full scale deflection of 10 mV. Show how the instrument may be used to measure:

a) Voltage upto 50 V and

b) Current upto 10 A. $2\frac{1}{2}+2\frac{1}{2}=5$

3. The Inductance of a Moving-iron ammeter with a full-scale deflection of 90° at 1.5 A is given by

$$L=\left(200+40\theta-4\theta^2-\theta^3\right)\mu H$$

where θ is the deflection in radian from the zero position. Estimate the angular deflection of the pointer for a current of 1 A. 5

4. A 4-terminal resistor was measured with the help of a Kelvin's Double bridge having the following components: Standard resistor = $98.02\mu\Omega$, inner ratio arms 98.022Ω and 202Ω, outer ratio arms = 98.025Ω and 201.96Ω, Resistance of the link connecting the standard resistance and the unknown resistance = $600\mu\Omega$. Calculate the true value of Unknown Resistance. 5

5. Two wattmeters are connected to measure the power consumed by a 3-phase load with power factor 0.4. Total Power consumed by the load, as indicated by the two wattmeters is 30 kW. Find the individual wattmeter readings. 5

6. An absolute electrometer has a movable circular plate 80 mm in the diameter. If the distance between the plates during measurement is 4 mm Find the voltage if the force of attraction 0.2 gr and the dielectric in air having a permittivity of 8.85×10^{-12} F/m. 5

7. A moving-coil instrument gives the full-scale deflection of 10 mA, when the potential difference across its terminals is 100 mV. Calculate. 5

a) The shunt resistance for a full scale deflection corresponding to 100 A,

b) The series resistance for full scale reading with 1000 V.

c) Calculate the power dissipation in each case. 5

GROUP–C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

8. Explain briefly about PMMC and MI instruments with torque equations. 7+8=15

9. i) Classify the resistances based on the range of the measurement.

   ii) What are the methods can be used for the measurements of the order of DC Machine field winding resistance?

   iii) Explain briefly about Kelvin Double Bridge with relevant diagram and equation. 2+3+10=15

10. i) What do you mean by Instrument Transformer?

    ii) Explain briefly about C.T. with relevant Diagrams.

    iii) What are the errors associated with current Transformer (C.T.)? 2+10+3=15

PART–B

(Marks : 35)

GROUP–A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following: 1×5=5

   i) Digital instruments have input impedance of the order of

      a) Ω

      b) kΩ

      c) MΩ

      d) mΩ.

   ii) The steady speed of the disc in the energy meter is achieved when

      a) breaking torque is zero

      b) operating torque is equal to breaking torque

      c) creeping effect is zero

      d) breaking torque is equal to creeping torque.

iii) When a potentiometer is used for measurement of voltage of an unknown source, the power consumption in the circuit of unknown source under null condition is

a) very high

b) high

c) small

d) ideally zero.

iv) The bridge by which inductance is measured in terms of capacitance and resistance is called

a) Maxwell-Wein bridge

b) Wein bridge

c) Anderson bridge

d) Schering bridge.

v) During the retrace time, the electrons forming the horizontal beam in CRO

a) move from left to right on the screen

b) move from right to left on the screen

c) move from bottom to top on the screen

d) move from top to bottom on the screen.

vi) The induction type energy meter is

a) an ampere-hour meter

b) true watt-hour meter

c) true volt-ampere-hour meter

d) None of the above.

vii) A Triangular wave shape is obtained

a) by integrating square wave

b) by differentiating a sine wave

c) by differentiating a square wave

d) by integrating a sine wave.

viii) The resolution of $n\frac{1}{2}$ digit multimeter of digital type is

a) n^2

b) $\frac{1}{10^n}$

c) $\frac{1}{n^{10}}$

d) $\frac{1}{n^2}$.

GROUP–B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. Describe briefly the strain gauge load cell with a hand sketch and strain gauge connection. 4+1=5

3. Draw the circuit diagram of Anderson bridge along with its vector diagram. $2\frac{1}{2}+2\frac{1}{2}=5$

4. What are the different types of digital voltmeter? Which one is used for true average value? 4+1=5

5. A $4\frac{1}{2}$ digit voltmeter is used for voltage measurement: $2\frac{1}{2}+2\frac{1}{2}=5$

   a) How would 12.98 V be displayed on 10 V range?

   b) How would 0.6973 V be displayed on 1 V range?

6. A 230 V, single phase domestic energy meter has a constant load of 4 A passing through it for 6 hours at unit p.f. and the meter disc makes 2208 revolutions during this period. What will be the load p.f. for which the revolution of disc is 1472 during 4 hours at 230 V and 5 A? 5

7. Explain briefly the working principle of LVDT along with its diagram. 5

GROUP–C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

8. a) Discuss the standardization of potentiometer. 5

   b) Describe Drysdale-Tinsley a.c. potentiometer with suitable diagram of phase-shifting device with its connection to the potentiometer circuit. 10

9. a) The four arms of a bridge are:

   arm ab : an imperfect capacitor C_1 with an equivalent series resistance r_1

   arm bc : a non-inductive resistance R_3

   arm cd : a non-inductive resistance R_4

   arm da : an imperfect capacitor C_2 with an equivalent series resistance r_2 series with a resistance R_2

   A supply of 450 Hz is gives between terminals a and c and the detector is connected between b and d. At balance:

   $R_2 = 4.8\Omega$, $R_3 = 2000\Omega$, $R_4 = 2850\Omega$

   $C_2 = 0.5\mu F$ and $r_2 = 0.4\Omega$

   Calculate the value of C_1 and r_1 and also the dissipation factor for the capacitor. 5+5+2=12

b) A simple slide wire is used for measurement of current in a circuit. The voltage drop across a standard resistance of 0.1Ω is balanced at 75 cm. Find the magnitude of the current if the standard cell emf of 1.45 V is balanced at 50 cm. 3

10. a) A platinum RTD transducer has resistance of 100Ω at $0^{\circ}C$ and 138Ω at $100^{\circ}C$:

i) What would be its resistance at $50^{\circ}C$?

ii) What temperature would be represented by a resistance of 115.2Ω? 3+3=6

b) Name three different thermocouples commonly used. 3

c) Name two materials (elements) used for resistance thermometer. 2

d) What is the difference between sensors and transducers? Explain with examples. 4

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Mathematics–III

Paper Code : M(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP-A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following: $1\times5=5$

   i) If $f(x)$ is a periodic function with period T then $f(ax)$ is a periodic function with period

   a) $\frac{T}{a}$

   b) Ta

   c) T

   d) None of these.

ii) $f(x) = -k, \quad -a < x < 0$
$= k, \quad 0 < x \le a$

and $f(x+2a) = f(x) \; \forall x$

The above function generally termed as–

a) square waveform

b) saw-toothed waveform

c) triangular waveform

d) None of these.

iii) If $f(x)$, $-\infty < x < \infty$ is an odd function, its Fourier transform be $F(s)$, Fourier sine transform be $F_s(s)$, then the correct statement is–

a) $F(s) = 2F_s(s)$

b) $F(s) = 2iF_s(s)$

c) $F(s) = -2F_s(s)$

d) $F(s) = -2iF_s(s)$.

iv) If $f(x) = e^{-\frac{x^2}{2}}$, then its Fourier transform will be –

a) $\sqrt{2\pi}\, e^{-\frac{s^2}{2}}$

b) $2\pi e^{-s^2}$

c) $\sqrt{2\pi}\, e^{-s^2}$

d) $\sqrt{2\pi e^{-\frac{s^2}{2}}}$.

v) If the Fourier transform of $f(x)$ be $F(s)$, then Fourier transform of $f(ax)$ will be –

a) $F\left(\frac{s}{a}\right)$

b) $F(as)$

c) $\frac{1}{a}F\left(\frac{s}{a}\right)$

d) $aF(as)$.

vi) The C-R Equation for a complex function $f(z) = u(x,y) + iv(x,y)$ is –

a) $u_x = v_y$ and $u_y = v_x$

b) $u_x = v_y$ and $u_y = -v_x$

c) $u_x = -v_y$ and $u_y = v_x$

d) $u_x = -v_y$ and $u_y = -v_x$.

vii) If α is an interior point of any simple closed curve C, then $\oint_c \frac{dz}{(z-\alpha)^n}$ for $n = 2, 3, \ldots$ will be–

a) -1

b) 1

c) $2\pi i$

d) 0.

viii) If $f(z)$ is analytic in a domain D and $\alpha \in D$. If $f(\alpha) = f^{(1)}(\alpha) = \ldots = f^{(m-1)}(\alpha) = 0$ but $f^{(m)}(\alpha) \neq 0$; $f^{(n)}(\alpha)$ denotes n-th derivative of f, then α is called zero of $f(z)$ of order –

a) $m-1$

b) m

c) $m+1$

d) None of these.

GROUP-B

(Short Answer Type Questions)

2. Answer any **three** of the following: $5\times3=15$

i) Obtain the Fourier series to represent $f(x) = x^2$ in $-\pi \le x \le \pi$. Hence prove that

$$\frac{1}{1^2}+\frac{1}{2^2}+\frac{1}{3^2}+\ldots=\frac{\pi^2}{6}.$$

ii) Let $f(x) = \frac{1}{4} - x, \quad 0 < x \le \frac{1}{2}$.

$= x - \frac{3}{4}, \quad \frac{1}{2} < x < 1.$

Find the half-range Fourier sine series of $f(x)$.

iii) Show that $e^{-\frac{x^2}{2}}$ is its own Fourier transform.

iv) Evaluate $F^{-1}\left(\frac{1}{s^2+4s+13}\right)$. [Fourier inverse transform $\equiv F^{-1}$]

v) Prove that $u = 2x - 2xy$ is a harmonic function. Determine its harmonic conjugate and find the corresponding analytic function $f(z)$ in terms of z.

vi) Evaluate $\oint_c |z|^2 dz$ around the square with vertices at $(0,0), (1,0), (1,1), (0,1)$.

GROUP-C

(Long Answer Type Questions)

3. Answer any **one** of the following: $15\times1=15$

i) a) Show that every function can be represented as a sum of an even function and an odd function.

b) Find the Fourier expansion of the function $f(x)$ of period 2π defined as

$$f(x) = 0, \quad -\pi \le x \le 0$$
$$= x, \quad 0 < x \le \pi \ .$$

Find the sum of the series at $x = -5\pi$.

c) Write Parseval's Identity corresponding to the Half Range cosine series of the function $f(x) = x, \ 0 < x < 2$.

4+6+5

ii) a) Find the Fourier transform of the function

$$f(x) = 1, \quad |x| \le a$$
$$= 0, \quad |x| > a$$

Hence evaluate $\int_{-\infty}^{\infty} \frac{\sin sa \cos sx}{s} ds$.

b) Find Fourier sine transform of $\frac{e^{-ax}}{x}$.

c) If $f(x)$ and $g(x)$ are two functions having Fourier Transforms then prove $F(c_1 f(x) + c_2 g(x)) = c_1 F(f(x)) + c_2 F(g(x))$.

6+6+3

iii) a) Evaluate $\oint_c \frac{z}{(2z+1)(z-3)} dz$, $c : |z-1| = 5$.

b) Expand $f(z) = \frac{z-1}{z+1}$ about $z = 0$ in Taylor's series.

c) Using Cauchy's Residue theorem, prove that $\oint_c \frac{z \cos z}{\left(z - \frac{\pi}{2}\right)^3} dz = -2\pi i$, $c : |z-1| = 1$.

5+5+5

PART - B

(Marks : 35)

GROUP : A

(Multiple Choice Type Questions)

4. Choose the correct alternatives for any **five** of the following: $1\times5=5$

i) If X is discrete random variable, then –

a) $E(1\times1)\le|E(X)|$

b) $E(1\times1)\ge|E(X)|$

c) $E(1\times1)=|E(X)|$

d) None of these.

ii) $P_n(1)$ is equal to

a) 0

b) $(-1)^n$

c) 1

d) None of these.

iii) The mean of the Binomial distribution $B\left(10,\frac{2}{5}\right)$ is –

a) 0

b) 4

c) 5

d) 6.

iv) Which one of the following is true?

a) $\int_{-1}^{1}P_m(x)P_n(x)dx=0$ if $m\neq n$

b) $\int_{-1}^{1}[P_n(x)]^2dx=0$ if $m=n$

c) $\int_{-\infty}^{\infty}[P_n(x)]^2dx=\frac{2}{2n+1}$ if $m=n$

d) None of these.

v) $J_{-\frac{1}{2}}(x)$ is equal to

a) $\sqrt{\frac{2}{\pi x}}\sin x$

b) $\sqrt{\frac{2}{\pi x}}\cos x$

c) $\sqrt{\frac{2}{n\pi}}\sin x$

d) None of these.

vi) The distribution for which mean and variance are equal is –

a) Poisson

b) Normal

c) Binomial

d) Exponential.

vii) Which of the following is true?

a) $J_0' = -J_1$

b) $J_0' = J_1$

c) $J_0' = J_1'$

d) $J_0' = -J_1'$.

viii) The condition for independence of two events A and B is –

a) $P(A \cap B) = P(A).P(B)$

b) $P(A + B) = P(A).P(B)$

c) $P(A - B) = P(A).P(B)$

d) $P(A \cap B) = P(A).P(B/A)$.

GROUP : B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

5. What is the probability that a leap year, selected at random, will contain 53 Fridays?

6. If X is normally distributed with mean 3 and s.d. 2, find c such that

$$P(X > c) = 2P(X \le c).$$

7. Prove the recurrence relation:

$$nP_n = x p_n' - P_{n-1}'.$$

8. Prove that $\frac{d}{dx}(x^n J_n) = x^n J_{n-1}$.

9. For any two events A_1, A_2 (may not be mutually exclusive), prove that

$$P(A_1 \cup A_2) = P(A_1) + P(A_2) - P(A_1 \cap A_2).$$

GROUP-C

(Long Answer Type Questions)

Answer any **one** of the following: 15×1=15

10. i) Use Laplace transform to solve the one dimensional wave equation

$$\frac{\partial^2 u}{dt^2} = c^2 \frac{\partial^2 u}{dx^2} (x > 0, t > 0),$$

where $u(x,0) = 0$, $\frac{\partial u}{\partial t}(x,0) = 0$, $x > 0$

$$u(0,t) = F(t),\ u(\infty, t) = 0,\ t \ge 0.$$

ii) Show that when n is a positive integer

$$J_{-n}(x) = (-1)^n J_n(x).$$ 10+5

11. i) If X has the normal distribution with parameters μ and σ, then prove that

a) the mean of X is μ.

b) the s.d. of X is σ.

ii) If X is uniformly distributed over $[1, 2]$, find U so that $P(X > U + \bar{X}) = \frac{1}{6}$. 8+7

12. i) State Baye's theorem.

ii) In a bolt factory machines A, B and C manufacture respectively 25%, 35% and 40% of the total of their output. 5%. 4% and 2% are defective bolts. A bolt is drawn at random from the product and is found to be defective. What are the probabilities that it was manufactured by machines A, B and C?

iii) A random variable X has the following probability mass function:

X :	0	1	2	3	4	5	6	7
$P(X=k)$:	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2+k$

a) Determine the constant k.

b) Evaluate $P(X<6), P(X\geq 6), P(3<X<6)$ and $P(3<X/X\leq 6)$. 2+7+6

2015

B. TECH (3rd Sem)

(ECE, EIE, EE, ME)

Paper Name : Mathematics-III

Paper Code : M-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for PART-A and PART-B.

PART–A

(Marks : 35)

GROUP–A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following: $1\times5=5$

i) If $f(x)=x+x^2,\ -\pi\le x\le\pi$ be represented in a Fourier Series as

$$\frac{a_0}{2}+\sum_{n=1}^{\infty}\left(a_n\cos nx+b_n\sin nx\right),$$

then the value of a_0 is

a) $\frac{\pi^3}{3}$

b) $\frac{\pi^2}{3}$

c) $\frac{2\pi^2}{3}$

d) $\frac{\pi^2}{6}$.

ii) If $F(s)$ is the Fourier transform of $f(x)$, then the Fourier transform of $f(ax)$ is

a) $aF\left(\frac{s}{a}\right)$

b) $\frac{1}{a}F\left(\frac{s}{a}\right)$

c) $\frac{1}{a}F\left(\frac{a}{s}\right)$

d) $aF\left(\frac{a}{s}\right)$.

iii) The period of the function $f(x) = 4 + \sin 4\pi x$ is

a) 1

b) 2π

c) 4π

d) $\frac{1}{2}$.

iv) The waveform of the periodic function $f(x)$ defined by $f(x) = x$, $-a < x \le a$, and $f(x+2a) = f(x)$ for all x is

a) Triangular waveform

b) Saw-toothed waveform

c) Square waveform

d) Half wave rectifier.

v) A function $u(x, y)$ will be harmonic if it satisfies

a) $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$

b) $\frac{\partial^2 u}{\partial x^2} - \frac{\partial^2 u}{\partial y^2} = 0$

c) $\frac{\partial u}{\partial x} = \frac{\partial u}{\partial y}$

d) $\frac{\partial u}{\partial x} = -\frac{\partial u}{\partial y}$.

vi) The singularity of the complex function $f(z) = \frac{1}{1+z}$ is at

a) $z = 1$

b) $z = -1$

c) $z = -i$

d) $z = i$.

vii) If $F(s)$ is the Fourier transform of $f(x)$, then the Fourier transform of $f(x-5)$ is

a) $e^{-5is}F(s)$

b) $e^{5s}F(s)$

c) $e^{i5s}F(s)$

d) $\frac{1}{5}F\left(\frac{s}{5}\right)$.

viii) The value of $\oint_C \frac{dz}{(z-\alpha)^n}$, $n = 2, 3, 4, \ldots$, when α is an interior point is

a) 0

b) $+1$

c) -1

d) $2\pi i$.

GROUP–B

(Short Answer Type Questions)

Answer any **three** of the following: $5\times3=15$

2. Find the Fourier Transform of the function

$$f(x) = \begin{cases} 1-x^2, & |x|\le 1 \\ 0, & |x|>1. \end{cases}$$

Hence evaluate $\int_0^\infty \frac{x\cos x - \sin x}{x^3}\cos\frac{x}{2}dx$.

3. Evaluate $F^{-1}\left(\frac{1}{s^2+4s+13}\right)$.

4. Find Fourier sine transform of $\frac{e^{-ax}}{x}$.

5. Find the value of integral $I = \int_C \bar{z}\,dz$ when C is the right hand half of $|z|=2$ (i.e. from $z=-2i$ to $z=2i$).

6. Let C be the positively oriented circle $|z|=2$.

$$f(z) = \frac{z}{9-z^2}, \quad [z_0 = -i \text{ is interior to C}]$$

Evaluate $\int_C \frac{f(z)}{z+i}dz$.

7. Find the harmonic conjugate of the given harmonic function $u(x, y) = y^3 - 3x^2y$.

GROUP–C

(Long Answer Type Questions)

Answer any **one** of the following: $15\times1=15$

8. i) a) If C is the positively oriented unit circle $|z|=1$ and $f(z)=e^{2z}$, then evaluate $\int_C \frac{e^{2z}}{z^4}dz$.

b) Let z_0 be any point interior to a positively oriented simple closed contour C, $f(z)=1$, evaluate $\int_C \frac{dz}{z-z_0}$

and $\int_C \frac{dz}{(z-z_0)^{n+1}}$. 4+4=8

ii) Represent the function $f(z)=\frac{z}{(z-1)(z-3)}$ by a series of positive and negative powers of $(z-1)$ which converges to $f(z)$ when $0<|z-1|<2$. 7

9. i) Find the Fourier expansion of x^2 on $[-\pi, \pi]$.

Hence show that $1-\frac{1}{2^2}+\frac{1}{3^2}-\frac{1}{4^2}+\ldots=\frac{\pi^2}{12}$.

8

ii) Expand the following function $f(x)$ into a Fourier cosine series, where 7

$$f(x) = 1 \quad , \quad 0 \le x < \frac{1}{3}\pi$$
$$= 0 \quad , \quad \frac{1}{3}\pi \le x \le \frac{2}{3}\pi$$
$$= -1 \quad , \quad \frac{2}{3}\pi < x \le \pi$$

Is the series convergent at all values of x?

10. i) Show that $f(z)=z^2$ is differentiable everywhere hence find $f'(z)$. 5

ii) Verify the nature of zero of the entire function $f(z)=z(e^z-1)$. 5

iii) Find the residue of the function

$$f(z)=\frac{z}{z^4+4}$$

at the isolated singular point $z_0=\sqrt{2}e^{i\pi/4}$. 5

PART–B

(Marks : 35)

GROUP–A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following: $1\times5=5$

i) The probability density function of the random variable X is

$$f(x)=k(2x-1),\ 0\le x\le 2.$$

The value of k is

a) 1

b) $\frac{1}{2}$

c) $\frac{1}{3}$

d) $\frac{2}{3}$.

ii) The generating function for the Legendre function $P_n(x)$ is

a) $(1-2xz+z^2)^{\frac{1}{2}}$

b) $(1+2xz+z^2)^{-\frac{1}{2}}$

c) $(1-2xz+z^2)^{-\frac{1}{2}}$

d) None of these.

iii) $\frac{d}{dx}\left(x^{-n}J_n(x)\right)$ is equal to

a) $x^{-n}J_{n+1}(x)$

b) $-x^{-n}J_{n+1}(x)$

c) $x^nJ_{n+1}(x)$

d) $-x^nJ_{n+1}(x)$.

iv) The singular points of $(x-x^2)y''+(1-x)y'-y=0$ is/are

a) 1, –1

b) 0, 1

c) 0, –1

d) 1, 2.

v) The variance of a random variable X is

a) $[E(X)]^2$

b) $E(X)^2$

c) $E(X^2)-\{E(X)\}^2$

d) $E(X^2)-E(X)$.

vi) The regular singular points of the following equation

$x^2(x-2)^2\frac{d^2y}{dx^2}+2(x-2)\frac{dy}{dx}+(x+3)y=0$ is

a) 0

b) 2

c) 0 and 2

d) None of these.

vii) When A and B are not mutually exclusive. then

a) $P(A+B) \le P(A)+P(B)$

b) $P(AB) = P(A)+P(B)$

c) $P(A+B) = P(A)+P(B)$

d) $P(A+B) > P(A)+P(B)$.

viii) Two-dimensional Laplace equation is given by

a) $k\frac{\partial^2 u}{\partial x^2} = \frac{\partial u}{\partial t}$

b) $\frac{\partial^2 u}{\partial t^2} = C^2\frac{\partial^2 u}{\partial x^2}$

c) $\frac{\partial^2 u}{\partial x^2} = -\frac{\partial^2 u}{\partial y^2}$

d) None of these.

GROUP–B

(Short Answer Type Questions)

Answer any **three** of the following: $5\times3=15$

2. A random variable X has the following probability mass function:

x:	−2	−1	0	1	2	3
f(x):	0.1	2k	0.2	3k	0.3	4k

i) find k

ii) evaluate $P(x<2)$, $P(X\le 2)$, $P(-2<X<2)$.

3. Express $P(x) = x^3+3x^2+x-3$ in terms of Legendre's polynomial.

4. Prove that $\frac{d}{dx}(x^n J_n) = x^n J_{n-1}$.

5. The probability density of a continuous distribution is given by

$$f(x) = \frac{5}{8}x(2-x),\ 0<x<2.$$

Compute mean and variance.

6. Prove that $\frac{d}{dx}\{x\ {}^nJ_n(x)\} = -x\ {}^nJ_{n-1}(x)$.

7. Prove that $\int_{-1}^{1}\{P_n(x)\}^2 dx = \frac{2}{2n+1}$ if $m=n$.

GROUP–C

(Long Answer Type Questions)

Answer any **one** of the following: $15\times1=15$

8. i) Using Fourier Transform solve the equation

$$\frac{\partial u}{\partial t} = k\frac{\partial^2 u}{\partial x^2},\ x>0, t>0$$

subject to the conditions

$u(0, t) = 0$; $u(x, 0) = e^{-x}$, $x>0$ and $u(x, t)$ is bounded.

ii) Prove that $\int_{-1}^{1} P_m(x)P_n(x)dx = 0$ if $m\ne n$.

10+5

9. i) If X has a binomial distribution with parameters n and p then prove that

   a) the mean of X is np

   b) and the s.d. of X is npq where $q = 1 - p$.

   ii) Solve in series the equation $\frac{d^2y}{dx^2} + xy = 0$.

8+7

10. i) Prove that $J_n(-x) = (-1)^n J_n(x)$ for +ve or –ve integers.

   ii) A car hire firm has two cars, which hires out by the day. The number of demands for a car on each day is Poisson distributed with parameter 1.3. Calculate the proportion of days on which neither of the cars is used and the proportion of days on which some demand can't be met for lack of cars.

   iii) Determine the regular and irregular singular points of the following equations:

   a) $x^2 \frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$

   b) $(x-1)^4 \frac{d^2y}{dx^2} + 2(x-1)\frac{dy}{dx} + y = 0$.

6+5+4

2014

B. TECH (3rd Sem)

(EE)

Paper Name : Thermal Power Engineering

Paper Code : ME(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

PART–A

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternative for any **five** of the following: 1×5=5

   i) In SI system, the unit of power is

   a) joule

   b) watt

   c) eV

   d) calorie.

ii) Which of the following is not a fossil fuel?

a) Coal

b) Diesel

c) Uranium

d) LPG.

iii) In steam power plant, Carnot cycle is not used because

a) efficiency is high

b) it has low work ratio

c) both

d) None.

iv) The main objective of regeneration cycle is to increase

a) pressure

b) efficiency

c) dryness fraction

d) temperature.

v) At any given pressure, temperature of saturated liquid and saturated vapour is

a) same

b) different

c) no relation

d) All.

vi) At critical point, pressure of saturated steam is

a) 100 bar

b) 150 bar

c) 200 bar

d) 221 bar.

vii) The main function of boiler is to provide

a) sensible heat

b) latent heat of evaporation

c) superheat

d) None.

viii) The function of cooling tower is to cool

a) steam

b) air

c) cooling water

d) All.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. Give the layout of a modern steam power plant and explain it briefly.

3. List the different means of coal transportation in power plants. What are the requirements of good coal handling plant?

4. What is the difference between ash and smoke? Explain the working of cyclone separator and ESP with sketches.

5. With the help of diagram, explain the working of a simple water tube boiler.

6. Describe recirculation ratio and top dryness fraction. Derive the relationship between the two.

7. What is a nozzle? Classify different types of nozzles and describe its working.

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. i) In a steam nozzle, the steam expands from 3.0 bar to 1.0 bar. The initial velocity is 90 m/s and initial temperature is 150°C. The nozzle efficiency is 0.95. Determine the exit velocity.

   ii) A steam power plant operates on a theoretical reheat cycle. From boiler, steam at 150 bar, 550°C expands through high pressure turbine. It is reheated at constant pressure of 40 bar to 550°C and expands through low pressure turbine to a condenser pressure at 0.1 bar.

Draw T-s and h-s diagrams. Find –

a) quality if steam at turbine exhaust,

b) cycle efficiency and

c) specific steam consumption in /kWh.

6+9

9. i) What are boiler mounting and boiler accessories? List them and explain their functions. Draw the Babcock and Wilcox boiler and show the different parts.

   ii) In a boiler consisting of superheater and economizer –

mass of water evaporated per hour $(m_s) = 5940\,kg$

mass of coal burnt per hour $(m_f) = 675\,kg$

lower calorific value (LCV) of fuel+31600 kJ/kg

pressure of steam at boiler stop valve = 14 bar

Temperature of feed water entering economizer = 32°C

Temperature of feed water leaving economizer = 115°C

Dryness fraction of steam leaving boiler = 0.96

Temperature of steam leaving superheater = 260°C

Specific heat of super heated steam = 2.3

Determine:

a) Percentage of heat utilized in boiler, economizer and superheater

b) Overall efficiency of the plant. 6+9

10. i) Explain the working of simple impulse turbine. Derive the relationship of stage efficiency with blade efficiency.

ii) Steam flows from the nozzles of a single row impulse turbine with a velocity 450 m/s at a direction which is inclined at an angle of 16° to the peripheral velocity. Steam comes out of moving blades with an absolute velocity of 100 m/s in the direction at 110° with the direction of blade motion. The blades are equiangular and steam flow rate is 6 kg/s. Determine power loss due to friction. 5+10

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

11. Choose the correct alternative for any **five** of the following: 1×5=5

i) The calorific value of gasoline is about

a) 45 J/kg

b) 45 kJ/kg

c) 45 MJ/kg

d) 45 GJ/kg.

ii) A heat engine gives an output of 3 kW and input is 10000 J/s. The thermal efficiency of the engine will be

a) 30%

b) 33.3%

c) 66.6%

d) 70%.

iii) Knocking tendency of a CI engine decreases with

a) decrease in speed

b) decrease in compression ratio

c) decrease in jacket water temperature

d) All of the above.

iv) The air standard Otto cycle comprises

a) two constant volume and two constant entropy processes

b) two constant pressure and two constant entropy processes

c) two constant volume and two constant pressure processes

d) None of the above.

v) The thermal efficiency of petrol engine as compared to diesel engine is

a) higher

b) lower

c) same for same power output

d) same for same speed.

vi) Iso-octane content in a fuel for spark ignition engines

a) accelerates auto ignition

b) retards auto ignition

c) does not affect auto ignition

d) None of the above.

vii) Type of air compressor generally used in gas turbines is

a) axial flow type

b) centrifugal type

c) reciprocating type

d) lobe type.

viii) Pressure ratio for a gas turbine may be in the range of

a) 2 to 3

b) 3 to 5

c) 16 to 18

d) 18 to 22.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following. 5×3=15

12. i) Mention the various assumptions made in the air-standard cycle analysis.

ii) What is the effect of compression ratio on the efficiency of Otto cycle? 3+2

13. Discuss the important characteristics of CI engine fuel. 5

14. Explain with pressure-crank angle diagram various stages of combustion in SI engines. 5

15. What do you understand by EGR? Explain how EGR reduces NO_x emission. 2+3

16. Derive the expressions for efficiency for a simple gas turbine cycle in terms of pressure ratio. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following. $15 \times 1 = 15$

17. An 8-cylinder, 4-stroke petrol engine of 82.5 mm bore and 85.7 mm stroke has a compression ratio of 7. It is tested at 4000 r.p.m. on a dynamometer which has 53.35 cm arm. During a 10 minute test, the dynamometer reads 400 N and the engine consumes 4.64 kg of fuel. Air is supplied at 1.013 bar pressure and 27°C at the rate of 6.5 kg per minute.

    Assuming CV of fuel = 44000 kJ/kg, find : b.m.e.p., volumetric efficiency and air-fuel ratio. 15

18. i) Discuss the relative advantages and disadvantages of reciprocating IC engines and gas turbine. 4

    ii) In a gas turbine plant, air is compressed from 1 bar and 15°C through a pressure ratio of 6. It is then heated to 1000 K in a combustion chamber and expanded back to a pressure of 1 bar. Calculate the work done, cycle efficiency and work ratio. Assume isentropic efficiencies of the turbine and compressor at 90 and 85 percent respectively. 11

2015

B. TECH. (3rd Sem)

(EE)

Paper Name : Numerical Methods and Computer Programming

Paper Code : CS(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for Part-A and Part-B.

PART - A

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternative for any **five** of the following : $1\times5=5$

   i) In the problem 'Find the perimeter of a circle having radius 3; given $\pi = 3.14$" the kind of error of the approximation 3.14 for π is

   a) truncation error

   b) round-off error

   c) inherent error

   d) relative error.

ii) The order of 'h' in the error expression of trapezoidal rule is

a) 1

b) 2

c) 3

d) 4.

iii) If $f(x)=\frac{1}{x^2}$ then the divided difference f(a,b) is

a) $\frac{(a+b)}{(ab)^2}$

b) $\frac{(a-b)}{(ab)^2}$

c) $\frac{1}{a^2}-\frac{1}{b^2}$

d) $\frac{1}{a^2-b^2}$

iv) In Simpson's 1/3 rule, the area under the curve is approximated by

a) a reactangle

b) a parabola

c) a circle

d) an ellipse.

v) If the interval of differencing is unity and $f(x)=ax^2$ (a is a constant) which one of the following choice is wrong?

a) $\Delta f(x)=a(2x+1)$

b) $\Delta^2 f(x)=2a$

c) $\Delta^3 f(x)=2$

d) $\Delta^4 f(x)=0$

vi) The minimum number of function in any C program is

a) 1

b) 2

c) 3

d) 4.

vii) The operator ++ is a

a) unary operator

b) binary operator

c) ternary operator

d) null operator.

viii) The value of x that satisfies f(x) = 0 is called the

a) root of an equation f(x) = 0

b) root of a function f(x)

c) zero of equation f(x) = 0

d) None of these.

GROUP - B
(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Evaluate $\sqrt[3]{17}$ by Newton-Raphson method correct upto three decimal places. 5

3. Evaluate $\int_0^{\frac{\pi}{2}} \sqrt{\cos x}\, dx$ by using Simpson's 1/3 rule where h =15°. 5

4. Prove that $\Delta - \nabla = \Delta\nabla$ 5

5. Using Newton's divided difference formula evaluate f(6) from the following values: 5

x	3	7	9	10
f(x)	168	120	72	63

6. i) What is truncation error and computational error? Explain with example.

   ii) Round off the given numbers :

   a) 1.3225

   b) 0.657 4+1

7. What is finite difference? Differentiate Interpolation from Extrapolation. 2+3

GROUP - C
(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. i) Evaluate the following integral using trapezoidal rule, taking n = 8.

$$I = \int_0^2 \left[1/\left(x^2+4\right)\right] dx$$

compute absolute error and relative error.

ii) Write a C program to find out the integral of $\int_a^b x\, dx$, where n is the no. of subintervals.

7+8

9. i) Find out the polynomial which takes the following values :

x	2	4	6	8	10
f(x)	0	0	1	0	0

Evaluate f(2.5) and f(8.3).

ii) Derive Newton's divided difference formula. 8+7

10. i) Find the positive real root of $x^3 - x^2 - 1 = 0$ using bisection method of seven iterations.

ii) Derive the formula for Newton-Raphson method to find out the real root of an equation. Write the condition of convergence for the same method. 7+8

PART-B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : $1\times5=5$

   i) Gauss Elimination method is a
      a) substitution solution method
      b) iterative solution method
      c) solution method expressing both of the above
      d) solution method following none of the above.

   ii) Pivoting and ill-condition are associated with
      a) LU factorization method
      b) Matrix Inversion method
      c) Gauss Elimination method
      d) All of the above methods.

   iii) Euler's method is basically Runge-Kutta method of
      a) 1st order
      b) 2nd order
      c) 3rd order
      d) 4th order.

   iv) Example of predictor-corrector method is
      a) Gauss Elimination method
      b) Milne's method
      c) Runge-Kutta method
      d) Euler's method.

   v) If $a_{i,i}$ becomes O in Gauss Elimination method the following variables remain undermined:
      a) x_k for $k=i+1,i+2,....,n$
      b) x_k for $k=i,i-1,i-2,....,1$
      c) Both of the above
      d) None of the above.

   vi) In Finite difference method u_{xx} is represented as
      a) $\dfrac{u(x+h,y)-2u(x,y)+u(x-h,y)}{(\Delta x)^2}$
      b) $\dfrac{u(x+h,y)+2u(x,y)+u(x-h,y)}{(\Delta x)^2}$
      c) $\dfrac{u(x+h,y)-u(x,y)}{(\Delta x)}$
      d) $\dfrac{u(x,y)-u(x-h,y)}{(\Delta x)}$

vii) 5 point standard formula is

a) $u_{i,j} = \frac{u_{i-1,j-1} + u_{i-1,j+1} + u_{i+1,j-1} + u_{i+1,j+1}}{4}$

b) $u_{i,j} = \frac{u_{i,j-1} + u_{i+1,j} + u_{i-1,j} + u_{i,j+1}}{4}$

c) Both of the above

d) None of the above.

viii) Gauss-Seidel iterative method uses

a) Old set of iterative values of variables

b) Latest available values of variables

c) random values of variables

d) always a set of fixed values of variables

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Discuss Gauss-Seidel Iteration method. Write down the generalized equation representing method.

3. Solve the following equations following LU factorization method:

$3a - 2b + c = 19;\ 2a - 6b - 5c = 21;\ 7a + 4b - 11c = 5.$

4. Write down an algorithm representing Matrix Inversion method.

5. Prove Euler's method for the solution of Ordinary differential equation.

6. Derive the 5 point standard formula for the numerical solution of Laplace's equation by finite difference method.

7. What is pivoting? How it can be avoided? When it is not at all possible to avoid?

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. Write down an algorithm of Gauss-Elimination method taking care of pivoting and ill-conditioning.

9. For the Poisson's equation $\nabla^2 u = 4x^2 + y^2$ and the boundary condition as shown in Figure-1 and considering a square mesh (h×k=1×1), write down the expressions of u_1, u_2, u_3, u_4. Show two complete iteration step following Gauss-Seidel iteration for the solution of u_1, u_2, u_3, u_4.

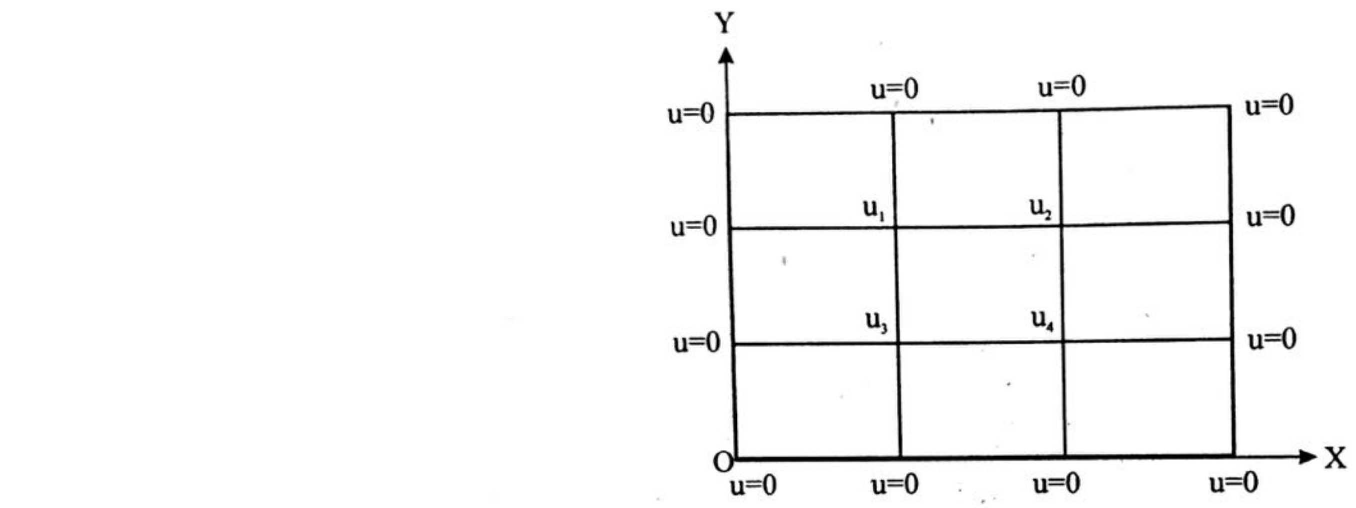

Fig.-1

10. Use 4th order Runge-Kutta method to solve the second order differential equation $y'' + xy' + y = 0$. Given that $y(0) = 1$ and $y'(0) = 0$. Find y and y' at $x = 0.1$.

2015

B. TECH (3rd Sem)

(EE)

Paper Name : Thermal Power Engineering

Paper Code : ME(EE)-301

Full Marks : 70 Time : 3 Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

Separate answer booklet to be used for PART-A and PART-B.

PART - A

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternatives for any **five** of the following : 1×5=5

   i) Lancashire boiler is a

      a) Stationary fire tube boiler

      b) Internally fire tube boiler

      c) Horizontal boiler

      d) All of the above.

ii) Locomotive boiler is a

a) Single tube, horizontal, internally fired and stationary boiler

b) Single tube, vertical, externally fired and stationary boiler

c) Multi- tubular, horizontally, internally fired and mobile boiler

d) Multi- tubular, horizontally, horizontally and stationary boiler.

iii) Which of the following water tube boiler?

a) Lancashire boiler

b) Babcock and Wilcox boiler

c) Locomotive boiler

d) Cochran boiler.

iv) In a fire tube boilers

a) Water passes through the tube

b) The flame and hot gases passes through tube

c) Forced circulation takes place

d) None of the above.

v) The modern steam turbine are

a) **Impulse Turbine**

b) **Reaction Turbine**

c) **Francis Turbine**

d) **Impulse-reaction Turbine.**

vi) A device attached to the steam chest for preventing explosion due to excessive internal pressure of steam is called -

a) Safety valve

b) Water level indicator

c) Pressure gauge

d) Fusible plug.

vii) A safety valve mainly used in locomotive and marine boiler is

a) Lever safety valve

b) High pressure and low water safety valve

c) Dead weight safety valve

d) Spring loaded safety valve.

viii) A device used to put off fire in the furnace of the boiler when the level of water in the boiler fails to an unsafe limit, is called

a) **Blow off cock**

b) **Fusible plug**

c) **Super-heater**

d) **Economizer.**

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following : 5×3=15

2. Derive an expression for Power output and Blade efficiency with the help of the velocity diagram of a single stage Impulse turbine. 5

3. Write the difference between Water tube boiler and Fire tube boiler with example. 5

4. Explain the different types of draughts in power plant. Why Artificial draught is preferred to natural draught? 5

5. Write down the working principle of water level indicator and pressure gauge in boilers. 5

6. Derive the expression for Maximum blade efficiency of an impulse turbine. 5

7. Define the term Base Load, Intermediate Load and Peaking Load for a Power Plant. 5

GROUP - C

(Long Answer Type Questions)

Answer any **one** of the following : 15×1=15

8. a) The following data observed during a boiler operation:

Coal used = 250kg of calorific value 29800 kJ/kg, water evaporated 2000kg, steam

pressure 11.5 bar, dryness fraction of steam 0.95 and the feed water temperature 34°C. Calculate the equivalent evaporation "from at 100°C" per kg of coal and the efficiency of the boiler. (Take h_{fl} at 34°C = 142.4 kJ/kg and h_f = 790kJ/kg, h_{fg} = 1991.4 kJ/kg at 11.5 bar). 11

b) Write down the difference between forced draught and induced draught. 4

9. a) Define the term Boiler Efficiency and derive the mathematical expression. 5

b) A Lancashire boiler generates 2400kg of dry steam per hour at a pressure of 11 bar. The grate area is $3m^2$ and 90kg of coal is burnt per m^2 of grate area per hour. The calorific value of the coal is 33180 kJ/kg and the temperature of the feed water is 17.5°C. Determine the following :

i) Actual evaporation per kg of coal,

ii) Equivalent evaporation "from and at 100°C"

iii) Efficiency of the boiler. 10

10. Write short notes with diagram (any **three**) : 5×3=15

a) Difference between Impulse Turbine and Reaction turbine.

b) Superheater

c) Electrostatic Precipitator (EPS)

d) Water level indicator

e) Economiser.

PART - B

(Marks : 35)

GROUP - A

(Multiple Choice Type Questions)

1. Choose the correct alternative for any **five** of the following : 1×5=5

i) External mixing of fuel with air occurs in case of

a) petrol engine

b) diesel engine

c) two stroke diesel engine

d) universal engine.

ii) Combustion in compression ignition engines is

a) homogeneous

b) heterogeneous

c) both (a) and (b)

d) laminar.

iii) If the compression ratio of an engine working on Otto cycle is increased from 5 to 7, the percentage increase in efficiency will be

a) 2%

b) 4%

c) 8%

d) 14%.

iv) A stoichiometric air-fuel ratio is

a) chemically correct mixture

b) lean mixture

c) rich mixture

d) None of the above.

v) Morse test is used to determine mechanical efficiency of

a) single cylinder C.T engine

b) single cylinder S.I engine

c) multi-cylinder engine

d) All of the above.

vi) Tendency of detonation in S.I engines increases with

a) decrease of engine speed

b) decrease of compression ratio

c) increase of compression ratio

d) None of the above.

vii) Efficiency of gas turbine is increased by

a) reheating

b) inter cooling

c) adding a regenerator

d) All of the above.

viii) The pressure ratio in gas turbines is of the order of

a) 2 : 1

b) 4 : 1

c) 6 : 1

d) 9 : 1.

GROUP - B

(Short Answer Type Questions)

Answer any **three** of the following: 5×3=15

2. Define swept volume and clearance volume. Show these volumes on the P-V diagram of Otto cycle.

3. Draw P-V and T-S diagram of diesel cycle with heat and work transfer details on the sketch.

4. Explain in detail the Octane rating of a fuel.

5. Compare S.I engine and C.I engine knock.

6. What are the differences between a closed cycle gas turbine and an open cycle gas turbine plants?

GROUP - C

(Long Answer Type Questions)

Answer any one of the following : 15×1=15

7. a) **Explain the knocking phenomena in S.I engine.** 6

b) In an ideal Otto cycle the air at the beginning of isotropic compression is at 1 bar 15°C. The ratio of compression is 8. If the heat added during the constant volume process is 1000 kJ/kg, determine:

a) the maximum temperature of the cycle

b) air standard efficiency

c) the work done per kg of air

take $C_v = 0.718$ and $\gamma = 1.4$. 9

8. a) Derive the expression for thermal efficiency for a simple gas turbine cycle in terms of pressure ratio. 5

b) Air enters the compressor of a gas turbine plant operating on Brayton cycle at 101.325 Pa, 27°C. The pressure ratio in the cycle is 6. Calculate the maximum temperature in the cycle and the cycle efficiency. Assume $W_T = 2.5\ W_C$, where W_T and W_C are the turbine and compressor work respectively. Take $\gamma = 1.4$. 10