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15MAT41

Fourth Semester B.E. Degree Examination, June/July 2019
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Employ Taylor's series method, find y(0.1) considering upto third degree term if y(x) satisfies the equation $\frac{dy}{dx} = x - y^2$, y(0) = 1. **(05 Marks)**

b. Using Runge-Kutta method of fourth order, find y(0.1) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$, y(0) = 1 taking h = 0.1. **(05 Marks)**

c. Apply Milne's method to compute y(1.4) correct to four decimal places given $\frac{dy}{dx} = x^2 + \frac{y}{2}$ and following the data : y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514. **(06 Marks)**

OR

2 a. Use Taylor's series method to find y(4.1) given that $(x^2 + y)y' = 1$ and y(4) = 4. **(05 Marks)**

b. Find y at x = 0.8, given $y' = x - y^2$ and y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762. Using Adams – Bashforth method. Apply the corrector formula. **(05 Marks)**

c. Using Modified Euler's method find y at x = 0.1 given $y' = 3x + \frac{y}{2}$ with y(0) = 1 taking h = 0.1. **(06 Marks)**

Module-2

3 a. Obtain the solution of the equation $2y'' = 4x + y'$ with initial conditions y(1) = 2, y(1.1) = 2.2156, y(1.2) = 2.4649, y(1.3) = 2.7514 and y'(1) = 2, y'(1.1) = 2.3178, y'(1.2) = 2.6725, y'(1.3) = 3.0657 by computing y(1.4) applying Milne's method. **(05 Marks)**

b. If α and β are two distinct roots of $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(05 Marks)**

c. Show that $J_{-\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\cos x$ **(06 Marks)**

OR

4 a. Given $y'' - xy' - y = 0$ with the initial conditions y(0) = 1, y'(0) = 0. Compute y(0.2) and y'(0.2) by taking h = 0.2 using Runge - Kutta method of fourth order. **(05 Marks)**

b. If $x^3 + 2x^2 - x + 1 = aP_0(x) + bP_1(x) + cP_2(x) + dP_3(x)$ then, find the values of a, b, c, d. **(05 Marks)**

c. Derive Rodrigue's formula

$$P_n(x) = \frac{1}{2^n n!}\frac{d^n}{dx^n}\left[(x^2-1)^n\right]$$ **(06 Marks)**

Module-3

5 a. State and prove Cauchy-Reimann equation in polar form. **(05 Marks)**

b. Discuss the transformation $w = z^2$. **(05 Marks)**

c. Find the bilinear transformation which maps the points $z = 1, i, -1$ into $w = 2, i, -2$. **(06 Marks)**

OR

6 a. Find the analytic function whose real part is

$$\frac{x^4 - y^4 - 2x}{x^2 + y^2}$$ **(05 Marks)**

b. State and prove Cauchy Integral formula. **(05 Marks)**

c. Evaluate $\int_c \frac{e^{2z}}{(z+1)(z-2)} dz$ where c is the circle : $|z| = 3$ using Cauchy's Residue theorem. **(06 Marks)**

Module-4

7 a. The probability function of a variate x is :

x	0	1	2	3	4	5	6	7
p(x)	0	k	2k	2k	3k	k^2	$2k^2$	$7k^2 + k$

(i) Find k (ii) Evaluate $p(x < 6)$, $p(x \geq 6)$ and $p(3 < x \leq 6)$. **(05 Marks)**

b. Obtain mean and standard deviation of Binomial distribution. **(05 Marks)**

c. The joint distribution of two discrete variables x and y is $f(x, y) = (2x + y)$ where x and y are integers such that $0 \leq x \leq 2$; $0 \leq y \leq 3$.
Find : (i) Marginal distribution of x and y.
(ii) Are x and y independent. **(06 Marks)**

OR

8 a. The marks of 1000 students in an examination follows a normal distribution with mean 70 and standard deviation 5. Find the number of students whose marks will be
(i) less than 65 (ii) more than 75 (iii) between 65 and 75 [Given $\phi(1) = 0.3413$] **(05 Marks)**

b. If the probability of a bad reaction from a certain injection is 0.001, determine the chance that out of 2000 individuals, more than two will get a bad reaction. **(05 Marks)**

c. The joint distribution of the random variables X and Y are given. Find the corresponding marginal distribution. Also compute the covariance and the correlation of the random variables X and Y. **(06 Marks)**

X \ Y	1	3	9
2	1/8	1/24	1/12
4	1/4	1/4	0
6	1/8	1/24	1/12

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15EE42

Fourth Semester B.E. Degree Examination, June/July 2019
Power Generation and Economics

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define the following:
   i) Hydrograph
   ii) Mass curve
   iii) Flow duration curve **(08 Marks)**

b. Explain the classification of hydroelectric power plants. **(08 Marks)**

OR

2 a. Explain the working of hydroelectric power plant with neat layout. **(08 Marks)**

b. With the neat sketch explain the working of Pelton wheel turbine. **(08 Marks)**

Module-2

3 a. Explain the factors to be considered for selection site of a steam power plant. **(08 Marks)**

b. With the sketch explain the block diagram of diesel power plant. **(08 Marks)**

OR

4 a. With the sketch explain working of closed cycle gas turbine power plants. **(08 Marks)**

b. List the merits and demerits of steam power plant. **(08 Marks)**

Module-3

5 a. Explain the function of the following in a nuclear reactor:
   i) Control rod
   ii) Moderator
   iii) Reflector
   iv) Biological shield **(10 Marks)**

b. Mention the advantages and disadvantages of a Nuclear power plant. **(06 Marks)**

OR

6 a. With the neat layout diagram, explain the working of nuclear power plant. **(10 Marks)**

b. Explain the methods of nuclear waste disposal. **(06 Marks)**

Module-4

7 a. Write short notes on:
   i) High voltage fuses
   ii) High voltage circuit breakers **(08 Marks)**

b. Explain the factors are to be considered for substation site selection. **(08 Marks)**

OR

8 a. Explain the advantages of gas insulated substation. **(06 Marks)**

b. Write a note on:
   i) Resistance grounding
   ii) Reactance grounding **(10 Marks)**

Module-5

9 a. List the principal factors affecting framing of Tariff. **(08 Marks)**

b. A 300 KVA distribution transformer costs Rs.20000 and has a salvage value of Rs.1000 at the end of 20 years. Determine the depreciated value of the plant at the end of 10 years on the following method of assessment:
   i) Straight line depreciation
   ii) Sinking fund depreciation of 8% compounded annually **(08 Marks)**

OR

10 a. Explain the methods of power factor improvement. **(10 Marks)**

b. A consumer takes a steady load of 250 KW at a power factor of 0.8 lagging for 10 hour per day and 300 days per annum. Estimate the annual payment under each of the following tariff:
   i) Rs.1.20 per KWh + Rs.1200 per KVA per annum
   ii) Rs.1.20 per KWh + Rs.1200 per KW per annum + 25 paise per KVARh. **(06 Marks)**

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15EE43

Fourth Semester B.E. Degree Examination, June/July 2019
Transmission and Distribution

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define sag. What are factors affecting sag? **(04 Marks)**

b. Discuss any two methods to improving the string efficiency in string insulator. **(06 Marks)**

c. An overhead line over a hillside with a gradient of 1 in 15 is supported by two 40 m towers. The horizontal distance between towers is 300 m. The weight of the conductor 1.5 kg/m and the tension is 1500 kg. Find the clearance between the lowest point of the conductor and the ground. **(06 Marks)**

OR

2 a. Discuss the properties of transmission line conductors. **(04 Marks)**

b. Obtain the expression for sag in overhead line conductor supported at different levels of height. **(06 Marks)**

c. A 3-phase overhead transmission line is being supported by three disc insulator. The potentials across top and middle units are 9 KV and 11 KV respectively. Calculate:
i) The ratio of capacitance between pin and earth to self capacitance of each unit
ii) The line voltage
iii) String efficiency **(06 Marks)**

Module-2

3 a. Explain the terms self GMD and mutual GMD. **(04 Marks)**

b. The three conductors of 3-phase line are arranged at the three corners of a triangle of sides 2m, 2.5m and 4.5m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each line conductors are 1.24 cm. **(06 Marks)**

c. Derive the expression for inductance of a single phase line. **(06 Marks)**

OR

4 a. Write a short note on transposition of transmission lines. **(04 Marks)**

b. A single phase overhead line 30 km long consists of two parallel wires each 5 mm in diameter and 1.5 m apart. If the line voltage be 50 KV at 50 Hz. Calculate current with the line open circuited. **(06 Marks)**

c. Derive the expression for a capacitance of the symmetrical 3-phase line. **(06 Marks)**

Module-3

5 a. Write a short note on classification of overhead transmission lines. **(04 Marks)**

b. Determine ABCD constants of medium line nominal T-method and check AD-BC = 1. **(06 Marks)**

c. A 220 KV, 3-phase overhead transmission line has an impedance per phase of $(20 + J100)\Omega$ and admittance of J0.0010 mho. Using π-model, determine the sending voltage and current when the current at the receiving end is 300 A at 0.9 pf lagging. **(06 Marks)**

OR

6 a. Discuss Ferranti effect in transmission lines. **(04 Marks)**

b. A 3 phase 300 km long transmission line has
Inductance/Ph = 10^{-3} H/km
Capacitance/Ph = 10×10^{-9} F/km
Resistance/Ph = 0.02 Ω/km
Determine ABCD parameters of the line. **(06 Marks)**

c. A single phase transmission line supplier of a load 1 MW at 11 KV, 0.8 pf lagging. The resistance and reactances of the line are 5Ω and 10Ω respectively. Determine:
i) Sending end voltage
ii) Efficiency of transmission line
iii) Percentage of regulation **(06 Marks)**

Module-4

7 a. Discuss the advantages and disadvantages of Corona. **(04 Marks)**

b. Prove that for a 3 layer inter sheath

$$\frac{g_{max}\,(\text{with inter sheath})}{g'_{max}\,(\text{without inter sheath})} = \frac{3}{1+\alpha+\alpha^2} \quad \text{where } \alpha = \frac{r_1}{r} = \frac{r_2}{r_1} = \frac{R}{r_2}$$ **(08 Marks)**

c. A single core cable has a diameter of 1.5 cm covered with an insulation layer of 2 cm thickness. The specific resistance of insulation of the material is 7.5×10^{12} MΩ-m. Calculate the insulation resistance/km of the cable. **(04 Marks)**

OR

8 a. Draw the cross sectional view of single core cable and explain its construction. **(04 Marks)**

b. A 132 KV line with 1.956 cm diameter conductor is built so, that corona takes place if the line voltage exceeds 210 KV (rms). If the value of potential gradient at which insulation occurs can be taken as 30 KV/cm. Find the spacing between conductors. Assume δ = 1, irregularity factor = 1. **(06 Marks)**

c. For most economical diameter of single cone cable to be used on a 132 KV, 3-phase system. Find also the overall diameter of the insulation if the peak permissible stress is not be exceed 60 KV/cm. **(06 Marks)**

Module-5

9 a. What are requirements of a power distribution system? **(04 Marks)**

b. Discuss the effect of disconnection of neutral in a 3-phase Four wire system. **(04 Marks)**

c. A single phase distributor AB is 500 m long and is fed at point A and it is loaded as follows:
i) 100 A at 0.8 pf lagging 200 m from A
ii) 150 A at 0.707 pf lagging at 500 m from A.
The total resistance and reactance of the distributor are 0.2 Ω and 0.1Ω per km respectively. If the receiving end voltage is 400 V, find the sending end voltage and power factor. **(08 Marks)**

OR

10 a. Discuss the limitation of distribution system. **(04 Marks)**

b. Write short note on radial and ring main distribution system. **(06 Marks)**

c. Explain the following with respect to distribution system:
i) Reliability
ii) Quality **(06 Marks)**

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15EE44

Fourth Semester B.E. Degree Examination, June/July 2019
Electric Motors

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. What do you mean by back emf in dc motors? Explain the significance of back emf. Also derive the condition for maximum power in dc motors. **(10 Marks)**

b. A 230 V series motor is taking 50 A. Resistance of armature and series field winding is 0.2 Ω and 0.1 Ω respectively. Calculate:
i) Brush voltage
ii) Back emf
iii) Power wasted in armature and mechanical power developed **(06 Marks)**

OR

2 a. Define torque. Derive the expression for torque developed by DC motor from fundamentals. **(10 Marks)**

b. A DC motor drives a 100 KW generator having an efficiency of 87%.
i) What should be the KW rating of the motor?
ii) If the overall efficiency of the motor generator set is 74%, what is the efficiency of the motor?
iii) Also calculate the losses in each machine. **(06 Marks)**

Module-2

3 a. With a neat circuit diagram, explain how Hopkinson's test is performed on dc shunt machines. Mention the merits and demerits of this test. **(10 Marks)**

b. The Hopkinson test on two shunt machines gave the following results for full load.
Line voltage 250 V
Line current excluding field currents 50A
Motor armature current 380A
Field currents 5A and 4.2A.
Calculate the efficiency of each machine. Armature resistance of each machine is 0.02 Ω **(06 Marks)**

OR

4 a. Describe Swinburne's test with the help of neat diagram to find out the efficiency of a dc machine. What are the main advantages and disadvantages of this test? **(10 Marks)**

b. A 220V dc shunt motor at no load takes a current of 3A. The resistance of the armature and shunt field are 0.9 Ω and 250 Ω respectively. Estimate the efficiency of the motor when input current is 18 a. **(06 Marks)**

Module-3

5 a. Draw the phasor diagram of 3ϕ induction motor on no load and load condition and explain. **(06 Marks)**

b. The following test results refer to a 3ϕ 20HP 440V delta connected, 50Hz 4 pole induction motor.
Running light tests : 440V, 10A (line) 1.5 KW input
Locked rotor test: 120V, 30A (line) 2.25 KW input
Draw the circle diagram of this induction motor and determine from the circle diagram full load current and power factor. **(10 Marks)**

OR

6 a. Develop the equivalent circuit of a double cage induction motor and obtain the approximate equivalent circuit. **(06 Marks)**

b. The standstill impedance of the outer cage of a double cage induction motor is $(0.3 + j0.4)\Omega$ and that of the inner cage is $(0.1 + j1.5)\Omega$. Compare the relative currents of the two cages (i) at standstill (ii) at a slip of 5%. Neglect stator impedance. **(10 Marks)**

Module-4

7 a. With a neat diagram, explain star delta starter used for starting 3ϕ induction motor. **(06 Marks)**

b. Explain briefly the different methods of speed control of 3ϕ induction motor. **(10 Marks)**

OR

8 a. Explain double revolving field theory with reference to single phase induction motor. **(06 Marks)**

b. Explain the construction and working of shaded pole motor. **(10 Marks)**

Module-5

9 a. With a neat diagram explain the principle of operation of a 3ϕ synchronous motor. **(06 Marks)**

b. Explain the operation of a synchronous motor under (i) constant load, varying excitation (ii) constant excitation, varying load. Discuss how a synchronous motor can function as synchronous condenser. **(10 Marks)**

OR

10 a. What is a two phase servo motor? Describe its construction and working. Draw its torque speed characteristics for various control voltages. **(10 Marks)**

b. Explain the principle of operations of a linear induction motor. Draw its characteristics. State its important applications. **(06 Marks)**

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15EE45

Fourth Semester B.E. Degree Examination, June/July 2019
Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Define operator Del, ∇. Explain its operation with solar and vector fields. Define divergence, gradient and curl and expression the same in rectangular coordinate system. **(06 Marks)**

b. Evaluate both sides of the Divergence theorem for the field $\bar{D} = 2xy\,\bar{a}_x + x^2\bar{a}_y\ c/m^2$, the surface is a rectangular parallelepiped formed by planes x = 0 and x = 1, y = 0 and y = 2 and z = 0 and z = 3. **(10 Marks)**

OR

2 a. With empherical formula to support, state the following:
i) Gauss law ii) Gauss Divergence theorem iii) Coulomb's law. **(06 Marks)**

b. Determine electric flux density D in Cartesian coordinates caused by P(6, 8, -10) by
i) A point charge of 30 MC at origin.
ii) An infinite line charge with $\rho_L = 40\ \mu c/m$ on x = 0 ; y = 0
iii) A surface charge with $\rho_S = 57.2\ \mu c/m^2$ on this plane z = 9m. **(10 Marks)**

Module-2

3 a. Derive the boundary conditions on E and D at the interface of perfect dielectrics. **(05 Marks)**

b. Determine work done in carrying a charge of -2C from (2, 1, -1) to (8, 2, -1) in an electric field $\bar{E} = y\bar{a}_x + x\bar{a}_y$ v/m along this path $x = 2y^2$. **(07 Marks)**

c. Explain the following terms with empherical formula to support:
i) Current density ii) Potential difference iii) The dipole. **(04 Marks)**

OR

4 a. Derive an expression for the equation of continuity. **(06 Marks)**

b. Obtain an expression for this capacitance per unit length of a co-axial cable with inner conductor radius 'a' meters and outer conductor radius 'b' meters. **(06 Marks)**

c. Determine the capacitance consisting of two parallel metal plates 30cm × 30cm, surface area, separated by 5mm in air. What is the total energy stored by this capacitor of the capacitor is charged to a potential difference of 500V? **(04 Marks)**

Module-3

5 a. State the following terms with empherical formula/expressions to support
i) Biot-Savart's law
ii) Ampere's circuital law and
iii) Stokes theorem. **(05 Marks)**

b. Clearly distinguish between scalar magnetic potential and vector magnetic potential. **(04 Marks)**

c. Given $V = [Ar^4 + Br^{-4}] \sin 4\phi$. Show that $\nabla^2 V = 0$. Select A and B so that V = 100V and (E) = 500 v/m at p(r = 1, ϕ = 22.5 and z = 2). **(07 Marks)**

OR

6 a. Derive Poisson's and Laplace's equation. **(04 Marks)**

b. State and prove uniqueness theorem. **(06 Marks)**

c. Given the field $\bar{H} = 20r^2 \bar{a}_\phi$ A/m. Determine: i) the current density, $\bar{J}$ and ii) Also the total current that crosses the surface r = 1m, $0 < \phi < 2\pi$ and z = 0 (in cylindrical coordinates) **(06 Marks)**

Module-4

7 a. A point charge Q = 18nc moves with a velocity of $5 * 10^6$ m/sec in the direction of $0.06\bar{a}_x + 0.75\bar{a}_y + 0.3\bar{a}_z$ $(\bar{a}_v)$. Calculate the magnitude of the force exerted on the charge by the field

i) $\bar{E} = -3\bar{a}_x + 4\bar{a}_y + 6\bar{a}_z$ kv/m

ii) $\bar{B} = -3\bar{a}_x + 4\bar{a}_y + 6\bar{a}_z$ MT

iii) $\bar{B}$ and $\bar{E}$ acting together. **(08 Marks)**

b. Discuss the magnetic boundary condition to be applied to B, H and M at the interface between two different magnetic materials. **(05 Marks)**

c. Define the terms with empherical formula to support
i) Magnetization and ii) Permeability. **(03 Marks)**

OR

8 a. Derive an expression for the force on a differential current element placed in a magnetic field. **(06 Marks)**

b. A toroid 0.2m in diameter and 10sqcm sectional area of the core is uniformly wound with 250 truss of wire. If the flux density in the core is to be $1 wb/m^2$ and relative permeability of iron is $\mu_r = 500$, what is the exciting current required to be passed in the winding? Determine also the value of self inductance and the stored energy. **(06 Marks)**

c. Find the force /mtr length between two long parallel wires separated by 10cm in air and carrying a current of 100A is opposite direction. State the nature of force between the wires. **(04 Marks)**

Module-5

9 a. Explain Faraday's laws applied to
i) Stationary path, changing field and
ii) Steady field moving circuit
Derive necessary relationship. **(08 Marks)**

b. State and derive an expression for Poynting's theorem. **(08 Marks)**

OR

10 a. List Maxwell's equations for both:
i) Steady and
ii) Time varying fields in integral and differential form, also mention the relevant laws they demonstrate. **(08 Marks)**

b. Discuss the physical significance of displacement current and justify that for the case of a parallel plate capacitor the displacement current is equivalent to conduction current. Comment on the ratio of magnitudes of conduction current density to displacement current density. **(08 Marks)**

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15EE46

Fourth Semester B.E. Degree Examination, June/July 2019
Operational Amplifiers and Linear IC's

Time: 3 hrs. Max. Marks: 80

Note: *Answer any FIVE full questions, choosing ONE full question from each module.*

Module-1

1 a. Design a capacitor coupled inverting amplifier for lower cut-off frequency (f_L) of 10Hz, voltage gain of 50, output voltage of 2.5V using 741 op-amp. **(05 Marks)**

b. Consider an amplifier circuit using op-amp with voltage series feedback. Derive an expression for the exact closed loop gain and input impedance of the circuit with feedback. **(06 Marks)**

c. With a circuit of 3-input summing amplifier in inverting mode, derive an expression for output interms of input voltages. Indicate under which condition, circuit can be used as averaging circuit. **(05 Marks)**

OR

2 a. Write a single stage amplifier using differential configuration with 4-inputs (V_1, V_2, V_3, V_4) to obtain an output $V_0 = (-V_1 - V_2 + V_3 + V_4)$. Derive the above equation. **(04 Marks)**

b. With a neat circuit, explain instrumentation amplifier (with 3-op-amps) using transducer bridge to detect change in temperature. **(06 Marks)**

c. Write a neat circuit of capacitor coupled high Z_{in} voltage follower. Obtain the expression for input impedance of the circuit and write design equations. **(06 Marks)**

Module-2

3 a. With a circuit and frequency response curve, explain I order high pass filter. Derive an expression for the gain. **(06 Marks)**

b. Explain the operation of adjustable voltage regulator using LM317 regulator. With the help of block diagram. **(05 Marks)**

c. Design a voltage follower type regulator circuit using 741 op-amp and Zener of 12V with I_z = 25mA to meet the following : i) Output voltage 12V ii) Maximum load current = 50mA. **(05 Marks)**

OR

4 a. With a circuit and frequency response curve, explain multistage wide band reject filter using highpass, lowpass and summing amplifier. Design the same to have f_1 = 400Hz and f_2 = 2KHz and passband gain of 2. **(09 Marks)**

b. Explain with a neat circuit, adjustable output regulator using voltage follower. **(07 Marks)**

Module-3

5 a. With circuit and waveforms, explain square wave/triangular wave signal generator. **(06 Marks)**

b. With circuit and waveforms, explain how Barkhausen criterion is met in RC phase shift oscillator. Design the same using ± 12V supply, for an output frequency of 3.5KHz using 741 op-amp. **(06 Marks)**

c. Write the circuit of voltage of current converter with grounded load. Derive an expression for output current. **(04 Marks)**

OR

6 a. With a circuit, explain how signal generator outputs (amplitude and DC levels) are controlled. **(04 Marks)**

b. Design an inverting Schmitt trigger for LTP = 0 V and UTP = +3V. Using 741 with $|V_{osat}|$ = 12V. Write transfer characteristics and output wave form for an input signal of 10 cos ωt. **(07 Marks)**

c. Explain with a circuit, non inverting Schmitt trigger to obtain different LTP and UTP values Write the transfer characteristics. **(05 Marks)**

Module-4

7 a. With circuit and relevant waveforms, explain full wave precision rectifier (using half wave rectifier and summing circuit). Derive an expression for output voltage showing full wave rectification. **(07 Marks)**

b. With the help of circuit and waveform, explain negative precision clamping circuit. **(04 Marks)**

c. Explain 3-bit R/2R ladder type DAC with circuit. **(05 Marks)**

OR

8 a. Briefly explain with circuit, voltage follower type positive peak detector. Design the same to be suitable for a pulsed input of 2.5V peak and 5μs rise time. Peak value is to be held for 100μs with maximum error of 1%. Also determine $I_{0(max)}$. Use BIFET op-amp. **(06 Marks)**

b. With the help of block diagram, explain successive approximation ADC. **(05 Marks)**

c. With the help of block diagram and waveform, explain dual slope ADC. **(05 Marks)**

Module-5

9 a. Explain the operation of PLL with block diagram. Briefly explain function of each component part. **(06 Marks)**

b. Briefly explain any two applications of PLL together with block diagram. **(06 Marks)**

c. Mention the features of IC555Timer. **(04 Marks)**

OR

10 a. Write the pin diagram and block diagram of IC565PLL. **(04 Marks)**

b. With circuit and waveform, explain how 555 Timer can be used as monostable multi-vibrator. **(06 Marks)**

c. Derive an expression for duty cycle of astable multi-vibrator with the help of waveforms. Mention the applications of astable multi-vibrator. **(06 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2019
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing ONE full question from each module.

Module-1

1 a. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ by elementary row operation. **(06 Marks)**

b. Find the inverse of the matrix $\begin{bmatrix} 3 & 1 \\ 1 & 2 \end{bmatrix}$ using Cayley - Hamilton theorem. **(05 Marks)**

c. Find all eigen values of the matrix $A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$ **(05 Marks)**

OR

2 a. Solve the system of equation by Gauss - Elimination method.

$x + y + z = 9$
$x - 2y + 3z = 8$
$2x + y - z = 3$ **(06 Marks)**

b. Using Cayley – Hamilton theorem find A^{-1}, given $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ **(05 Marks)**

c. Reduce the matrix $A = \begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ into row echelon form and hence find its rank. **(05 Marks)**

Module-2

3 a. Solve by the method of undetermined co-efficient $y'' - 4y' + 4y = e^x$. **(06 Marks)**

b. Solve $(D^3 + 6D^2 + 11D + 6)y = 0$. **(05 Marks)**

c. Solve $y'' + 2y' + y = 2x$. **(05 Marks)**

OR

4 a. Solve by the method of variation of parameter $y'' + a^2y = \sec ax$. **(06 Marks)**

b. Solve $y'' - 4y' + 13y = \cos 2x$. **(05 Marks)**

c. Solve $(D^2 - 1)y = e^{2x}$. **(05 Marks)**

Module-3

5 a. If $f(t) = t^2, 0 < t < 2$ and $f(t+2) = f(t)$ for $t > 2$, find $L[f(t)]$. (06 Marks)

b. Find $L[\cos t \cdot \cos 2t \cdot \cos 3t]$ (05 Marks)

c. Find $L[e^{-2t}(2\cos 5t - \sin 5t)]$ (05 Marks)

OR

6 a. Find $L[e^{-t} \cdot \cos^2 3t]$ (06 Marks)

b. Express the following function into unit step function and hence find $L[f(t)]$ given

$$f(t) = \begin{cases} t, & 0 < t < 4 \\ 5, & t > 4 \end{cases}$$ (05 Marks)

c. Find $L[t \cdot \cos at]$ (05 Marks)

Module-4

7 a. Using Laplace transforms solve the differential equation $y'' + 4y' + 4y = e^{-t}$ given $y(0) = 0$, $y'(0) = 0$. (06 Marks)

b. Find $L^{-1}\left[\frac{2s-5}{4s^2+25}\right] + L^{-1}\left[\frac{8-6s}{16s^2+9}\right]$ (05 Marks)

c. Find $L^{-1}\left[\frac{1}{s(s+1)(s+2)(s+3)}\right]$ (05 Marks)

OR

8 a. Employ Laplace transform to solve the equation

$y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. (06 Marks)

b. Find $L^{-1}\left[\frac{s+5}{s^2-6s+13}\right]$ (05 Marks)

c. Find $L^{-1}\left[\log\left(\frac{s+a}{s+b}\right)\right]$ (05 Marks)

Module-5

9 a. If A and B are any two mutually exclusive events of S, then show that

$P(A \cup B) = P(A) + P(B) - P(A \cap B)$ (06 Marks)

b. Prove the following :

(i) $P(\phi) = 0$ (ii) $P(\overline{A}) = 1 - P(A)$ (05 Marks)

c. Three machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentages of defective output of these machines are respectively 2%, 3% and 4%. An item is selected at random and is found defective. Find the probability that the item was produced by machine C. (05 Marks)

OR

10 a. State and prove Bay's theorem. (06 Marks)

b. If A and B are events with $P(A \cup B) = \frac{7}{8}$, $P(A \cap B) = \frac{1}{4}$ and $P(\overline{A}) = \frac{5}{8}$ find P(A), P(B) and $P(A \cap \overline{B})$. (05 Marks)

c. A shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out of 3 shots. Find the probability that the target is being hit.

(i) when both of them try (ii) by only one shooter. (05 Marks)

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