CBCS SCHEME

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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: 1. ***Answer FIVE full questions, choosing ONE full question from each module.***
2. ***Use of statistical table can be provided.***

Module-1

1 a. Using Taylor's series method find, y(0.1) given that $\frac{dy}{dx} = x - y^2$, y(0) = 1 by considering upto third degree terms. **(05 Marks)**

b. Apply Runge Kutta method of fourth order to find an approximate value of y when x = 0.5 given that $\frac{dy}{dx} = \frac{1}{x+y}$ with $y(0.4) = 1$. Take h = 0.1. **(05 Marks)**

c. Evaluate y(0.4) by Milne's Predictor-Corrector method given that $\frac{dy}{dx} = \frac{y^2(1+x^2)}{2}$ and y(0) = 1, y(0.1) = 1.06, y(0.2) = 1.12, y(0.3) = 1.21. Apply the corrector formula twice. **(06 Marks)**

OR

2 a. Solve by Euler's modified method $\frac{dy}{dx} = \log_e(x+y)$; y(0) = 2 to find y(0.2) with h = 0.2. Carryout two modifications. **(05 Marks)**

b. Using Runge-Kutta method of fourth order find y(0.2) to four decimal places given that $\frac{dy}{dx} = 3x + \frac{y}{2}$; $y(0) = 1$. Take h = 0.2. **(05 Marks)**

c. Given $\frac{dy}{dx} = x^2(1+y)$; y(1) =1, y(1.1) = 1.233, y(1.2) = 1.548, y(1.3) = 1.979. Evaluate y(1.4) to four decimal places using Adam's-Bashforth predictor corrector method. Apply the corrector formula twice. **(06 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = y + x\frac{dy}{dx}$ with y(0) = 1, $y'(0) = 0$. Evaluate y(0.2) using Runge Kutta method of fourth order. Take h = 0.2. **(05 Marks)**

b. With usual notation prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$. **(05 Marks)**

c. Express $f(x) = 2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomial. **(06 Marks)**

OR

4 a. Apply Milnes predictor corrector method to compute y(0.4) given that $\frac{d^2y}{dx^2} = 6y - 3x\frac{dy}{dx}$ and the following values: **(05 Marks)**

x	0	0.1	0.2	0.3
y	1	1.03995	1.138036	1.29865
y′	0.1	0.6955	1.258	1.873

b. State Rodrigue's formula for Legendre polynomials and obtain the expression for $P_4(x)$ from it. **(05 Marks)**

c. If α and β are the two roots of the equation $J_n(x) = 0$ then prove that $\int_0^1 xJ_n(\alpha x)J_n(\beta x)dx = 0$ if $\alpha \neq \beta$. **(06 Marks)**

Module-3

5 a. Derive Cauchy-Riemann equation in Cartesian form. **(05 Marks)**

b. Evaluate using Cauchy's residue theorem, $\int_C \frac{3z^2+z+1}{(z^2-1)(z+3)}dz$ where C is the circle $|z| = 2$. **(05 Marks)**

c. Find the bilinear transformation which maps the points $-1, i, 1$ onto the points 1, i, -1 respectively. **(06 Marks)**

OR

6 a. Find the analytic function, $f(z) = u + iv$ if $v = r^2\cos 2\theta - r\cos\theta + 2$. **(05 Marks)**

b. Evaluate $\int_C \frac{e^{2z}}{(z-1)(z-2)}dz$ where C is the circle $|z| = 3$ using Cauchy integral formula. **(05 Marks)**

c. Discuss the transformation $\omega = e^z$. **(06 Marks)**

Module-4

7 a. Find the constant C such that the function,

$$f(x) = \begin{cases} Cx^2 & \text{for } 0 < x < 3 \\ 0 & \text{Otherwise} \end{cases}$$ is a probability density function.

Also compute $P(1<X<2)$, $P(X \leq 1)$, $P(X>1)$. **(05 Marks)**

b. Out of 800 families with five childrens each, how many families would you expect to have (i) 3 boys (ii) 5 girls (iii) either 2 or 3 boys (iv) at most 2 girls, assume equal probabilities for boys and girls. **(05 Marks)**

c. Given the following joint distribution of the random variables X and Y.

X \ Y	1	3	9
2	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$
4	$\frac{1}{4}$	$\frac{1}{4}$	0
6	$\frac{1}{8}$	$\frac{1}{24}$	$\frac{1}{12}$

Find (i) E(X) (ii) E(Y) (iii) E(XY) (iv) COV(X, Y) (v) ρ(X, Y) **(06 Marks)**

OR

8 a. Obtain the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on electric bulbs it was found that the life time of bulbs of a particular brand was distributed normally with an average life of 2000 hours and standard deviation of 60 hours. If a firm purchases 2500 bulbs find the number of bulbs that are likely to last for,
(i) More than 2100 hours (ii) Less than 1950 hours (iii) Between 1900 and 2100 hours.
Given that $\phi(1.67) = 0.4525$, $\phi(0.83) = 0.2967$ **(05 Marks)**

c. A fair coin is tossed thrice. The random variables X and Y are defined as follows:
X = 0 or 1 according as head or tail occurs on the first toss.
Y = number of heads
Determine (i) The distribution of X and Y (ii) Joint distribution of X and Y. **(06 Marks)**

Module-5

9 a. In a city A 20% of a random sample of 900 school boys had a certain slight physical defect. In another city B, 18.5% of a random sample of 1600 school boys had the same defect. Is the difference between the proportions significant. **(05 Marks)**

b. The nine items of a sample have the following values : 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ from the assumed mean 47.5. Apply student's t – distribution at 5% level of significance ($t_{0.05} = 2.31$ for 8 d.f) **(05 Marks)**

c. Find the unique fixed probability vector of the regular stochastic matrix $\begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ \frac{1}{2} & \frac{1}{2} & 0 \end{bmatrix}$. **(06 Marks)**

OR

10 a. A sample of 100 tyres is taken from a lot. The mean life of tyres is found to be 40,650 kms with a standard deviation of 3260. Can it be considered as a true random sample from a population with mean life of 40,000 kms (use 0.05 level of significance) Establish 99% confidence limits within which the mean life of tyres is expected to lie, (given $Z_{0.05} = 1.96$, $Z_{0.01} = 2.58$) **(05 Marks)**

b. In the experiments of pea breeding the following frequencies of seeds were obtained.

Round and Yellow	Wrinkled and Yellow	Round and Green	Wrinkled and Green	Total
315	101	108	32	556

Theory predicts that the frequencies should be in proportions 9 : 3 : 3 : 1. Examine the correspondence between theory and experiment.
$\left(\chi^2_{0.05} = 7.815 \text{ for } 3 \text{ d.f}\right)$ **(05 Marks)**

c. Three boys A, B, C are throwing ball to each other. A always throws the ball to B and B always throws the ball to C. C is just as likely to throw the ball to B is to A. If C was the first person to throw the ball find the probabilities that after the three throws.
(i) A has the ball (ii) B has the ball (iii) C has the ball. **(06 Marks)**

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CBCS SCHEME

USN | | | | | | | | | | 15EE43

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Transmission & Distribution

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Describe the different types of supporting structures used in transmission lines and discuss the advantages of HVDC transmission systems. **(08 Marks)**

b. Define Sag and explain its importance, also derive an expression for sag of a transmission line when supports are at the same level. **(08 Marks)**

OR

2 a. Indicate a string of 3 insulators and derive an expressions for string efficiency of 3 discs. **(08 Marks)**

b. A 3ϕ overhead transmission line is being supported by 3 discs of suspension insulator the potential across the 1st and 2nd insulator are 8 KV and 11 KV respectively, calculate (i) The line voltage (ii) String efficiency. **(08 Marks)**

Module-2

3 a. Determine the inductance of conductor due to internal flux. **(08 Marks)**

b. In a single phase line as shown in Fig.Q3 (b), conductors 'a' and 'a'' in parallel from one conductor while conductors 'b' and 'b'' in parallel from the return path. Calculate the total inductance of the line/km, assuming that current is equally shared by the two parallel conductors. Conductor diameter is 2.0 cm. **(08 Marks)**

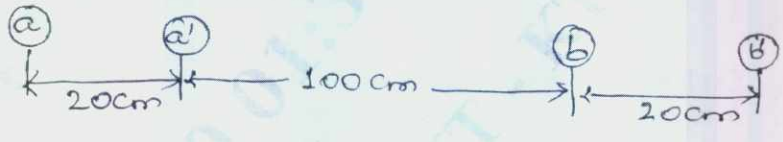

Fig. Q3 (b)

OR

4 a. Derive an expression for capacitance of 1ϕ line. **(08 Marks)**

b. A 3ϕ, 50 Hz, 66 kV overhead line conductors are placed in a horizontal plane as shown in Fig. Q4 (b). The conductor diameter is 1.25 cm. The line length is 100 km. Calculate the capacitance per phase and charging current per phase. Assume complete transposition of the lines. **(08 Marks)**

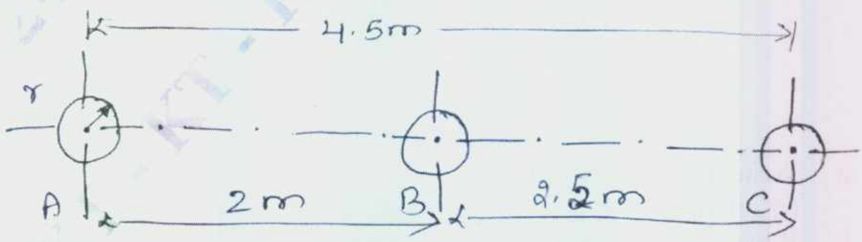

Fig. Q4 (b)

Module-3

5 a. What are generalized circuit constants of a transmission line? Determine the ABCD constants of a medium transmission line using nominal T-model and prove AD-BC = 1. **(08 Marks)**

b. A medium single phase transmission line 100 km long has the following constants:
Resistance /km/ph = 0.15 Ω
Inductive reactance /km/ph = 0.377 Ω
Capacitive reactance /km/ph = 31.87 Ω
Receiving end line voltage = 132 KV
Assuming that the total capacitance of the line is localized at the receiving end alone, determine
(i) Sending end current (ii) Line value of sending end voltage
(iii) Regulation (iv) Sending end p.f.
The line is delivering 72 MW at 0.8 p.f. lagging. **(08 Marks)**

OR

6 a. Write a short notes on classification of transmission lines. Also explain voltage regulation and transmission efficiency with suitable formula. **(08 Marks)**

b. A 3ϕ, 50 Hz, 16 km long overhead line supplies 1000 kW at 11 kV, 0.8 p.f. lagging. The line resistance is 0.03 Ω perphase per km and line inductance is 0.7 mH per phase km. Calculate the sending end voltage, voltage regulation and efficiency of transmission. **(08 Marks)**

Module-4

7 a. What is Corona? State and explain with the expression for disruptive critical voltage and visual critical voltage. **(08 Marks)**

b. Write a note on factors affecting the corona and methods to reduce it. **(08 Marks)**

OR

8 a. Draw the cross sectional view of a single core cable and explain its construction. **(08 Marks)**

b. Derive an expression for insulation resistance of a single core cable. **(08 Marks)**

Module-5

9 a. Explain radial distribution system. State its merits and demerits. **(08 Marks)**

b. A two conductor copper cable is loaded as shown in figure below in Fig. Q9 (b). Both the ends are fed at the same voltage of 250 V DC. Calculate:
(i) The point of minimum potential.
(ii) The current in each section.
(iii) The voltage at load points. The resistance of copper is 0.8 Ω per km for go and return wires put together. **(08 Marks)**

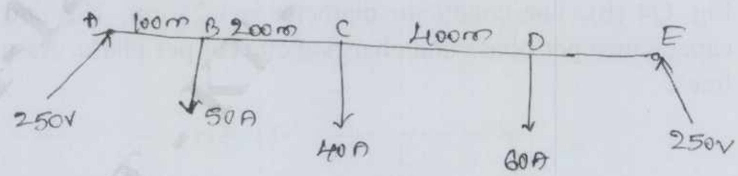

Fig. Q9 (b)

OR

10 a. Write a short note on:
(i) Bath tub curve (ii) Weibull distribution (iii) MTTF and MTBF **(08 Marks)**

b. What are the limitations of distribution system? **(08 Marks)**

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CBCS SCHEME

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15EE44

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
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. Explain the principles of torque production in dc motor and derive the torque equation of a dc motor. **(06 Marks)**

b. With the help of relevant characteristic, explain why a series motor should never be started at no load. **(05 Marks)**

c. A shunt wound motor has a armature resistance of 0.1Ω. It is connected across 220V supply. The armature current taken by the motor is 20A and the motor runs at 800rpm. Calculate additional resistance to be inserted in series with the armature to reduce speed to 520rpm. Assume that there is no change in armature current. **(05 Marks)**

OR

2 a. With a neat sketch, explain the Ward-Leonard method of speed control of DC motor. **(06 Marks)**

b. Explain the different types of losses in a DC motor. **(04 Marks)**

c. A 250V, 15kW DC shunt motor has a maximum efficiency of 88% and a speed of 700rpm, when delivering 80% of its rated output. The resistance of its shunt field is 100Ω. Determine the armature resistance. **(06 Marks)**

Module-2

3 a. A 400V, DC shunt motor when running on no load takes 5A. Armature resistance (including brushes) is 0.5Ω and shunt field resistance is 200Ω. Find the output in KW and efficiency of the motor when running on full load and taking a current of 50A. **(05 Marks)**

b. Explain back to back test on two identical DC machines and calculate the efficiency of the machines as a generator and motor. **(07 Marks)**

c. Explain the advantages and disadvantages of field's test applied to two similar DC series motors. **(04 Marks)**

OR

4 a. Derive an expression for rotor copper losses in terms of slip and rotor input. **(05 Marks)**

b. The power input to the rotor of 440V, 50Hz 6 pole 3 phase induction motor is 80kW. The rotor emf is observed to make 100 complete alternations per minute. Calculate: i) the slip ii) the rotor speed iii) the mechanical power developed. **(05 Marks)**

c. Draw and explain the torque characteristics for 3 phase induction motor covering motoring, generating and braking regions of operation. **(06 Marks)**

Module-3

5 a. Draw and explain the phasor diagram of induction motor at slip S. (06 Marks)

b. A 50kW, 6 pole, 50Hz, 450V, 3ϕ slip ring induction motor gave the following test data (line values).
No load test : 450V, 20A, p.f. = 0.15
Blocked rotor test : 200V, 150A, p.f. = 0.3
The ratio of stator to rotor copper losses on short circuit was 5:4. Draw the circle diagram and determine:
i) Line current
ii) Power factor
iii) Slip at full load
iv) Efficiency at full load. (10 Marks)

OR

6 a. With a neat sketch explain the working of a deep bar cage rotor induction motor. (05 Marks)

b. Draw and explain equivalent circuit and torque slip characteristic of a double cage induction motor. (06 Marks)

c. Explain the stand alone operation of the induction generator. (05 Marks)

Module-4

7 a. Why starter is necessary for an induction motor? With a neat diagram, explain the operation of a direct on line starter. (08 Marks)

b. Explain any two speed control methods of three phase induction motor. (08 Marks)

OR

8 a. Why single phase induction motor is not self starting? Explain the principle of operation of single phase induction motor using double revolving field theory. (08 Marks)

b. With a neat diagram, explain the construction and working principle of split phase induction motor. (08 Marks)

Module-5

9 a. Briefly explain V and inverted v curves of synchronous motor. (06 Marks)

b. Explain how synchronous motor acts as a synchronous condenser. (05 Marks)

c. Explain hunting in a synchronous motor. (05 Marks)

OR

10 a. Explain the construction working, characteristics and application of ac servomotor. (08 Marks)

b. Explain the principle of operation of a linear induction motor. Draw its characteristics. State its important applications. (08 Marks)

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CBCS SCHEME

USN

15EE45

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020

Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

1 a. What is a unit vector? Illustrate its significance in the vector representation. **(02 Marks)**

b. Explain Cartesian coordinate system and differential elements in Cartesian coordinate system. **(04 Marks)**

c. Define:

i) Dot product and cross product of two vectors.

ii) Gradient of a scalar field

iii) Divergence and curl of a vector field. **(10 Marks)**

OR

2 a. State and explain Coulomb's law of force between the two point charges. **(05 Marks)**

b. A point charge Q = 30nc is located at the origin in Cartesian co-ordinates. Find the electric flux density $\overline{D}$ at (1, 3, -4) m. **(05 Marks)**

c. State and explain Gauss law in electrostatics. **(06 Marks)**

Module-2

3 a. Derive an expression for energy expanded in making a point charge in an electric field. **(08 Marks)**

b. Derive an expression for the electric intensity at any point in the negative of the potential gradient at that point or $E = -\nabla V$. **(08 Marks)**

OR

4 a. With necessary relations, define current and current density. **(03 Marks)**

b. Explain the boundary conditions for a boundary between two di-electric materials. **(08 Marks)**

c. A capacitor consists of two metal plates each $100cm^2$ placed parallel and 2mm apart. The whole of space between the plates is filled with a di-electric having a relative permittivity of 3.5. A potential difference of 500V is maintained between the plates. Calculate:

i) The capacitance

ii) The charge on capacitor

iii) Electric flux density

iv) Potential gradient. **(05 Marks)**

Module-3

5 a. Derive Poisson's and Laplace equations starting from point form of Gauss law. **(06 Marks)**

b. Verify that the potential field given below satisfies the Laplace's equation $V = 2x^2 - 3y^2 + z^2$ **(02 Marks)**

c. State and prove Unigueness theorem. **(08 Marks)**

OR

6 a. State and explain Biot-Savart's law. **(06 Marks)**
b. State and explain Stoke's theorem. **(04 Marks)**
c. Derive an expression for vector magnetic potential. **(06 Marks)**

Module-4

7 a. Derive an expression for the force between differential current elements. **(08 Marks)**
b. A point chart of Q = -1.2C has velocity $\bar{v} = (5\bar{a}x + 2\bar{a}y - 3\bar{a}z)\text{m/s}$. Find the magnitude of the force exerted on the charge if,
i) $\bar{E} = -18\bar{a}x + 5\bar{a}y - 10\bar{a}z \text{ v/m}$
ii) $\bar{B} = -4\bar{a}x + 4\bar{a}y + 3\bar{a}z \text{ T}$
iii) Both are present simultaneously **(08 Marks)**

OR

8 a. Derive the boundary conditions at the interface between two magnetic materials of different permeabilities. **(08 Marks)**
b. Calculate the inductance of a solenoid of 200 turns wound tightly on a cylindrical tube of 6cm diameter. The length of the tube is 60cm and the solenoid is in air. **(02 Marks)**
c. Define mutual inductance. Derive an expression for mutual inductance of two different coils. **(06 Marks)**

Module-5

9 a. Explain briefly Faraday's law and displacement current for time varying fields. **(07 Marks)**
b. In a given lossy dielectric medium conduction current density $J_C = 0.02\text{Sin}10^9 t(\text{A/m}^2)$. Find the displacement current density if $\sigma = 10^3$ s/m and $\varepsilon_r = 6.5$. **(03 Marks)**
c. Write Maxwell's equations in point form and in integral form for time varying fields. **(06 Marks)**

OR

10 a. Discuss the propagation of uniform plane waves in a lossless medium. **(06 Marks)**
b. Define poynting vector and explain the power flow associated with it. **(06 Marks)**
c. A 300MHz uniform plane wave propagates through fresh water for which $\sigma = 0$, $\mu_r = 1$ and $\epsilon_r = 78$. Calculate:
i) The attenuation constant
ii) The phase constant
iii) The wave length. **(04 Marks)**

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CBCS SCHEME

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Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Operational Amplifiers and Linear ICs

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Explain the following terms:
(i) CMRR (ii) Slew Rate **(06 Marks)**

b. For inverting amplifier obtain exact and approximate expression for gain A_f. Why inverting mode is preferred when compared with non-inverting mode? **(06 Marks)**

c. State ideal characteristics of opamp. **(04 Marks)**

OR

2 a. Explain the working of non-inverting ac amplifier and derive an expression for lower cut off frequency f_L and $\left(\frac{V_0}{V_{in}}\right)$ **(08 Marks)**

b. Consider adder circuit with 3 inputs V_a, V_b and V_c. Assume inverting mode. Show that this circuit can be used as summing amplifier, averaging amplifier and scaling amplifier. **(08 Marks)**

Module-2

3 a. For I order low pass filter, derive an expression for $\left|\frac{V_o}{V_{in}}\right|$ and expression for frequency scaling. Assume non-inverting mode. **(08 Marks)**

b. Design a wide bandpass filter for $F_L = 200$ Hz, $f_H = 1$ kHz, passband gain = 4. Assume C = 0.01 μF for CPF and 0.05 μF for HPF. Calculate Q-factor also. Draw the circuit diagram. **(04 Marks)**

c. Explain the working of notch filter. **(04 Marks)**

OR

4 a. Compare shunt regulator and series regulator circuits. **(05 Marks)**

b. Explain the working of voltage follower regulator using opamp. **(07 Marks)**

c. Explain connection diagram of LM317 voltage regulator. **(04 Marks)**

Module-3

5 a. Obtain an expression for frequency of oscillation in Wein bridge oscillator using opamp and expression for minimum gain. **(08 Marks)**

b. Explain working of square wave generator using opamp and state expression for frequency of oscillation. **(08 Marks)**

OR

6 a. Explain zero crossing detector and what are its drawback? **(06 Marks)**

b. Explain working of voltage to current converter with grounded load. **(05 Marks)**

c. Consider Schmitt trigger in inverting mode. $R_1 = 100\ \Omega$, $R_2 = 56\ k\Omega$, $V_{in} = 1$ V, peak to peak sine wave, $V_{cc} = \pm15$V. calculate V_{ut} and V_{lt}. Draw the circuit diagram and waveform. **(05 Marks)**

Module-4

7 a. Explain working of precision free wave rectifier. Obtain expression for V_o in positive and negative half cycles. **(08 Marks)**

b. Explain the working of peak detector. Draw the circuit diagram and different waveforms. **(08 Marks)**

OR

8 a. For digital to analog converted explain resolution, accuracy, monotonocity and conversion time. **(08 Marks)**

b. Explain working of counter type ADC. Draw its block diagram and timing diagram. State its drawback. **(08 Marks)**

Module-5

9 a. Explain the internal architecture of IC 555 timer. Draw its block diagram and pin diagram also. **(10 Marks)**

b. Design 555 timer based square wave generator to produce a symmetrical square wave of 1 kHz. V_{cc} = 12 V, draw the circuit diagram and draw the waveforms of V_c and V_o. Assume C = 0.1 μF. **(06 Marks)**

OR

10 a. Explain the operating principle of PLL. Draw the block diagram. **(06 Marks)**

b. Explain the application of PLL as frequency multiplier. **(05 Marks)**

c. Consider PLL IC 565 circuit diagram. R_1 = 10 kΩ, C_1 = 0.01 μF, V_{cc} = +/– 10V, calculate free running frequency, lock range and capture range and output range. Draw the circuit diagram. **(05 Marks)**

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CBCS SCHEME

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2019/Jan.2020
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

Module-1

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

b. Find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Caylery-Hamilton theorem. **(05 Marks)**

c. Solve the following system of equations by Gauss elimination method.
$2x + y + 4z = 12$, $4x + 11 - z = 33$, $8x - 3y + 2z = 20$ **(05 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix} 2 & -1 & -3 & -1 \\ 1 & 2 & 3 & -1 \\ 1 & 0 & 1 & 1 \\ 0 & 1 & 1 & -1 \end{bmatrix}$ by reducing it to echelon form. **(06 Marks)**

b. Find the eigen values of $A = \begin{bmatrix} 7 & -2 & 0 \\ -2 & 6 & -2 \\ 0 & -2 & 5 \end{bmatrix}$ **(05 Marks)**

c. Solve by Gauss elimination method: $x + y + z = 9$, $x - 2y + 3z = 8$, $2x + y - z = 3$ **(05 Marks)**

Module-2

3 a. Solve $\frac{d^3y}{dx^3} + 6\frac{d^2y}{dx^2} + 11\frac{dy}{dx} + 6y = 0$ **(05 Marks)**

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

c. Solve by the method of undetermined coefficients $y'' + 3y' + 2y = 12x^2$ **(06 Marks)**

OR

4 a. Solve $\frac{d^2y}{dx^2} + 5\frac{dy}{dx} + 6y = e^x$ **(05 Marks)**

b. Solve $y'' + 4y' - 12y = e^{2x} - 3\sin 2x$ **(05 Marks)**

c Solve by the method of variation of parameter $\frac{d^2y}{dx^2} + y = \tan x$ **(06 Marks)**

Module-3

5 a. Find the Laplace transform of
i) $e^{-2t} \sin h\, 4t$ ii) $e^{-2t}(2\cos 5t - \sin 5t)$ **(06 Marks)**

b. Find the Laplace transform of $f(t) = t^2 \;\; 0 < t < 2$ and $f(t + 2) = f(t)$ for $t > 2$. **(05 Marks)**

c. Express $f(t)=\begin{cases} t & 0<t<4 \\ 5 & t>4 \end{cases}$ interms of unit step function and hence find $L[f(t)]$. **(05 Marks)**

OR

6 a. Find the Laplace transform of i) $t\cos at$ ii) $\dfrac{\cos at-\cos bt}{t}$ **(06 Marks)**

b. Given $f(t)=\begin{cases} E & 0<t<a/2 \\ -E & a/2<t<a \end{cases}$ where $f(t+a)=f(t)$. Show that $L[f(t)]=\dfrac{E}{S}\tanh\left(\dfrac{as}{4}\right)$. **(05 Marks)**

c. Express $f(t)=\begin{cases} 1 & 0<t<1 \\ t & 1<t\le 2 \\ t^2 & t>2 \end{cases}$ interms of unit step function and hence find $L[f(t)]$. **(05 Marks)**

Module-4

7 a. Find the inverse Laplace transform of i) $\dfrac{2s-1}{s^2+4s+29}$ ii) $\dfrac{s+2}{s^2+36}+\dfrac{4s-1}{s^2+25}$ **(06 Marks)**

b. Find the inverse Laplace transform of $\log\sqrt{\dfrac{s^2+1}{s^2+4}}$ **(05 Marks)**

c. Solve by using Laplace transforms $y''+4y'+4y=e^{-t}$, given that $y(0)=0$, $y'(0)=0$. **(05 Marks)**

OR

8 a. Find the inverse Laplace transform of $\dfrac{1}{(s+1)(s+2)(s+3)}$. **(06 Marks)**

b. Find the inverse Laplace transform of $\cot^{-1}\left(\dfrac{s+a}{b}\right)$. **(05 Marks)**

c. Using Laplace transforms solve the differential equation $y'''+2y''-y'-2y=0$ given $y(0)=y'(0)=0$ and $y''(0)=6$. **(05 Marks)**

Module-5

9 a. State and prove Baye's theorem. **(06 Marks)**

b. The machines A, B and C produce respectively 60%, 30%, 10% of the total number of items of a factory. The percentage 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)**

c. The probability that a team wins a match is 3/5. If this team play 3 matches in a tournament, what is the probability that i) win all the matches ii) lose all the matches. **(05 Marks)**

OR

10 a. If A and B are any two events of S, which are not mutually exclusive then $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. **(06 Marks)**

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

c. The probability that a person A solves the problem is 1/3, that of B is 1/2 and that of C is 3/5. If the problem is simultaneously assigned to all of them what is the probability that the problem is solved? **(05 Marks)**

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