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15MAT41

Fourth Semester B.E. Degree Examination, June/July 2018
Engineering Mathematics – IV

Time: 3 hrs. Max. Marks: 80

Note: **1.** ***Answer any FIVE full questions, choosing one full question from each module.***
2. ***Use of statistical tables is permitted.***

Module-1

1 a. Use Taylor's series method to find y at x = 1.1, considering terms upto third degree given that $\frac{dy}{dx} = x + y$ and y(1) = 0. **(05 Marks)**

b. Using Runge-Kutta method, find y(0.2) for the equation $\frac{dy}{dx} = \frac{y-x}{y+x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. Given $\frac{dy}{dx} = x^2 - y$, y(0) = 1 and the values y(0.1) = 0.90516, y(0.2) = 0.82127, y(0.3) = 0.74918, evaluate y(0.4), using Adams-Bashforth method. **(06 Marks)**

OR

2 a. Using Euler's modified method, find y(0.1) given $\frac{dy}{dx} = x - y^2$, y(0) = 1, taking h = 0.1. **(05 Marks)**

b. Solve $\frac{dy}{dx} = xy$; y(1) = 2, find the approximate solution at x = 1.2, using Runge-Kutta method. **(05 Marks)**

c. Solve $\frac{dy}{dx} = x - y^2$ with the following data y(0) = 0, y(0.2) = 0.02, y(0.4) = 0.0795, y(0.6) = 0.1762, compute y at x = 0.8, using Milne's method. **(06 Marks)**

Module-2

3 a. Using Runge-Kutta method of order four, solve $y'' = y + xy'$, y(0) = 1, y'(0) = 0 to find y(0.2). **(05 Marks)**

b. Express the polynomial $2x^3 - x^2 - 3x + 2$ in terms of Legendre polynomials. **(05 Marks)**

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

OR

4 a. Given $y'' = 1 + y'$; y(0) = 1, y'(0) = 1, compute y(0.4) for the following data, using Milne's predictor-corrector method.

y(0.1) = 1.1103 y(0.2) = 1.2427 y(0.3) = 1.399
y'(0.1) = 1.2103 y'(0.2) = 1.4427 y'(0.3) = 1.699. **(05 Marks)**

b. Prove that $J_{\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}} \sin x$. **(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. Derive Cauchy-Riemann equations in polar form. **(05 Marks)**

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

c. Find the bilinear transformation which maps $z = \infty$, i, 0 on to $w = 0$, i, ∞. **(06 Marks)**

OR

6 a. State and prove Cauchy's integral formula. **(05 Marks)**

b. If $u = \frac{\sin 2x}{\cosh 2y + \cos 2x}$, find the corresponding analytic function $f(z) = u + iv$. **(05 Marks)**

c. Discuss the transformation $w = z^2$. **(06 Marks)**

Module-4

7 a. Derive mean and standard deviation of the binomial distribution. **(05 Marks)**

b. If the probability that an individual will suffer a bad reaction from an injection of a given serum is 0.001, determine the probability that out of 2000 individual (i) exactly 3 (ii) more than 2 individuals will suffer a bad reaction. **(05 Marks)**

c. The joint probability distribution for two random variables X and Y is as follows:

X \ Y	-3	-2	4
1	0.1	0.2	0.2
3	0.3	0.1	0.1

Determine: i) Marginal distribution of X and Y ii) Covariance of X and Y
iii) Correlation of X and Y **(06 Marks)**

OR

8 a. Derive mean and standard deviation of exponential distribution. **(05 Marks)**

b. In an examination 7% of students score less than 35% marks and 89% of students score less than 60% marks. Find the mean and standard deviation if the marks are normally distributed. Given $P(0 < z < 1.2263) = 0.39$ and $P(0 < z < 1.14757) = 0.43$. **(05 Marks)**

c. The joint probability distribution of two random variables X and Y is as follows:

Y \ X	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Compute: i) E(X) and E(Y) ii) E(XY) iii) COV(X, Y) iv) $\rho(X, Y)$ **(06 Marks)**

Module-5

9 a. Explain the terms: i) Null hypothesis ii) Type I and Type II errors. **(05 Marks)**

b. The nine items of a sample have the values 45, 47, 50, 52, 48, 47, 49, 53, 51. Does the mean of these differ significantly from the assumed mean of 47.5? **(05 Marks)**

c. Given the matrix $A = \begin{pmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ ½ & ½ & 0 \end{pmatrix}$ then show that A is a regular stochastic matrix. **(06 Marks)**

OR

10 a. A die was thrown 9000 times and of these 3220 yielded a 3 or 4, can the die be regarded as unbiased? **(05 Marks)**

b. Explain: i) Transient state ii) Absorbing state iii) Recurrent state **(05 Marks)**

c. A student's study habits are as follows. If he studies one night, he is 70% sure not to study the next night. On the other hand, if he does not study one night, he is 60% sure not to study the next night. In the long run, how often does he study? **(06 Marks)**

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15EE42

Fourth Semester B.E. Degree Examination, June/July 2018
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. What is hydrological cycle? **(02 Marks)**
b. Describe the merits and demerits of hydroelectric power –plants. **(08 Marks)**
c. What are the characteristics of a water turbine? **(06 Marks)**

OR

2 a. What is meant by the phenomenon 'water hammer? Explain how a surge tank helps in reducing water hammer effect. **(05 Marks)**
b. Explain working of pumped shortage power plant, stating its advantages with the help of a schematic diagram. **(08 Marks)**
c. Define impulse and reaction type of turbines. **(03 Marks)**

Module-2

3 a. What are the main considerations for selection of site for a thermal power station? **(08 Marks)**
b. Explain briefly the functions of : i) Reheaters ii) Condensers. **(06 Marks)**
c. What do you understand by fluidized bed combustion? **(02 Marks)**

OR

4 a. Explain the filed of applications of diesel power plants. **(08 Marks)**
b. Describe the working of closed cycle gas turbine power-plant with a schematic diagram. **(08 Marks)**

Module-3

5 a. Describe the operation of nuclear power plant with the help of a block diagram showing basic components. **(07 Marks)**
b. Describe fast breeder reactors, stating its advantages. **(07 Marks)**
c. What is nuclear fission? **(02 Marks)**

OR

6 a. With a neat diagram, explain main parts and their function of a nuclear reactor. **(08 Marks)**
b. Explain with respect to a nuclear plant : i) Nuclear waste disposal ii) Shielding. **(06 Marks)**
c. What is meant by radio activity? **(02 Marks)**

Module-4

7 a. What are the functions of a sub-station? **(06 Marks)**
b. List out the advantages and disadvantages of outdoor substation over indoor substation. **(06 Marks)**
c. What do you understand by : i) switch gear ii) protective relay. **(04 Marks)**

OR

8 a. Explain : i) resistance grounding and ii) reactance grounding, stating where they are employed. **(06 Marks)**

b. State the functions of : i) current limiting reactor ii) lighting arrester iii) fuse. **(06 Marks)**

c. Give the classification of sub–stations. **(04 Marks)**

Module-5

9 a. Describe the classification of cost of electricity. **(06 Marks)**

b. What are the factors to be considered while deciding the number of generating units? **(06 Marks)**

c. Define : i) cold reserve ii) hot reserve iii) operating reserve iv) spinning reserve. **(04 Marks)**

OR

10 a. Define : i) demand factor ii) diversity factor. **(04 Marks)**

b. Describe types of consumers and their tariffs. **(06 Marks)**

c. Explain the disadvantages of low power factor. **(06 Marks)**

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15EE43

Fourth Semester B.E. Degree Examination, June/July 2018
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. What are the advantages of high voltage transmission? Explain. **(06 Marks)**

b. A transmission line has a span of 275m between level supports. The conductor has an effective diameter of 1.96cm and weighs 0.865kg/m. The ultimate strength is 8060 kg. If the conductors has ice coating of radial thickness 1.27cm and is subjected to a wind pressure of 3.9gm/cm^2 of projected area, calculate sag for a safety factor of 2. Weight of 1cc of ice is 0.91gm. **(10 Marks)**

OR

2 a. Draw a schematic diagram and hence briefly describe feeders, distributors and service mains. **(06 Marks)**

b. A 3-phase overhead transmission line is supported by 3 suspension type insulators. The potentials across first and second insulators are 8 KV and 11 KV respectively. Calculate : i) ratio of self to shunt capacitance ii) line voltage iii) string efficiency. **(06 Marks)**

c. Write a short note on vibrations of conductors. **(04 Marks)**

Module-2

3 a. Derive an expression for the inductance of a conductor due to internal and external flux. **(10 Marks)**

b. Calculate inductance of each conductor in a 3-phase 3 wire system. The conductors are arranged as shown in Fig.3(b). The conductors are transposed and have a diameter of 2.5cm. **(06 Marks)**

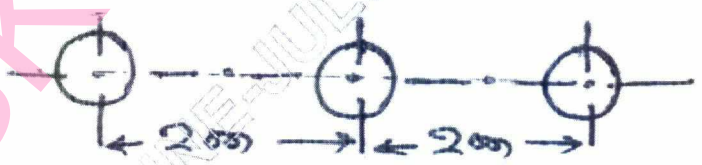

Fig.Q3(b)

OR

4 a. Derive an expression for the line to neutral capacitance for a 3-phase overhead transmission line when the conductors are unsymmetrically spaced. **(10 Marks)**

b. If the double circuit 3-phase line has conductors of diameter 2cm and are separated with 2m in hexagonal spacing arrangement. Calculate phase to neutral capacitance for 100km line. **(06 Marks)**

Module-3

5 a. Explain the nominal π method for obtaining the performance calculations of medium transmission line. Draw the corresponding vector diagram. **(08 Marks)**

b. A 3-phase, 50Hz overhead transmission line of 100km has the following constants. Resistance per km per phase is 0.1Ω, inductive reactance per km per phase is 0.2Ω, capacitive susceptance per km per phase is 0.4×10^{-14}℧. Find :

i) Sending end current
ii) Sending end voltage
iii) Sending end p.f
iv) Transmission efficiency

when supplying a balanced load of 10,000 KW at 66KV with a lagging p.f. of 0.8. Use nominal T–method. **(08 Marks)**

OR

6 a. Derive an expression for ABCD constants of a medium transmission line using nominal T–method. Show that AD – BC = 1. **(10 Marks)**

b. Write a short note on 'Ferranti effect'. **(06 Marks)**

Module-4

7 a. Derive an expression for critical disruptive voltage and visual critical voltage with reference to corona. **(06 Marks)**

b. A 132KV line with 1.956cm dia. conductors is built so that corona takes place if the line voltage exceeds 210KV(rms). If the value of potential gradient at which ionization occurs can be taken as 30 Kv/cm. Find the spacing between the constructors. **(06 Marks)**

c. Explain the factors affecting corona in brief. **(04 Marks)**

OR

8 a. What are the methods of grading of cables? Explain intersheath grading of cable. **(09 Marks)**

b. Derive an expression for the insulation resistance of a single core cable. **(07 Marks)**

Module-5

9 a. Briefly explain radial and ring main distributors. **(07 Marks)**

b. Draw the schematic diagram and hence obtain the expressions for voltages at different tapping points of a DC distributor fed at one end with concentrated loads. **(09 Marks)**

OR

10 a. A two–wire distributor AB, 600m long is loaded as –

Distance from A (mtrs)	150	300	350	450
Loads in Amps	100	200	250	300

The feeding point A is maintained at 440V and that of B at 430V. If each conductor has a resistance of 0.01Ω per 100m, Calculate :

i) The currents supplied from A and B
ii) The power dissipated in the distributor. **(12 Marks)**

b. What are the requirements of good distribution system? **(04 Marks)**

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15EE44

Fourth Semester B.E. Degree Examination, June/July 2018
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. Derive torque equation of a D.C. Motor. **(04 Marks)**

b. Explain why a D.C. series motor should never run unloaded. **(04 Marks)**

c. A 220V D.C. series motor is running at a speed of 800 rpm and draws 100A. Calculate at what speed the motor will run when developing half the torque. Total resistance of the armature and field is 0.1Ω. Assume that the magnetic circuit is unsaturated. **(08 Marks)**

OR

2 a. Describe the working of three point starter with neat sketch. What are its limitations? **(10 Marks)**

b. What are the losses that occur in DC machines? Derive the condition for maximum efficiency of a D.C. motor. **(06 Marks)**

Module-2

3 a. Explain briefly Field's test for determination of efficiency of DC series machines. **(08 Marks)**

b. The Hopkinson's test on two shunt machines gave the following results for full load :
Line voltage = 230 V.
Armature currents of motor and generator are 37A and 30A respectively.
Field currents of motor and generator are 0.85A and 0.8A respectively.
Calculate the efficiency of the motor and generator. Assume resistance of each machine for the armature as 0.33Ω. **(08 Marks)**

OR

4 a. Discuss the torque – slip characteristics of a three phase induction motor including motoring generating and braking regions. **(12 Marks)**

b. A 8 – pole , 50Hz induction motor has an emf in the rotor of frequency 1.5Hz. Determine the slip and speed of the motor. **(04 Marks)**

Module-3

5 a. Starting from the first principles develop the equivalent circuit of a 3 – phase induction motor. **(08 Marks)**

b. Explain Cogging and Crawling in 3 – phase induction motor. **(08 Marks)**

OR

6 a. Describe the construction and working of a Double – Cage induction motor. **(08 Marks)**

b. Explain the principle of operation of an Induction Generator. What are its limitations? **(08 Marks)**

Module-4

7 a. Explain the method of speed control of 3 – ϕ Induction motor by varying the rotor resistance. **(06 Marks)**

b. Explain the construction and working of Star – delta starter with derivation. **(10 Marks)**

OR

8 a. Explain Double Revolving Field theory of Single – Phase Induction motor with a neat sketch. **(08 Marks)**

b. Explain construction and working principle of a Shaded – Pole Motors. **(08 Marks)**

Module-5

9 a. Explain the operation of synchronous motor at constant load variable excitation with phasor diagram. **(08 Marks)**

b. A synchronous motor developing 20KW is connected in parallel with a factory load of 200KW at a p.f of 0.8 lag. If the total load connected to the supply has a p.f of 0.92 lag, what is the value of reactive power taken by the motor and at what p.f is it operating? **(08 Marks)**

OR

10 a. Explain the construction and working principle of a Universal Motor. **(08 Marks)**

b. Write short note on Linear Induction Motor. **(04 Marks)**

c. Write short note on Stepper Motor. **(04 Marks)**

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15EE45

Fourth Semester B.E. Degree Examination, June/July 2018
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. Two points A and B have the following orientations.
A(2.614, 7.369, –3.079) and B (3.162, 7.023, –2.318)
Check whether $\overrightarrow{AB}$ is a unit vector. **(05 Marks)**

b. Given two points, C(–3, 2, 1) and D(r = 5, θ = 20°, ϕ = –70°)
Find (i) The spherical coordinates of C
(ii) The rectangular coordinates of D
(iii) The distance from C to D. **(06 Marks)**

c. Two point charges Q_1 = 100 μC and Q_2 = 100 μC are located at points $(-1, 1, -3)_m$ and $(3, 1, 0)_m$ respectively. Find the X, Y & Z components of the forces on Q_1. **(05 Marks)**

OR

2 a. Determine the electric field intensity at a point 'A' located at distance 0.3m and 0.4m respectively from charges Q_1 and Q_2 spaced 0.5m apart. Given $Q_1 = 1\times10^{-9}$ C and $Q_2 = 8\times10^{-10}$ C. **(06 Marks)**

b. State and prove Gauss Divergence theorem. **(06 Marks)**

c. If $\overline{D} = 9x^3\hat{a}_x + 5y^2\hat{a}_y + 2z\hat{a}_z$ c/m^2, find the charge density at the point (1, 5, 9)m. **(04 Marks)**

Module-2

3 a. Prove that electric field intensity is expressed as negative gradient of scalar potential. **(05 Marks)**

b. Prove that the potential at a point P due to a charge disc at distance 'r' is $\frac{Q}{4\pi \in_0 r}$ V. **(06 Marks)**

c. A parallel plate capacitor consists of 3 dielectric layers if
$\in_1 = 1$, $d_1 = 0.4$ mm
$\in_2 = 2$, $d_2 = 0.6$ mm
$\in_3 = 1$, $d_3 = 0.8$ mm
and the area of cross section is 20 cm^2, find its capacitance C. **(05 Marks)**

OR

4 a. Find the electric field strength at the point (1, 2, –1) given the potential $V = 3x^2y + 2yz^2 + 3xyz$. **(05 Marks)**

b. An electric field of strength 3 V/m in air enters a dielectric medium. The orientation of electric fields with respect to boundary in air and dielectric are 30 and 60 respectively. Find the relative permeability of the dielectric. Also find the electric field strength in the dielectric. **(06 Marks)**

c. Determine the capacitance of a capacitor consisting of two parallel plates 30cm × 30cm surface area separated by 5 mm in air. What is the total energy stored by the capacitor is capacitor is charged to a potential difference of 500 V? What is the energy density? **(05 Marks)**

Module-3

5 a. Derive Poisson's and Laplace's equations. Write Laplace's equations in cylindrical and spherical coordinate system. **(06 Marks)**

b. State and explain uniqueness theorem. **(05 Marks)**

c. Given vector field $\bar{E} = (12yx^2 - 6z^2x)\hat{a}_x + (4x^3 + 18zy^2)\hat{a}_y + (6y^3 - 6zx^2)\hat{a}_z$. Check for Laplace or Poisson's field. **(05 Marks)**

OR

6 a. State Biot-Savart's law, Ampere's circuital law and Stoke's theorem. **(06 Marks)**

b. A single turn circular coil of 50 meter in diameter carries a current of 28×10^4 Amps. Determine the magnetic field intensity $\bar{H}$ at a point on the axis of coil and 100 m from the coil. The μ_r of the free space is unity. **(05 Marks)**

c. Verify whether the vector field $\bar{F} = y^2z\hat{a}_x + z^2x\hat{a}_y + x^2y\hat{a}_z$ is irrotational or solenoidal. **(05 Marks)**

Module-4

7 a. Obtain the expression of Energy stored in a magnetic field. **(05 Marks)**

b. Derive Lorentz force equation and mention the applications of its solution. **(06 Marks)**

c. Derive the boundary conditions at the boundary between two magnetic media of different permeabilities. **(05 Marks)**

OR

8 a. Derive the expression for the inductance of a solenoid. **(05 Marks)**

b. Calculate the inductance of a 10 m long co-axial cable filled with a material for which $\epsilon_r = 18$, $\sigma = 0$, $\mu_r = 80$. The external and internal diameters of the cable are 1 mm and 4 mm respectively. **(06 Marks)**

c. Find the maximum torque on an 85 turn rectangular coil 0.2m by 0.3m carrying a current 2A in a field B = 6.5 J. **(05 Marks)**

Module-5

9 a. State and explain Poynting theorem with derivation. **(08 Marks)**

b. Determine the propagation constant at 500 kHz for a medium in which $\mu_r = 1$, $\epsilon_r = 15$, $\sigma = 0$. At what velocity will an electromagnetic wave travel in this medium? **(08 Marks)**

OR

10 a. A uniform plane wave $E_y = 10\sin(2\pi10^8t - \beta x)$ is travelling in x-direction in free space. Find the phase constant, phase velocity and the expression for H_z. Assume $E_z = 0 = H_y$. **(08 Marks)**

b. Explain skin depth and skin effect. Derive an expression for skin depth. **(08 Marks)**

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15EE46

Fourth Semester B.E. Degree Examination, June/July 2018
Operational Amplifiers and Linear Integrated Circuits

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Discuss the Ideal characteristics of an OPAMP. **(04 Marks)**

b. Show that the output of subtractor is proportional to the different between the two input voltages. **(06 Marks)**

c. Draw and explain the operation of peaking amplifier. **(06 Marks)**

OR

2 a. For a non inverting amplifier, the values of R_1 and R_f are 1KΩ and 10KΩ respectively. The various op-amp parameters are, open loop gain is 2×10^5, input resistance is 2MΩ, output resistance is 75Ω, single break frequency is 5Hz, supply voltage are ±12V. Calculate the closed loop gain, Input Resistance, output Resistance and Bandwidth with feedback. **(08 Marks)**

b. What is an Instrumentation amplifier? For instrumentation amplifier using transducer bridge, obtain the expression for output voltage V_0 in terms of change in Resistance ΔR of the transducer. Draw the circuit diagram. **(08 Marks)**

Module-2

3 a. Derive the expression for the phase shift produced by an All pass Filter. **(08 Marks)**

b. With a neat diagram, explain the operation of a voltage follower regulator using OPAMP. **(08 Marks)**

OR

4 a. Explain the following performance parameters of voltage Regulator.
(i) Line Regulation (ii) Load Regulation (iii) Ripple Rejection. **(05 Marks)**

b. Design second order Low pass Filter for a cut-off frequency of 100Hz with capacitor selected as 0.1μF and draw the circuit diagram. **(05 Marks)**

c. Briefly explain with the help of schematic Diagram, the working of LM317 IC Regulator. **(06 Marks)**

Module-3

5 a. Draw and explain triangular wave generator using square wave generator and integrator method. Draw the required waveforms. **(10 Marks)**

b. With a neat circuit diagram and waveforms, explain the operation of inverting Schmitt trigger circuit with different LTP and UTP. **(06 Marks)**

OR

6 a. Using 741 OPAMP with a supply voltage of ±12V, design a RC phase shift oscillator to have an output frequency of 3.5 KHz. Draw the circuit diagram. **(06 Marks)**

b. Draw and explain the operation of voltage to frequency converter using OPAMP. **(05 Marks)**

c. Design the wein bridge oscillator circuit to have output frequency of 10KHz. Use C = 0.01μF. **(05 Marks)**

Module-4

7 a. Design the precision full wave rectifier circuit to produce a 2V peak output from a sine wave input with a 0.5V peak value and 1MHz frequency. Use Bipolar OPAMPS with a supply voltage of ± 15V. Choose adequate diode current as 500μA. Draw the circuit diagram. **(06 Marks)**

b. Explain the successive approximation A/D converter technique with the help of block diagram. **(05 Marks)**

c. Sketch and explain the working of sample and Hold circuit. **(05 Marks)**

OR

8 a. With a neat circuit diagram, explain the operation of a high input impedance full wave precision rectifier. Draw the voltage waveforms at various points in the circuit and write the appropriate equations to show that full wave ratification is performed. **(08 Marks)**

b. Explain the working of Dual slope ADC with the help of neat diagram. **(08 Marks)**

Module-5

9 a. Draw and explain the functional block diagram of IC 555. **(08 Marks)**

b. Explain PLL IC 565 application as frequency multiplier and frequency synthesizer. **(08 Marks)**

OR

10 a. Design an Astable multivibrator having an output frequency of 10KHz with a duty cycle of 25%, using IC 555. Use C = 0.01μF. **(08 Marks)**

b. What is phase locked loop? Explain the working of the building blocks of PLL. **(08 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2018
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 $\begin{bmatrix} 5 & 3 & 14 & 4 \\ 0 & 1 & 2 & 1 \\ 1 & -1 & 2 & 0 \end{bmatrix}$ by reducing to echelon form. **(06 Marks)**

b. Use Cayley-Hamilton theorem to find the inverse of the matrix $\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$. **(05 Marks)**

c. Apply Gauss elimination method to solve the equations $x+4y-z=-5$; $x+y-6z=-12$; $3x-y-z=4$ **(05 Marks)**

OR

2 a. Find all the eigen values and eigen vector corresponding to the largest eigen value of $\begin{bmatrix} 1 & 0 & -1 \\ 1 & 2 & 1 \\ 2 & 2 & 3 \end{bmatrix}$. **(06 Marks)**

b. Find the rank of the matrix by elementary row transformations $\begin{bmatrix} 1 & 1 & 1 \\ 2 & 2 & 2 \\ 3 & 3 & 3 \end{bmatrix}$. **(05 Marks)**

c. Solve the system of linear equations $x+y+z=6$; $2x-3y+4z=8$; $x-y+2z=5$ by Gauss elimination method. **(05 Marks)**

Module-2

3 a. Solve $\frac{d^2y}{dx^2}+4y=\tan 2x$ by the method of variation of parameters. **(06 Marks)**

b. Solve $\frac{d^2x}{dt^2}+5\frac{dx}{dt}+6x=0$, given $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(05 Marks)**

c. Solve $(D^2+5D+6)y=e^x$. **(05 Marks)**

OR

4 a. Solve by the method of undetermined coefficients $(D^2-2D+5)y=25x^2+12$. **(06 Marks)**

b. Solve $(D^2+3D+2)y=\sin 2x$. **(05 Marks)**

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

Module-3

5 a. Find the Laplace transforms of, (i) $t\cos^2 t$ (ii) $\frac{1-e^{-t}}{t}$ **(06 Marks)**

b. Find the Laplace transforms of, (i) $e^{-2t}(2\cos 5t-\sin 5t)$ (ii) $3\sqrt{t}+\frac{4}{\sqrt{t}}$. **(05 Marks)**

c. Express the function, $f(t)=\begin{cases} t, & 0<t<4 \\ 5, & t>4 \end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

OR

6 a. Find the Laplace transform of the periodic function defined by $f(t) = E\sin\omega t$, $0 < t < \frac{\pi}{\omega}$ having period $\frac{\pi}{\omega}$. **(06 Marks)**

b. Find the Laplace transform of $2^t + t\sin t$. **(05 Marks)**

c. Find the Laplace transform of $\frac{2\sin t \sin 5t}{t}$. **(05 Marks)**

Module-4

7 a. Using laplace transforms method, solve $y'' - 6y' + 9 = t^2e^{3t}$, $y(0) = 2$, $y'(0) = 6$. **(06 Marks)**

b. Find the inverse Laplace transforms of, (i) $\frac{s^2 - 3s + 4}{s^3}$ (ii) $\frac{s+3}{s^2 - 4s + 13}$ **(05 Marks)**

c. Find the inverse Laplace transforms of, (i) $\log\left(\frac{s+1}{s-1}\right)$ (ii) $\frac{s^2}{(s-2)^3}$ **(05 Marks)**

OR

8 a. Solve the simultaneous equations $\frac{dx}{dt} + 5x - 2y = t$, $\frac{dy}{dt} + 2x + y = 0$ being given $x = y = 0$ when $t = 0$. **(06 Marks)**

b. Find the inverse Laplace transforms of $\cot^{-1}\left(\frac{s}{2}\right)$. **(05 Marks)**

c. Find the inverse Laplace transforms of $\frac{2s^2 - 6s + 5}{s^3 - 6s^2 + 11s - 6}$. **(05 Marks)**

Module-5

9 a. For any three arbitrary events A, B, C prove that ,
$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(A \cap B) - P(B \cap C) - P(C \cap A) + P(A \cap B \cap C)$ **(04 Marks)**

b. A class has 10 boys and 5 girls. Three students are selected at random, one after the other. Find probability that, (i) first two are boys and third is girl (ii) first and third boys and second is girl. (iii) first and third of same sex and the second is of opposite sex. **(06 Marks)**

c. In a certain college 25% of boys and 10% of girls are studying mathematics. The girls constitute 60% of the student body. (i) what is the probability that mathematics is being studied ? (ii) If a student is selected at random and is found to be studying mathematics, find the probability that the student is a girl? (iii) a boy? **(06 Marks)**

OR

10 a. State and prove Bayes theorem. **(04 Marks)**

b. A problem in mathematics is given to three students A, B and C whose chances of solving it are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. What is the probability that the problem will be solved? **(06 Marks)**

c. A pair of dice is tossed twice. Find the probability of scoring 7 points. (i) Once, (ii) at least once (iii) twice. **(06 Marks)**

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