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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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. Using Taylor's series method solve $\frac{dy}{dx} = x^2 + y^2$ with y(0) = 1 and hence find y(0.1) and consider upto 3rd degree. **(06 Marks)**

b. Using modified Euler's method solve $\frac{dy}{dx} = 1 + \frac{y}{x}$ with y(1) = 2 then find y(1.2) in two steps. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{x+y}{2}$, give that y(0) = 2, y(0.5) = 2.636, y(1) = 3.595 and y(1.5) = 4.968 then find value of y at x = 2 using Milne's predictor and corrector formulae. **(05 Marks)**

OR

2 a. Using modified Euler's method solve $\frac{dy}{dx} = x + \sqrt{y}$, with y(0) = 1 then find y(0.2) with h = 0.2. **(06 Marks)**

b. Solve $\frac{dy}{dx} = \frac{y-x}{y+x}$, with y(0) = 1 and hence find y(0.1) by taking one steps using Runge-Kutta method of fourth order. **(05 Marks)**

c. Given $\frac{dy}{dx} = \frac{(1+x^2)y^2}{2}$, given that y(0) = 1, y(0.1) = 1.06. y(0.2) = 1.12 and y(0.3) = 1.21 then evaluate y(0.4) using Adam's – Bash forth method. **(05 Marks)**

Module-2

3 a. Given $\frac{d^2y}{dx^2} = \frac{2dy}{dx} - y$, y(0) = 1, y'(0) = 2, evaluate y(0.1) and y'(0.1) using Runge-Kutta method of fourth order. **(06 Marks)**

b. Solve the Bessel's differential equation : $x^2\frac{d^2y}{dx^2} + x\frac{dy}{dx} + (x^2 - n^2)y = 0$ leading to $J_n(x)$. **(05 Marks)**

c. Express $x^3 + 2x^2 - 4x + 5$ in terms of Legendre polynomials. **(05 Marks)**

OR

4 a. Using Milne's method. obtain an approximate solution at the point x = 0.8 of the problem $\frac{d^2y}{dx^2} = 1 - 2y\frac{dy}{dx}$ using the following data :

x	0	0.2	0.4	0.6
y	0	0.02	0.0795	0.1762
y'	0	0.1996	0.3937	0.5689

(06 Marks)

b. If α and β are two distinct roots of $J_n(x) = 0$ then P-T $\int_0^1 x\, J_n(\alpha x)\, J_n(\beta x)\, dx = \{0$ if $\alpha \neq \beta$. (05 Marks)

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

Module-3

5 a. State and prove Cauchy-Riemann equation in Cartesian form. (06 Marks)

b. Find analytic function f(z) whose imaginary part is $v = \left(r - \frac{1}{r}\right)\sin\theta$. (05 Marks)

c. Discuss the transformation of $\omega = e^z$. (05 Marks)

OR

6 a. State and prove Cauchy's integral formula. (06 Marks)

b. Emulate $\oint_c \frac{e^{2z}}{(z+1)(z-2)} dz$ where c is |z| = 3 using Cauchy's residue theorem. (05 Marks)

c. Find the bilinear transformation which maps z = –1, 0, 1 into ω = 0, i, 3i. (05 Marks)

Module-4

7 a. Derive mean and variance of the binomial distribution. (06 Marks)

b. A random variable x has the following probability mass function.

x	0	1	2	3	4	5
P(x)	k	3k	5k	7k	9k	11k

i) find k ii) find p(x < 3) iii) find p(3 < x ≤ 5). (05 Marks)

c. The joint distribution of two random variable x and y as follows :

x \ y	–4	2	7
1	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
5	$\frac{1}{4}$	$\frac{1}{8}$	$\frac{1}{8}$

Compute : i) E(x) and E(y) ii) E(xy) iii) cov(xy). (05 Marks)

OR

8 a. 2% of the fuses manufactured by a firm are found defective. Find the probability that a box containing 200 fuses contains. i) no defective fuses ii) 3 or more defective fuses. **(06 Marks)**

b. In a test on 2000 electric bulbs. It was found that the life of a particular brand was distributed normally with an average life of 2040 hours and S.D 60 hours. Estimate the number of bulbs likely to burn ($P(0 < z < 1.83) = 0.4664$ $P(1.33) = 0.4082$, $P(2) = 0.4772$) i) more than 2150 ii) less than 1960 iii) more than 1920 but less than 2160 hours. **(05 Marks)**

c. The joint probability distribution of two random variable X and Y given by the following table:

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 marginal distribution of X and Y and evaluate cov(XY). **(05 Marks)**

Module-5

9 a. Define: i) Null hypothesis ii) significance level iii) Type–I and Type–II error. **(06 Marks)**

b. Ten individual are chosen at random from a population and their height in inches are found to be 63, 63, 66, 67, 68, 69, 70, 70, 71, 71. Test the hypothesis that mean height of the universe is 66 inches. Given that ($t_{0.05} = 2.262$ for 9d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix :

$$A = \begin{bmatrix} \frac{1}{2} & \frac{1}{4} & \frac{1}{4} \\ \frac{1}{2} & 0 & \frac{1}{2} \\ 0 & 1 & 0 \end{bmatrix}.$$ **(05 Marks)**

OR

10 a. A coin is tossed 1000 times and head turns up 540 times. Decide on the hypothesis that the coin is unbiased. **(06 Marks)**

b. Four coins are tossed 100 times and following results were obtained :

No. of heads	0	1	2	3	4
Frequency	5	29	36	25	5

Fit a binomial distribution for the data and test the goodness of fit $\left(\chi^2_{0.05} = 9.49\right)$. **(05 Marks)**

c. A student's study habit 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? **(05 Marks)**

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15EE42

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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 terms with graph : i) Hydrograph ii) Flow duration curve iii) Mass curve. **(06 Marks)**

b. What are the points to be considered for the selection of site in hydro power plant? **(06 Marks)**

c. List out the merits and demerits of Hydro Power Plant. **(04 Marks)**

OR

2 a. Explain the components of high head hydroelectric power plant with its schematic arrangement. **(10 Marks)**

b. Explain the classification of hydro electric power plant based on water head. **(06 Marks)**

Module-2

3 a. Mention the classification of stokers. Explain overfeed and underfeed stoker with diagram. **(08 Marks)**

b. What is Steam prime movers? Explain Impulse and Reaction turbine. **(08 Marks)**

OR

4 a. Explain how the use of Regenerator, Intercooler and Reheater in gas – turbine power plant help in improvement of thermal efficiency. **(08 Marks)**

b. With a flow diagram, explain the Fuel handling system. **(04 Marks)**

c. Give the application of Diesel Power Plant. **(04 Marks)**

Module-3

5 a. Mention the factors which go in favour of Nuclear Power station. **(06 Marks)**

b. What are the classification of Nuclear Reactor? Explain BWR with diagram. **(10 Marks)**

OR

6 a. With a neat sketch, explain the main parts of Nuclear Reactor. **(10 Marks)**

b. Write briefly about Nuclear Waste Disposal. **(06 Marks)**

Module-4

7 a. Define the terms :
i) Circuit breakers ii) Lighting arresters iii) Reactors and capacitors. **(04 Marks)**

b. Explain the Interconnection of power station with its advantages and disadvantages. **(04 Marks)**

c. Write short notes on : i) Resistance Grounding ii) Reactance Grounding. **(08 Marks)**

OR

8 a. Give short notes on : i) Resonant Grounding ii) Solid Grounding. **(08 Marks)**

b. With neat sketch, explain single bus bar system. **(08 Marks)**

Module-5

9	a.	What are the main disadvantages and causes of poor power factor?	(07 Marks)
	b.	Mention the measures by which low power factor can be avoided.	(05 Marks)
	c.	Discuss the Economics of Power factor correction.	(04 Marks)

OR

10	a.	Define Tariff. Explain different types of Tariffs.	(06 Marks)
	b.	What are the main objectives in framing a Tariff?	(06 Marks)
	c.	Explain the types of consumers and write the general form of Tariff.	(04 Marks)

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15EE43

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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. Explain with the help of a neat diagram and typical transmission and distribution system scheme indicating the standard voltages. **(05 Marks)**

b. With neat diagram, explain Feeders, Distributors and service Mains. **(03 Marks)**

c. The towers of height 30m and 90m respectively support transmission line conductor's at water crossing. The horizontal distance between the tower is 500m. If the tension in the conductor is 1600kg, find the minimum clearance of the conductor and water and clearance midway between the support weight of conductor is 1.5kg/m, Bases of the towers can be considered to be at water level. **(08 Marks)**

OR

2 a. Explain the advantages of (i) ACSR (ii) AAAC iii) ZTAI iv) GTACSR (v) GZTACSR **(05 Marks)**

b. With neat diagram derive a expression for the sag when the supports are at equal heights. **(05 Marks)**

c. Explain the classification of Insulators? Define string efficiency? Methods of improving string efficiency. **(06 Marks)**

Module-2

3 a. With neat diagram. Develop an expression for Inductance of a 3 phase over head line with unsymmetrical spacing. **(06 Marks)**

b. Explain the concept of (i) Self GMD (ii) Mutual GMD. **(04 Marks)**

c. Calculate the Inductance of each conductor in a 3 phase 3 wire system when the conductors are arranged in a horizontal plane with spacing such that D_{31} = 4m, D_{12} = D_{23} = 2m, the conductors are transposed and have a diameter of 2.5cm. **(06 Marks)**

OR

4 a. With neat diagram Develop an expression for capacitance of a 3 phase over head line with symmetrical and unsymmetrical spacing. **(10Marks)**

b. A 3phase, 50Hz, 66kV overhead line conductors are placed in horizontal plane as shown in Fig Q4(b)

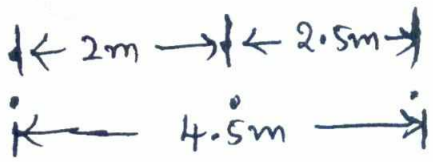

Fig Q4(b)

The conductor diameter is 1.25cm. if the line length is 100km, calculate :
(i) Capacitance per phase (ii) Charging current per phase. Assuming complete transposition of the line. **(06 Marks)**

Module-3

5 a. Show how regulation and transmission efficiency are determined for medium transmission line using nominal T method. Illustrate your answer with suitable vector diagram. **(05 Marks)**

b. A 3 phase, 50Hz, 150km line has a resistance inductive reactance and capacitive shunt admittance of 0.1Ω, 0.5Ω and 3×10^{-6} S per km per phase. If the line delivers 50mW at 110kV and 0.8pf lagging. Determine the sending end voltage and current. Assume a nominal π circuit of the line. **(08 Marks)**

c. Differentiate the types of over head transmission lines. **(03 Marks)**

OR

6 a. Develop the Generalized circuit constants for (i) short transmission line (ii) Medium line – nominal T method. **(08 Marks)**

b. Find the following for a single circuit transmission line delivering a load of 50MVA at 110kV and p.f 0.8 lagging:
(i) Sending end voltage (ii) Sending end current (iii) Sending end power
(iv) Efficiency of transmission.
Given $A = D = 0.98\angle 3^\circ$ $B = 110\angle 75^\circ\ \Omega$, $C = 0.0005\ \angle 80^\circ$ Siemen. **(08 Marks)**

Module-4

7 a. What is Corona? What are the factors which affect Corona? **(04 Marks)**

b. Explain the following terms with reference to corona
(i) Critical disruptive voltage
(ii) Visual critical voltage **(06 Marks)**

c. Describe the various methods of reducing corona effect in an overhead transmission line. **(06 Marks)**

OR

8 a. With neat diagram. show the various parts of high voltage single core cable. **(04 Marks)**

b. Define Grading of cables, Analyze capacitance Grading. **(08 Marks)**

c. Write the comparison between ac and dc cables. **(04 Marks)**

Module-5

9 a. With neat diagram, explain the concept of AC distributor. With concentrated loads. **(08 Marks)**

b. A single phase ac distributor AB 300 meters long is fed from End A and is loaded as under
i) 100A at 0.707 pf lagging 200m from point A
ii) 200A at 0.8pf lagging 300m from point A
The load resistance and reactance of the distributor is 0.2Ω and 0.1Ω per kilometer. Calculate the total voltage drop in the distributor. The load power factor refer to the voltage at the far end. **(08 Marks)**

OR

10 a. Define reliability, power Quality. **(06 Marks)**

b. Limitations of Distribution systems. **(07 Marks)**

c. Explain the effect of disconnection of natural in a 3 phase four wire system. **(03 Marks)**

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15EE44

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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. Explain the significance of back emf in DC motors. **(04 Marks)**

b. Describe with a neat sketch the working of 3-point starter. **(06 Marks)**

c. A 250 V DC shunt motor on no load runs at 1000 rpm and takes 5A. The total armature circuit and shunt field resistance are 0.2Ω and 250Ω respectively. Calculate the speed when loaded and taking a current of 50A, if armature reaction weakens the field by 3%. Assume a brush contact drop of 1V at each brush. **(06 Marks)**

OR

2 a. Derive the torque equation of DC motor. **(05 Marks)**

b. Explain briefly the losses in DC motor. **(05 Marks)**

c. A 60 KW, 500 V DC shunt motor has a lap connected armature with 492 conductors. Flux/pole is 0.05 wb and full load efficiency is 90%. Its armature resistance is 0.1Ω and shunt field resistance is 250Ω. Find for full load (i) speed (ii) useful torque, if 6% of the torque is lost in friction. **(06 Marks)**

Module-2

3 a. Discuss in detail the Swinburn's test conducted on DC machine for predetermination of efficiency. **(05 Marks)**

b. Derive an expression for the torque of an induction motor and obtain the condition for maximum torque. **(05 Marks)**

c. A Retardation test is carried out on a 1000 rpm DC machine. The time taken for the speed to fall from 1030 rpm to 970 rpm is,

1) 40 seconds with no excitation
2) 20 seconds with full excitation
3) 9 seconds with full excitation and the armature supplying an extra load of 10 A at 225 V. Calculate:

i) The moment of inertia of the armature in kg-m^2.
ii) Iron losses
iii) The mechanical losses at the mean speed of 1000 rpm. **(06 Marks)**

OR

4 a. Describe the field test applied to two similar DC series motors. **(05 Marks)**

b. The following results were obtained during Hopkinson's test on two similar 230 V machines, armature currents 37A and 30A; filed currents of 0.85 A and 0.8A. Calculate the efficiencies of machines if each has armature resistance of 0.33Ω. **(06 Marks)**

c. Calculate the torque exerted by an 8-pole, 50 Hz, 3-phase induction motor operating with a 4% slip which develops a maximum torque of 150 kg-m at a speed of 660 rpm. The resistance per phase of the rotor is 0.5Ω. **(05 Marks)**

Module-3

5 a. Discuss the various losses that take place in 3-phase induction motor. Explain briefly. **(05 Marks)**

b. Explain no load and blocked rotor tests conducted on 3-phase induction motors to construct circle diagram. **(06 Marks)**

c. Draw a neat sketch and explain the working of double cage induction motor. **(05 Marks)**

OR

6 a. Write a brief note on induction generator. **(04 Marks)**

b. Draw the circle diagram for a 20 HP, 50 Hz, 3-phase star connected induction motor with the following data:
No load test: 400 V, 9A, 0.2 PF
Blocked rotor test: 200 V, 50A, 0.4PF
Determine the line current and efficiency for full load condition. **(08 Marks)**

c. A 5 HP, 400V, 6-pole, 50 Hz, 3-phase induction motor operating at full load draws a line current of 7A at 0.866 PF with 2% slip. Find the rotor speed and efficiency of the motor. **(04 Marks)**

Module-4

7 a. Justify the necessity of starter for 3-phase induction motor. Explain star-delta starter with neat sketch. **(08 Marks)**

b. Explain with a neat sketch the construction and working principle of split phase induction motor. **(04 Marks)**

c. A 250 W, 230 V, 50 Hz single phase capacitor start induction motor has the following constants for the main and auxiliary windings. Main winding $Z_m = (4.5 + j3.7)\Omega$, auxiliary winding $Z_a = (9.5 + j3.5)\Omega$. Determine the value of the capacitor that will place the main and auxiliary winding currents in quadrature at starting. **(04 Marks)**

OR

8 a. Describe the different methods of speed control of three phase induction motors. **(06 Marks)**

b. Discuss with a neat sketch the working of DOL starter. **(05 Marks)**

c. Explain with a neat sketch the construction and working principle of capacitor start induction motor. **(05 Marks)**

Module-5

9 a. Write a brief note on V and inverted V curves of synchronous motor. **(06 Marks)**

b. List the applications of linear induction motor. **(04 Marks)**

c. Describe the different methods of starting synchronous motor. **(06 Marks)**

OR

10 a. Explain briefly why synchronous motors are not self starting. **(06 Marks)**

b. Write a brief note on AC series motor. **(04 Marks)**

c. Describe the phenomenon of hunting in synchronous machine. **(06 Marks)**

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15EE45

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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. Given two vector combinations

$\vec{A}+\vec{B}=2\vec{a_x}+3\vec{a_y}-3\vec{a_z}$ and $\vec{A}-\vec{B}=4\vec{a_x}+\vec{a_y}+\vec{a_z}$. Find

i) The value of $\vec{A}$ and $\vec{B}$ in vector form

ii) Cross product of $\vec{A}$ and $\vec{B}$

iii) Dot product of $\vec{A}$ and $\vec{B}$ **(06 Marks)**

b. Given the Rectangular components of vector

$\vec{H}=20\vec{a_\rho}-10\vec{a_\phi}+3\vec{a_z}$ at point P(5, 2, −1) **(05 Marks)**

c. State and explain Coulomb's law in vector form. **(05 Marks)**

OR

2 a. State and explain Gauss law. Find electric field intensity at a distance 'r' from an infinite line charge using Gauss law. **(06 Marks)**

b. Given the electric flux density $\vec{D}=5\sin\theta\,\vec{a_\theta}+5\sin\phi\,\vec{a_\phi}$ at $P\left(0.5,\frac{\pi}{4},\frac{\pi}{4}\right)$. There exist spherical volume charge of radius 'a' with uniform charge density of ρ_v. Obtain electric field intensity as a function of radius r.verify Divergence theorem for r < a and r > a. **(08 Marks)**

c. State the relationship between rectangular and cylindrical corrdinates. **(02 Marks)**

Module-2

3 a. A charge of 10nc is located at $P_1(0, 0, 5)$ and another charge of −5nc at P_2 (0, 0, −5). Find the coordinate of point at which $\vec{E}$ is zero. **(06 Marks)**

b. Show that $\vec{E}$ is expressed as negative gradient of scalar potential. **(06 Marks)**

c. Calculate the numerical value of V and ρ_v in free space if $V=\frac{4yz}{x^2+1}$ at P(1, 2, 3). **(04 Marks)**

OR

4 a. Obtain the boundary condition between Dielectric and conductor. **(06 Marks)**

b. Derive current continuity Equation with usual notation. **(04 Marks)**

c. Find the Energy stored in free space for the region $2*10^{-3}m < r < 3*10^{-3}m$, $0<\theta<\frac{\pi}{2}, 0<\phi<\frac{\pi}{2}$. Given the potential field is $V=\frac{200}{r}$ volts. **(06 Marks)**

Module-3

5 a. Starting form point from of Gauss law derive Laplace equation and Poisson's equation. Also derive uniqueness theorem. **(08 Marks)**

b. Determine whether the given potential field satisfy Laplace equation $V = r \cos \phi + z$. **(02 Marks)**

c. Assume the space between inner and outer conductors of co-axial cylindrical structure is filled with electron cloud having volume charge density $\rho_v = \frac{A}{r}$ for $a < r < b$, where a and b are radii of inner and outer conductor. The inner conductor is maintained at a potential of V_0 and outer conductor at ground. Determine the potential distribution in the region $a < r < b$. **(06 Marks)**

OR

6 a. Find magnetic field Intensity at point P for the circuit shown in Fig Q6(a). **(06 Marks)**

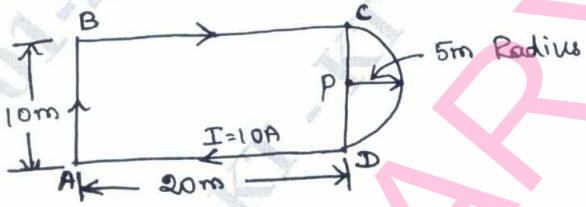

Fig Q6(a)

b. Distinguish Scalar Magnetic Potential and vector magnetic potential. Also prove that $A = \frac{\mu_0}{4\pi} \int_{vol} \frac{J}{r} \cdot dv$ **(06 Marks)**

c. State Biot Savart's law and Ampere's circuital law. **(04 Marks)**

Module-4

7 a. Derive an expression for force between two parallel conductors carrying a current of 'I' amps in opposite direction. **(07 Marks)**

b. Current flowing in conductor A and B are 500A and 800A respectively. Net force acting on conductor B is 2N/m. Find current in conductor C and also its direction. Refer the below Figure. [Fig Q7(b)]. **(06 Marks)**

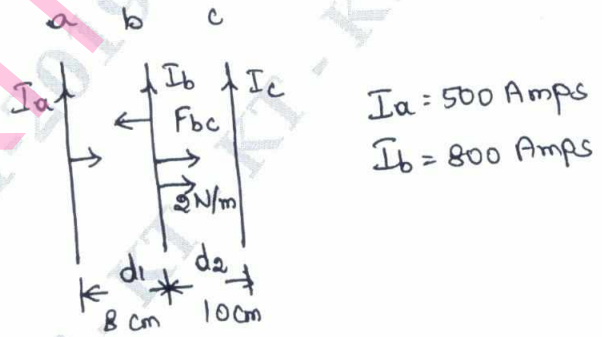

Fig Q7(b)

c. Obtain the Relation between J and ρ_v. **(03 Marks)**

OR

8 a. Obtain magnetic boundary condition if the boundary carries zero surface current. **(08 Marks)**

b. With neat sketch obtain and derive an expression for inductance of a co-axial cable. **(08 Marks)**

Module-5

9 a. List Maxwell's Equation for Time varying field in point form and Integral form. **(06 Marks)**

b. Starting from Ampere's circuital law derive and expression for Displacement current density for time varying fields. **(06 Marks)**

c. A conductor carries a steady current of "I' amps. The components of current density vector $\vec{J}_x = 2ax$ and $\vec{J}_y = 2ay$. Find the third component $\vec{J}_z$. Derive any relation used. **(04 Marks)**

OR

10 a. A short vertical antenna erected on the surface of perfectly conducting earth produces effective field strength $E_{eff} = 100 \text{ Sin } \theta$ mV/m at points at a distance of 1 mile from the antenna. Compute the poynting vector and total power radiated. **(08 Marks)**

b. A conductor of circular cross section of radius 'a' m and length 'ℓ' m carrying a current of I amps of conductivity σ. Find power loss in the conductor over the surface of cylindrical conductor carrying current of 'I' amps and show that it is equal to power loss in the conductor. **(08 Marks)**

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15EE46

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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. With a neat block diagram, explain the general stages for an op-amp. **(08 Marks)**

b. Explain the effect of feedback as input resistance (R_i) and output resistance for voltage shunt amplifier. **(08 Marks)**

OR

2 a. Define the following terms :
i) input offset voltage
ii) input offset current
iii) PSRR
iv) CMRR. **(08 Marks)**

b. The circuit of peaking amplifier is to provide a gain of 10 at a peak frequency of 16KHz. Determine the value of all components. **(08 Marks)**

Module-2

3 a. Using a 741 op-amp, design the first order active low pass filter to have a 1.0 KHz cut off frequency. **(06 Marks)**

b. Sketch the circuit of a second order active low pass active filter and explain its operation. **(10 Marks)**

OR

4 a. For a voltage regulator define.
i) Line regulation
ii) Load regulation
iii) Ripple rejection. Write equation for each. **(06 Marks)**

b. Explain the working and design to op-amp voltage follower regulator. **(10 Marks)**

Module-3

5 a. Draw the circuit diagram of a triangular/rectangular waveform generator using op-amps. Sketch the circuit waveforms and explain its circuit operation. **(10 Marks)**

b. Design a triangular waveform generator to produce a ±2V 1KHz output. Use a ±15V supply assume $I_1 = 100\mu A$. **(06 Marks)**

OR

6 a. Explain the working of Schmitt trigger in inverting mode. Draw its hysterisis curve. **(06 Marks)**

b. State the Barkhauses criteria for a sine wave oscillator. Draw the circuit diagram of an op-amp phase shift oscillator. Sketch the circuit wave forms and briefly explain the oscillator operation. **(10 Marks)**

Module-4

7 a. Show how a half wave precision rectifier can be obtained with a summing circuit to produce a full wave precision rectifier. Draw the voltage wave forms and write the equation to show that full-wave rectification is performed. **(10 Marks)**

b. Explain the working of R-2R ladder DAC. Assume that binary input is 001. **(06 Marks)**

OR

8 a. Design a precision full wave rectifier circuit to produce a 2V peak output from a sinewave input with a 0.5Vp value and 1MHz frequency. Use bipolar op-amp with a supply voltage of ±15V. Assume $I_1 = 500\mu A$. **(08 Marks)**

b. Sketch an op-amp precision clamping circuit draw the input and output waveforms and explain the circuit operation. Show how the output voltage can be biased to any desired level. **(08 Marks)**

Module-5

9 a. Draw the basic block diagram and waveforms for a PLL system. Identify each component part and explain its function. **(08 Marks)**

b. Draw the block diagram for a PLL frequency synthesizer. Sketch all waveforms and explain the system operation. **(08 Marks)**

OR

10 a. Sketch the basic circuit diagram of an astable multivibrator using 555 timer with two resistances and a capacitor. Show the capacitor and output waveforms and explain the circuit operation. **(08 Marks)**

b. Sketch the functional block diagram for a 555 IC timer. Identify all terminals and explain each component part. **(08 Marks)**

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15MATDIP41

Fourth Semester B.E. Degree Examination, Dec.2018/Jan.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 matrix $A=\begin{bmatrix}2 & -1 & -3 & -1\\ 1 & 2 & 3 & -1\\ 1 & 0 & 1 & 1\\ 0 & 1 & 1 & -1\end{bmatrix}$ **(05 Marks)**

b. Solve by Gauss elimination method:
$2x+y+4z=12 \qquad 4x+11y-z=33 \qquad 8x-3y+2z=20$ **(05 Marks)**

c. Find all the eigen values of the matrix
$A=\begin{bmatrix}8 & -6 & 2\\ -6 & 7 & -4\\ 2 & -4 & 3\end{bmatrix}$ **(06 Marks)**

OR

2 a. Find the values of K, such that the matrix A may have the rank equal to 3:
$A=\begin{bmatrix}1 & 1 & 1 & 1\\ 1 & 2 & 4 & K\\ 1 & 4 & 10 & K^2\end{bmatrix}$ **(05 Marks)**

b. Solve by Gauss elimination method
$x_1-2x_2+3x_3=2 \qquad 3x_1-x_2+4x_3=4 \qquad 2x_1+x_2-2x_3=5$ **(05 Marks)**

c. Find all the eigen values and corresponding eigen vectors of the matrix
$A=\begin{bmatrix}-19 & 7\\ -42 & 16\end{bmatrix}$ **(06 Marks)**

Module-2

3 a. Find C.F of $(4D^4-8D^3-7D^2+11D+6)y=0$. **(05 Marks)**

b. Solve the initial value problem $\frac{d^2x}{dt^2}+4\frac{dx}{dt}+29x=0$

Subject to the conditions $x(0)=0$, $\frac{dx}{dt}(0)=15$. **(05 Marks)**

c. Using the method of undetermined coefficients, solve $(D^2-4D+3)y=20\cos x$ **(06 Marks)**

OR

4 a. Solve $(D^2-2D+4)y=e^x\cos x$. **(05 Marks)**

b. Solve $(D^2+4)y=x^2+2^{-x}$. **(05 Marks)**

c. Using the method of variation of parameters, find the solution of $(D^2-2D+1)y=e^x/x$. **(06 Marks)**

Module-3

5 a. Find the Laplace transform of $\frac{\cos 3t - \cos 4t}{t}$. **(05 Marks)**

b. Find $L\{t\sin^2 t\}$ **(05 Marks)**

c. Express the following function interms of Heaviside unit step function and hence find the Laplace transform where

$$f(t) = \begin{cases} t^2 & 0 < t \le 2 \\ 4t & t > 2 \end{cases}$$ **(06 Marks)**

OR

6 a. Find $L\left[\frac{e^{-t}.\sin t}{t}\right]$. **(05 Marks)**

b. Using Laplace transform evaluate $\int_0^\infty e^{-t} t \sin^2 3t dt$. **(05 Marks)**

c. If $f(t) = \begin{cases} t & 0 \le t \le a \\ 2a - t & a \le t \le 2a \end{cases}$ $f(t+2a) = f(t)$, show that $L[f(t)] = \frac{1}{s^2}\tan h\left(\frac{as}{2}\right)$. **(06 Marks)**

Module-4

7 a. Find inverse Laplace transform of $\frac{s+5}{s^2 - 6s + 13}$. **(05 Marks)**

b. Find inverse Laplace transform of $\log\left[\frac{s^2+4}{s(s+4)(s-4)}\right]$. **(05 Marks)**

c. Solve by using Laplace transform method $y''(t) + 4y(t) = 0$, given that $y(0) = 2$, $y'(0) = 0$. **(06 Marks)**

OR

8 a. Find $L^{-1}\left[\frac{s^2}{(s^2+1)(s^2+4)}\right]$. **(05 Marks)**

b. Find $L^{-1}\left[\frac{(s+2)e^{-s}}{(s+1)^4}\right]$ **(05 Marks)**

c. Solve by using Laplace transform method $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. **(06 Marks)**

Module-5

9 a. There are 10 students of which three are graduates. If a committee of five is to be formed, what is the probability that there are (i) only 2 graduates (ii) atleast 2 graduates? **(05 Marks)**

b. In a school 25% of the students failed in the first language, 15% of the students failed in second language and 10% of the students failed in both. If a student is selected at random find the probability that :

i) He failed in first language if he had failed in the second language.

ii) He failed in second language if he had failed in the first language. **(05 Marks)**

c. In a bolt factory there are four machines A, B, C and D manufacturing respectively 20%, 15%, 25%, 40% of the total production. Out of these 5%, 4%, 3% and 2% are defective. If a bolt drawn at random was found defective what is the probability that it was manufactured by A or D. **(06 Marks)**

OR

10 a. From 6 positive and 8 negative numbers, 4 numbers are chosen at random (without replacement) and multiplied. What is the probability that the product is a positive number? **(05 Marks)**

b. Three students A, B, C write an entrance examination. Their chances of passing are $\frac{1}{2}$, $\frac{1}{3}$ and $\frac{1}{4}$ respectively. Find the probability that (i) atleast one of them passes (ii) all of them passes. **(05 Marks)**

c. Three major parties A, B, C are contending for power in the elections of a state and the chance of their winning the election is in the ratio 1:3:5. The parties A, B, C respectively have probability of banning the online lottery $\frac{2}{3}$, $\frac{1}{3}$, $\frac{3}{5}$. What is the probability that there will be a ban on the online lottery in the state? What is the probability that the ban is from the party 'C'? **(06 Marks)**

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