CBCS Scheme

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15MAT41

Fourth Semester B.E. Degree Examination, June/July 2017
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 tables are permitted.***

Module-1

1 a. Find by Taylor's series method the value of y at x = 0.1 from $\frac{dy}{dx} = x^2y - 1$, $y(0) = 1$ (upto 4th degree term). **(05 Marks)**

b. The following table gives the solution of $5xy' + y^2 - 2 = 0$. Find the value of y at x = 4.5 using Milne's predictor and corrector formulae. **(05 Marks)**

x	4	4.1	4.2	4.3	4.4
y	1	1.0049	1.0097	1.0143	1.0187

c. Using Euler's modified method. Obtain a solution of the equation $\frac{dy}{dx} = x + |\sqrt{y}|$, with initial conditions y = 1 at x = 0, for the range $0 \le x \le 0.4$ in steps of 0.2. **(06 Marks)**

OR

2 a. Using modified Euler's method find y(20.2) and y(20.4) given that $\frac{dy}{dx} = \log_{10}\left(\frac{x}{y}\right)$ with $y(20) = 5$ taking h = 0.2. **(05 Marks)**

b. Given $\frac{dy}{dx} = x^2(1+y)$ and y(1) = 1, y(1.1) = 1.233, y(1.2) =1.548, y(1.3) = 1.979. Evaluate y(1.4) by Adams-Bashforth method. **(05 Marks)**

c. Using Runge-Kutta method of fourth order, solve $\frac{dy}{dx} = \frac{y^2 - x^2}{y^2 + x^2}$ with $y(0) = 1$ at x = 0.2 by taking h = 0.2 **(06 Marks)**

Module-2

3 a. Obtain the solution of the equation $2\frac{d^2y}{dx^2} = ux + \frac{dy}{dx}$ by computing the value of the dependent variable corresponding to the value 1.4 of the independent variable by applying Milne's method using the following data: **(05 Marks)**

x	1	1.1	1.2	1.3
y	2	2.2156	2.4649	2.7514
y′	2	2.3178	2.6725	3.0657

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

c. Obtain the series solution of Bessel's differential equation $x^2y'' + xy' + (x^2 + n^2)y = 0$ **(06 Marks)**

OR

4 a. By Runge-Kutta method solve $\frac{d^2y}{dx^2} = x\left(\frac{dy}{dx}\right)^2 - y^2$ for x = 0.2. Correct to four decimal places using the initial conditions y = 1 and $y' = 0$ at x = 0, h = 0.2. **(05 Marks)**

b. Prove that $J_{+\frac{1}{2}}(x) = \sqrt{\frac{2}{\pi x}}\sin x$ **(05 Marks)**

c. Prove the Rodrigues formula,

$$\rho_n(x) = \frac{1}{2^n n!}\frac{d^n(x^2-1)^n}{dx^n}$$ **(06 Marks)**

Module-3

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

b. Discuss the transformation $W = e^z$. **(05 Marks)**

c. Evaluate $\int_C \left\{\frac{\sin(\pi z^2) + \cos(\pi z^2)}{(z-1)^2(z-2)}\right\} dz$

using Cauchy's residue theorem where 'C' is the circle $|z| = 3$ **(06 Marks)**

OR

6 a. Find the analytic function whose real part is, $\frac{\sin 2x}{\cosh 2y - \cos 2x}$. **(05 Marks)**

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

c. Find the bilinear transformation which maps z = ∞, i, 0 into ω = -1, -i, 1. Also find the fixed points of the transformation. **(06 Marks)**

Module-4

7 a. Find the mean and standard deviation of Poisson distribution. **(05 Marks)**

b. In a test on 2000 electric bulbs, it was found that the life of a particular make was normally distributed with an average life of 2040 hours and S.D of 60 hours. Estimate the number of bulbs likely to burn for,

(i) more than 2150 hours.
(ii) less than 1950 hours
(iii) more than 1920 hours and less than 2160 hours.

[A(1.833) = 0.4664, A(1.5) = 0.4332, A(2) = 0.4772] **(05 Marks)**

c. The joint probability distribution of two random variables x and y is as follows:

x/y	-4	2	7
1	1/8	1/4	1/8
5	1/4	1/8	1/8

Determine:

(i) Marginal distribution of x and y.
(ii) Covariance of x and y
(iii) Correlaiton of x and y. **(06 Marks)**

OR

8 a. The probability that a pen manufactured by a factory be defective is $\frac{1}{10}$. If 12 such pens are manufactured what is the probability that, (i) Exactly 2 are defective (ii) at least 2 are defective (iii) none of them are defective. **(05 Marks)**

b. Derive the expressions for mean and variance of binomial distribution. **(05 Marks)**

c. A random variable X take the values -3, -2, -1, 0, 1, 2, 3 such that $P(x = 0) = P(x < 0)$ and $P(x = -3) = P(x = -2) = P(x = -1) = P(x = 1) = P(x = 2) = P(x = 3)$. Find the probability distribution. **(06 Marks)**

Module-5

9 a. In 324 throws of a six faced 'die' an odd number turned up 181 times. Is it reasonable to think that the 'die' is an unbiased one? **(05 Marks)**

b. Two horses A and B were tested according to the time (in seconds) to run a particular race with the following results:

Horse A:	28	30	32	33	33	29	34
Horse B:	29	30	30	24	27	29	

Test whether you can discriminate between the two horses.($t_{0.05}$=2.2 and $t_{0.02}$=2.72 for 11 d.f) **(05 Marks)**

c. Find the unique fixed probability vector for the regular stochastic matrix, $A = \begin{bmatrix} 0 & 1 & 0 \\ 1/6 & 1/2 & 1/3 \\ 0 & 2/3 & 1/3 \end{bmatrix}$ **(06 Marks)**

OR

10 a. Define the terms: (i) Null hypothesis (ii) Type–I and Type–II error (iii) Confidence limits. **(05 Marks)**

b. Prove that the Markov chain whose t.p.m $P = \begin{bmatrix} 0 & 2/3 & 1/3 \\ 1/2 & 0 & 1/2 \\ 1/2 & 1/2 & 0 \end{bmatrix}$ is irreducible. Find the corresponding stationary probability vector. **(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 as to A. If C was the first person to throw the ball find the probabilities that after three throws (i) A has the ball. (ii) B has the ball. (iii) C has the ball. **(06 Marks)**

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15EE42

Fourth Semester B.E. Degree Examination, June/July 2017
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 : i) hydrograph ii) flow duration curve and mass curve. **(06 Marks)**

b. Explain the factors to be considered for selection of site for hydro-electric power plant. **(05 Marks)**

c. Give the classification of hydro power plant. **(05 Marks)**

OR

2 a. Explain the essential elements of hydro power plant with neat schematic diagram. **(06 Marks)**

b. Explain the governing mechanism of hydraulic impulse turbine and reaction turbine with neat sketches. **(06 Marks)**

c. Discuss the merits and demerits of hydro power plant. **(04 Marks)**

Module-2

3 a. Explain the working of steam power plant with neat schematic diagram. **(06 Marks)**

b. Explain the techniques of dust collection in thermal power station. **(06 Marks)**

c. Explain the function of air-preheater and economizer in thermal plant. **(04 Marks)**

OR

4 a. Mention the application of diesel electric power plant. **(05 Marks)**

b. With neat sketch, explain the working of a gas turbine plant. **(06 Marks)**

c. Give the comparison of hydro power plant with stream power plant. **(05 Marks)**

Module-3

5 a. Explain the nuclear reactor with neat diagram. **(06 Marks)**

b. List the advantages and disadvantages of nuclear power plant. **(05 Marks)**

c. Describe construction and working of a pressurized water reactor. **(05 Marks)**

OR

6 a. Explain the working operation of nuclear power plant with neat sketch. **(06 Marks)**

b. Give the various classifications of nuclear reactor and explain anyone. **(04 Marks)**

c. Explain the function of moderator, control rod, coolant in nuclear power plant. **(06 Marks)**

Module-4

7 a. Explain resonant grounding with a neat diagram. **(06 Marks)**

b. Explain the function of transformer, high voltage circuit breaker and high voltage insulator in substation. **(06 Marks)**

c. Draw a neat single diagram of substation and explain it. **(04 Marks)**

OR

8 a. Define substation and mention different types of substations. **(06 Marks)**

b. A 230V, 3ϕ, 50Hz, 200 km transmission has a capacitance to earth of 0.01mF/km per phase. Calculate the inductance and KVA rating of Peterson coil used for earthling the above system. **(05 Marks)**

c. Explain double bus without sectionlisation. **(05 Marks)**

Module-5

9 a. Define the following terms :
i) Load factor ii) diversity factor iii) plant use factor. **(06 Marks)**

b. A generating station has 3×50 MW units. The station output is 876×10^6 KWH per annum. The maximum demand is 120 MW calculate : **(06 Marks)**
i) average load on the station
ii) annual load factor
iii) annual capacity factor.

c. Explain the factors affecting tariff. **(04 Marks)**

OR

10 a. Explain : i) two part tariff ii) power factor tariff iii) maximum demand tariff. **(06 Marks)**

b. Discuss various methods of power factor improvement. **(04 Marks)**

c. Calculate the annual energy cost of an industrial consumer who takes a load of 20 KW for 1 hour per day, 150 KW for 7 hours per day and 50 KW for 8 hours/day. The tariff in force is Rs. 20 per kilowatt of maximum demand and 10 paise per KWH. Assume 6 working days in a weak. **(06 Marks)**

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15EE43

Fourth Semester B.E. Degree Examination, June/July 2017
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. With a neat diagram, explain feeders, distributor and service main of a distribution system. **(06 Marks)**

b. A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 meter above water level. The horizontal distance between the tower is 300 meters. If the tension in the conductor is 2000 kg. Find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per meter = 0.844 kg. Assume that the conductor take the shape of parabolic curve. **(10 Marks)**

OR

2 a. Discuss the advantage of high voltage transmission. **(06 Marks)**

b. Each line of a 3-phase system is suspended by a string of 3 similar insulation. If the voltage across the line unit is 17.5 KV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $\frac{1}{8}$th of the capacitance of the insulator itself. Also find the string efficiency. **(10 Marks)**

Module-2

3 a. Derive an expression for the inductance of a single phase two wire line. **(06 Marks)**

b. Explain the concept of self GMD and mutual GMD. **(04 Marks)**

c. A 3-phase, 50Hz, 132KV overhead line has conductor placed in a horizontal plane 4 meter apart. Conductor diameter is 2cm. If the line length is 100km. Calculate the charging current per phase. Assume complete transposition. **(06 Marks)**

OR

4 a. Derive a expression for the capacitance of a 3-phase overhead line for symmetrical spacing and unsymmetrical spacing. **(10 Marks)**

b. Two conductors of a single phase line each of 1 cm diameter are arranged in a vertical plane with one conductor mounted 1m above the other. A second identical line is mounted at the same height as the first and spaced horizontally 0.25m apart from it. The two upper and the two lower conductors are connected in parallel. Determine the inductance per km of the resulting double circuit line. **(06 Marks)**

Module-3

5 a. Two transmission lines having generalized circuit constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2 D_2 are connected in series. Develop expressions for the overall constants ABCD of the combination in terms of A_1, B_1 C_1 D_1 and A_2 B_2 C_2 D_2. **(06 Marks)**

b. Derive an expression for sending end voltage and current for long transmission line using rigorous solution. **(10 Marks)**

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15EE43

Fourth Semester B.E. Degree Examination, June/July 2017
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. With a neat diagram, explain feeders, distributor and service main of a distribution system. **(06 Marks)**

b. A transmission line conductor at a river crossing is supported from two towers at height of 50 and 80 meter above water level. The horizontal distance between the tower is 300 meters. If the tension in the conductor is 2000 kg. Find the clearance between the conductor and water at a point midway between the towers. Weight of conductor per meter = 0.844 kg. Assume that the conductor take the shape of parabolic curve. **(10 Marks)**

OR

2 a. Discuss the advantage of high voltage transmission. **(06 Marks)**

b. Each line of a 3-phase system is suspended by a string of 3 similar insulation. If the voltage across the line unit is 17.5 KV. Calculate the line to neutral voltage. Assume that the shunt capacitance between each insulator and earth is $\frac{1}{8}$th of the capacitance of the insulator itself. Also find the string efficiency. **(10 Marks)**

Module-2

3 a. Derive an expression for the inductance of a single phase two wire line. **(06 Marks)**

b. Explain the concept of self GMD and mutual GMD. **(04 Marks)**

c. A 3-phase, 50Hz, 132KV overhead line has conductor placed in a horizontal plane 4 meter apart. Conductor diameter is 2cm. If the line length is 100km. Calculate the charging current per phase. Assume complete transposition. **(06 Marks)**

OR

4 a. Derive a expression for the capacitance of a 3-phase overhead line for symmetrical spacing and unsymmetrical spacing. **(10 Marks)**

b. Two conductors of a single phase line each of 1 cm diameter are arranged in a vertical plane with one conductor mounted 1m above the other. A second identical line is mounted at the same height as the first and spaced horizontally 0.25m apart from it. The two upper and the two lower conductors are connected in parallel. Determine the inductance per km of the resulting double circuit line. **(06 Marks)**

Module-3

5 a. Two transmission lines having generalized circuit constants A_1, B_1, C_1, D_1 and A_2, B_2, C_2 D_2 are connected in series. Develop expressions for the overall constants ABCD of the combination in terms of A_1, B_1 C_1 D_1 and A_2 B_2 C_2 D_2. **(06 Marks)**

b. Derive an expression for sending end voltage and current for long transmission line using rigorous solution. **(10 Marks)**

OR

6 a. Explain with vector diagram the nominal π method for obtaining the performance of medium transmission line. **(08 Marks)**

b. An overhead 3-phase transmission line deliver 5000KW at 22 KV at 0.8 pf lagging. The resistance and reactance of each conductor is 4Ω and 6Ω respectively. Determine sending end voltage and transmission efficiency. **(08 Marks)**

Module-4

7 a. Discuss different factors affecting corona and corona loss. **(06 Marks)**

b. A single core lead sheathed cable has a conductor diameter of 3 cm. The diameter of the cable being 9 cm. The cable is graded by using two dielectrics of relative permittivity 5 and 4 respectively with corresponding safe working stresses of 30KV/cm and 20 KV/cm. Calculate the radial thickness of each insulation and the safe working voltage of the cable. **(06 Marks)**

c. A single core cable has a conductor diameter of 1cm and insulation thickness of 0.4cm. If the specific resistance of insulation is 5×10^{14} Ω. Cm. Calculate the insulation resistance for a 2 km length of the cable. **(04 Marks)**

OR

8 a. Derive the expression for the capacitance of a single core cable. **(06 Marks)**

b. A 33 KV, 50Hz, 3-phase underground cable 4 km long uses three single core cables. Each of the conductor has a diameter of 2.5 cm and the radial thickness of insulation is 0.5cm. Determine : i) capacitance of the cable/ phase ii) charging current/phase iii) total charging KVAR. The relative permittivity of insulation is 3. **(06 Marks)**

c. Explain the following terms with reference to corona :
   i) Critical disruptive voltage
   ii) Critical visual disruptive voltage. **(04 Marks)**

Module-5

9 a. Explain radial feeders for AC distribution system. Mention the characteristics of radial feeders. **(06 Marks)**

b. A 3-phase 4wire system supplies power at 400V and lighting at 230V. If the lamps in use require 70, 84 and 33 ampere in each of the three lines. What should be the current in the neutral wire? If a 3-phase motor is now taking 200A from the lines at a pf of 0.2 lagging. What should be the total current in each line and the neutral wire? Find also the total power supplied to the lamps and the motor. **(10 Marks)**

OR

10 a. Explain 3-phase 4 wire star connected unbalanced loads for AC distribution system. **(06 Marks)**

b. A single phase AC distributor AB 300 meter 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 0.8 pf 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 power factors refer to the voltage at the far end. **(10 Marks)**

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15EE44

Fourth Semester B.E. Degree Examination, June/July 2017
Electric Motors

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Derive the torque equation of a D.C. motor. **(05 Marks)**

b. What are the applications of D.C. shunt motor, series motor and compound motor? **(05 Marks)**

c. A 4 pole D.C. shunt takes 22 amp from 220 V supply. The armature and shunt field resistances are 0.5Ω and 100Ω respectively. The armature is lap connected with 300 conductors if the flux/pole is 20 milli ωb, calculate the speed and the developed torque. **(06 Marks)**

OR

2 a. With a neat sketch, explain the Ward-Leonard method of speed control of D.C. motor. **(05 Marks)**

b. Explain the operation of a three point starter with a neat sketch. **(05 Marks)**

c. A 230 V, d.c. shunt motor runs at 800 rpm and takes armature current of 50A. Find resistance to be added to the field circuit to increase speed from 800 rpm to 1000 rpm at an armature current of 80 A. Assume flux proportional to field current. Armature resistance = 0.15 Ω and field resistance = 250 Ω. **(06 Marks)**

Module-2

3 a. With a neat circuit diagram, explain the importance and procedure of conducting Swinburne test on d.c. motor. Show how the efficiency as motor can be predetermined. **(05 Marks)**

b. Explain back to back test as two identical D.C. machines and calculate the efficiency of the machines as a generator and motor. **(05 Marks)**

c. A test on two coupled tram way motors, with their fields connected in series gave the following results when one machine acted as a motor and the other as a generator.
Motor: Armature current = 56 A, Armature voltage = 590 V, Voltage drop across field winding = 40 V.
Generator: Armature current = 44 A, armature voltage = 400 V, field voltage drop = 40 V, resistance of each armature = 0.3 Ω.
Calculate the efficiency of the motor and generator at this load. **(06 Marks)**

OR

4 a. Derive the torque equation for a three phase induction motor. **(05 Marks)**

b. Discuss the complete torque-slip characteristics of a three phase induction motor including motoring, generating and braking regions. **(05 Marks)**

c. A 400 V, 4 pole 3 phase, 50 Hz star connected induction motor has a rotor resistance and reactance perphase equal to 0.01Ω and 0.1Ω respectively. Determine:
i) Starting torque
ii) Slip at which maximum torque will occur
iii) Speed at which maximum torque will occur
iv) Maximum torque
v) Full load torque if full load slip is 4%.
Assume ratio of stator to rotor turns as 4. **(06 Marks)**

Module-3

5 a. Starting from the fundamentals develop the equivalent circuit of three phase induction motor. **(05 Marks)**

b. Explain the phenomenon of cogging and crawling in a 3 phase induction motor. **(05 Marks)**

c. Draw and explain the phasor diagram of a three phase induction motor. **(06 Marks)**

OR

6 a. What is induction generator? Discuss the principle of operation with the help of phasor diagram. **(06 Marks)**

b. Draw the circle diagram from No-load and short circuit test of a 3-phase 14.92 kW, 400 V, 6 pole induction motor with the following test data (line values):
No-load: 400 V, 11A, p.f. = 0.2
S.C. test: 100V, 25A, p.f. = 0.4
Rotor copper loss at stand still is half the total copper loss. From the circle diagram, find:
i) line current
ii) slip
iii) efficiency
iv) p.f. at full load
v) maximum torque. **(10 Marks)**

Module-4

7 a. Name the different methods of starting of squirrel cage induction motor. Explain star-delta starter of 3 phase squirrel cage induction motor with a suitable diagram. **(08 Marks)**

b. Describe any two methods of speed control of a 3-phase induction motor. **(08 Marks)**

OR

8 a. Explain double field revolving theory as applied to a single phase induction motor and prove that it cannot produce any starting torque. **(10 Marks)**

b. Describe the construction working and applications of shaded pole induction motor. **(06 Marks)**

Module-5

9 a. State the methods of starting synchronous motor. Explain any one in detail. **(05 Marks)**

b. Explain the operation of synchronous motor at constant load variable excitation. **(05 Marks)**

c. Explain the concept of hunting in synchronous motors. What are the methods to overcome this? **(06 Marks)**

OR

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

b. Explain the working of permanent magnet stepper motor and give some application. **(08 Marks)**

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15EE45

Fourth Semester B.E. Degree Examination, June/July 2017
Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 80

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

Module-1

1 a. Define scalar and vector. For a given vectors $\bar{A} = 6\bar{a}_x + 2\bar{a}_y + 6\bar{a}_z$ and $\bar{B} = -2\bar{a}_x + 9\bar{a}_y - \bar{a}_z$.
i) Show that vectors $\bar{A}$ and $\bar{B}$ are perpendicular to each other.
ii) Find $\bar{A} \times \bar{B}$ and show $\bar{A} \times \bar{B} = -\bar{B} \times \bar{A}$. **(06 Marks)**

b. Derive the relationship between rectangular and cylindrical coordinates. **(05 Marks)**

c. Using surface integral obtain an expression for surface area of a sphere of radius 'r_1' meter. **(05 Marks)**

OR

2 a. State and prove Gauss law. **(05 Marks)**

b. Two identical uniform line charges of line charge density 5 nc/mt are parallel to x-axis are kept at z = 0, y = –2 m and z = 0, y = +4 mt. Find the electric field at P(4, 1, 3) mt. Assume free space conditions and infinite line charge. **(06 Marks)**

c. If $\bar{D} = 2xy\bar{a}_x + 3yz\bar{a}_y + 4zx\bar{a}_z$ c/m^2, how much electric flux passes through that portion of the plane at x = 3 mt for which $-1 \le y \le 2$ mt and $0 \le z \le 4$ mt. **(05 Marks)**

Module-2

3 a. Show that the electric field intensity (E) can be expressed as negative gradient of scalar potential (V). **(06 Marks)**

b. Find the work done in moving a point charge of Q = -20 μC from origin to P(4, 2, 0) along the path $x^2 = 8y$. Given $\bar{E} = 2(x+4y)\bar{a}_x + 8x\bar{a}_y$ V/m and $\epsilon = t_0$. **(06 Marks)**

c. A point charge of 1 μC is at y = -3mt and another point charge of 2 μC is at y = +3mt. Find the electric potential at a point P(4, 0, 0)mt. **(04 Marks)**

OR

4 a. With usual notations prove that $\nabla . \bar{J} = -\frac{\partial \rho_v}{\partial t}$. **(06 Marks)**

b. Derive an expression for capacitance of a parallel plate capacitor with a dielectric interface (εr_1 and εr_2) parallel to the conducting plates. **(06 Marks)**

c. A parallel plate capacitor of 8.0 nF has an area of 1.51 m^2 and separation of 10 mm. What separation would be required to obtain the 10 nF capacitance between the plates? **(04 Marks)**

Module-3

5 a. Starting from Gauss's law in integral form, derive Poisson's and Laplace equation. Write Laplace equation in all the coordinate systems. **(08 Marks)**

b. Obtain electric potential at a point between two parallel plates at z = 10 mt and z = 5 mt kept at potential of 60 Volts and 10 Volts respectively. Also find the electric field intensity at point. **(08 Marks)**

OR

6 a. Derive an expression for magnetic field intensity at a point due to an infinite long straight conductor carrying a current of I Amps along z-axis. **(06 Marks)**

b. Evaluate both sides of stokes theorem for the field $\bar{H} = .10\sin\theta\,\bar{a}_\phi$ Ampers/meter and the surface r = 3m, $0 \le \theta \le 90^\circ$, $0 \le \phi \le 90^\circ$. Let the surface has the $\bar{a}_r$ direction. What each side of stokes theorem represents? **(10 Marks)**

Module-4

7 a. Derive an expression for the force between differential current elements. **(08 Marks)**

b. A point charge of Q = –40μC is moving with a velocity of $\bar{v} = (-3\bar{a}_x - 4\bar{a}_y + 4.5\bar{a}_z) \times 10^6$ m/sec. find the magnitude of the vector force exerted on the moving particle by the field:

i) $\bar{B} = 2\bar{a}_x - 3\bar{a}_y + 5\bar{a}_z$ mT,

ii) $\bar{E} = 2\bar{a}_x + 3\bar{a}_y - 4\bar{a}_z$ KV/m,

iii) Both B and E acting together. **(08 Marks)**

OR

8 a. The z = 0 plane marks the boundary between two magnetic medium. Medium-1 is the region z > 0 and the medium-2 is the region z < 0. The magnetic flux density in the medium-1 is, $\bar{B}_1 = 1.5\bar{a}_x + 0.8\bar{a}_y + 0.6\bar{a}_z$ mT. Find:

i) The magnetic flux density in medium-2;

ii) Angle between the magnetic flux density and the boundary between two magnetic medium. Assume $\mu_{r_1} = 3$ and $\mu_{r_2} = 4$. **(07 Marks)**

b. Derive an expression for inductance of a solenoid. **(04 Marks)**

c. A solenoid with air core has 2000 turns and a length of 500 mm. Core radius is 40 mm. Find its self inductance. **(05 Marks)**

Module-5

9 a. Write Maxwell's equations in point form and in integral form for time varying fields. **(06 Marks)**

b. The circular loop conductor at z = 0 plane has a radius of 0.1 mt and resistance of 5Ω. Given $\bar{B} = 0.2\sin 10^3 t\,\bar{a}_z$ Telsa. Find the current in the coil. **(06 Marks)**

c. Derive continuity equation from Maxwell equation. **(04 Marks)**

OR

10 a. Starting from Maxwell's equations obtain the general wave equations in electric and magnetic fields. **(08 Marks)**

b. A 50 GHz plane wave is travelling in a perfect dielectric medium has $E_0 = 20$ V/m. Find:

i) Intrinsic impedance

ii) Propogation constant

iii) Velocity of wave

iv) Magnetic field intensity.

Given $\epsilon_r = 2$ and $\mu_r = 5$. **(08 Marks)**

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15EE46

Fourth Semester B.E. Degree Examination, June/July 2017
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. Define and explain the following terms : input offset voltage, input offset current and input bias current. **(06 Marks)**

b. For the noninverting amplifier configuration, obtain expressions for closed loop gain. A_f from basic concepts, show that difference input voltage is zero ideally and hence gain A_f from this concept and input resistance R_{if} with feedback. **(10 Marks)**

OR

2 a. For the noninverting ac amplifier using single supply $R_{ia} = 50\Omega = R_0$, $C_i = C_1 = 0.1\mu F$, $R_1 = R_2 = R_3 = 100k\Omega$, $R_F = 1M\Omega$, $V_{cc} = +15V$, gain $A_f = 11$, uGB = 1MHz. Calculate bandwidth of amplifier and maximum output voltage swing. Draw the circuit diagram. **(06 Marks)**

b. What is an instrumentation amplifier? For instrumentation amplifier using transducer bridge obtain an expression for output voltage V_o in terms of change in resistance ΔR of the transducer. Draw the circuit diagram. **(10 Marks)**

Module-2

3 a. For the II order lowpass filter, show that the pass band voltage gain is equal to 1.586 and also obtain an expression for high cut off frequency f_H. Draw the circuit diagram. **(10 Marks)**

b. Explain the working and design of opamp voltage follower regulator. **(06 Marks)**

OR

4 a. Design a wide band pass filter with $f_\alpha = 200Hz$, $f_H = 1KHz$ and pass band gain = 4. Assume capacitor value for high pass section = $0.05\mu F$ and for low pass section = $0.01\mu F$. Also calculate the value of Q-factor for the filter and center frequency. Draw the circuit diagram. **(06 Marks)**

b. An LM 317regulator is to provide a 6V output from 15V supply. The load current is 200mA. Design the circuit, calculate the power dissipation. Draw the circuit diagram. Select $I_1 = 1mA$, $V_{ref} = 1.25V$. **(05 Marks)**

c. Explain the working of notch filter. Draw its frequency response. State its common application. **(05 Marks)**

Module-3

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

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

OR

6 a. Explain the circuit of noninverting comparator. Draw the different waveforms when V_{REF} is positive and negative. **(06 Marks)**

b. Design a RC phase shift oscillator using opamp. Assume C =0.1μF frequency of oscillations = 200 Hz. Draw the circuit diagram. **(06 Marks)**

c. Explain the working of voltage to converter with grounded load. **(04 Marks)**

Module-4

7 a. What is the major limitation of conventional rectifier? Explain working of precision positive and negative half wave rectifier using noninverting type. **(10 Marks)**

b. Draw and explain working of dual slope ADC. **(06 Marks)**

OR

8 a. Explain the working of R – 2R ladder DAC. Assume that binary input is 001. **(05 Marks)**

b. Draw and explain the circuit of peak detector. Draw the waveforms. **(06 Marks)**

c. An 8-bit DAC has an output voltage range of 0 – 2.55 V. Define the resolution in at least 2 ways. **(05 Marks)**

Module-5

9 a. Explain operating principle of PLL. Hence define lock range, capture range, and pull in time. **(08 Marks)**

b. An astable multivibrator is to be designed for getting rectangular waveform for t_{ON} = 0.6ms. Total time period = 1ms. Assume C = 0.1μF Draw the circuit diagram. **(08 Marks)**

OR

10 a. Explain the function of various pins of IC 555 timer. **(08 Marks)**

b. Explain PLL IC565 application as frequency multiplier and frequency synthesizer. **(08 Marks)**

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CBCS Scheme

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15MATDIP41

Fourth Semester B.E. Degree Examination, June/July 2017
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 :
$\begin{bmatrix} 1 & 2 & 3 & 2 \\ 2 & 3 & 5 & 1 \\ 1 & 3 & 4 & 5 \end{bmatrix}$ by elementary row transformations. **(06 Marks)**

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

c. Find all the eigen values and eigen vector corresponding to largest eigen value of the matrix :
$\begin{bmatrix} 1 & 1 & 3 \\ 1 & 5 & 1 \\ 3 & 1 & 1 \end{bmatrix}$. **(05 Marks)**

OR

2 a. Solve the following system of equations by Gauss elimination method :
$x + y + z = 9$
$2x + y - z = 0$
$2x + 5y + 7z = 52$. **(06 Marks)**

b. Reduce the matrix $\begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$ into its echelon form and hence find its rank. **(05 Marks)**

c. Find the inverse of the matrix $A = \begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$ using Cayley – Hamilton theorem. **(05 Marks)**

Module-2

3 a. Solve $(D^2 - 4D + 13)y = \cos 2x$ by the method of undetermined coefficients. **(06 Marks)**
b. Solve $(D^2 + 2D + 1)y = x^2 + 2x$. **(05 Marks)**
c. Solve $(D^2 - 6D + 25)y = \sin x$. **(05 Marks)**

OR

4 a. Solve $(D^2 + 1)y = \tan x$ by the method of variation of parameters. **(06 Marks)**
b. Solve $(D^3 + 8)y = x^4 + 2x + 1$. **(05 Marks)**
c. Solve $(D^2 + 2D + 5)y = e^{-x} \cos 2x$. **(05 Marks)**

Module-3

5 a. Find the Laplace transforms of :

i) $e^{-t}\cos^2 3t$ ii) $\frac{\cos 2t - \cos 3t}{t}$. **(06 Marks)**

b. Find:

i) $L\left[t^{-5/2} + t^{5/2}\right]$ ii) $L[\sin 5t \cdot \cos 2t]$. **(05 Marks)**

c. Find the Laplace transform of the function : $f(t) = E\sin\left(\frac{\pi t}{\omega}\right)$, $0 < t < \omega$, given that $f(t+\omega) = f(t)$. **(05 Marks)**

OR

6 a. Find :

i) $L[t^2 \sin t]$ ii) $L\left[\frac{\sin 2t}{t}\right]$. **(06 Marks)**

b. Evaluate : $\int_0^\infty \frac{\cos 6t - \cos 4t}{t}\,dt$ using Laplace transform. **(05 Marks)**

c. Express $f(t) = \begin{cases} \sin 2t, & 0 < t < \pi \\ 0, & t > \pi \end{cases}$, in terms of unit step function and hence find L[f(t)]. **(05 Marks)**

Module-4

7 a. Solve the initial value problem $\frac{d^2y}{dx^2} + \frac{5dy}{dx} + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transforms : i) $\frac{3(s^2-1)^2}{2s^2}$ ii) $\frac{s+1}{s^2+6s+9}$. **(05 Marks)**

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

OR

8 a. Solve the initial value problem :

$\frac{d^2y}{dt^2} + \frac{4dy}{dt} + 3y = e^{-t}$ with $y(0) = 1 = y'(0)$ using Laplace transforms. **(06 Marks)**

b. Find the inverse Laplace transform : i) $\frac{1}{s\sqrt{5}} + \frac{3}{s^2\sqrt{5}} - \frac{8}{\sqrt{5}}$ ii) $\frac{3s+1}{(s-1)(s^2+1)}$. **(05 Marks)**

c. Find the inverse Laplace transform : $\frac{2s-1}{s^2+4s+29}$. **(05 Marks)**

Module-5

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

b. A can hit a target 3 times in 5 shots, B 2 times in 5 shots and C 3 times in 4 shots. They fire a volley. What is the probability that i) two shots hit ii) atleast two shots hit? **(05 Marks)**

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

OR

10 a. Prove that $P(A \cup B) = P(A) + (B) - P(A \cap B)$, for any two events A and B. **(06 Marks)**

b. Show that the events $\overline{A}$ and $\overline{B}$ are independent, if A and B are independent events. **(05 Marks)**

c. Three 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)**

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