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15MAT41

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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. Employ Taylor's series method to find y at x = 0.1. Correct to four decimal places given $\frac{dy}{dx} = 2y + 3e^x$; y(0) = 0. **(05 Marks)**

b. Using Runge Kutta method of order 4, find y(0.2) for $\frac{dy}{dx} = \frac{y-x}{y+x}$; y(0) = 1, taking h = 0.2. **(05 Marks)**

c. If $y' = 2e^x - y$; y(0) = 2, y(0.1) = 2.010, y(0.2) = 2.040 and y(0.3) = 2.090. Find y(0.4) using Milne's predictor corrector formula. Apply corrector formula twice. **(06 Marks)**

OR

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

b. Using modified Euler's method find y at x = 0.1, given $y' = 3x + \frac{y}{2}$ with y(0) = 1, h = 0.1. Perform two iterations. **(05 Marks)**

c. Find y at x = 0.4 given $y' + y + xy^2 = 0$ and $y_0 = 1$, $y_1 = 0.9008$, $y_2 = 0.8066$, $y_3 = 0.722$ taking h = 0.1 using Adams-Bashforth method. Apply corrector formula twice. **(06 Marks)**

Module-2

3 a. Given $y'' = xy'^2 - y^2$ find y at x = 0.2 correct to four decimal places, given y = 1 and y' = 0 when x = 0, using R-K method. **(05 Marks)**

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

c. If $x^3 + 2x^2 - x + 1 = ap_0(x) + bp_1(x) + cp_2(x) + dp_3(x)$ then, find the values of a, b, c, d. **(06 Marks)**

OR

4 a. Apply Milne's method to compute y(0.8) given that $y'' = 1 - 2yy'$ and the table.

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

Apply corrector formula twice. **(05 Marks)**

b. Show 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)**

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

Module-3

5 a. Define analytic function and obtain Cauchy Riemann equation in Cartesian form. **(05 Marks)**

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

c. Discuss the transformation $w = e^z$ with respect to straight line parallel to x and y axis. **(06 Marks)**

OR

6 a. Find the analytic function whose real part is $u = \frac{x^4y^4 - 2x}{x^2 + y^2}$. **(05 Marks)**

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

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

Module-4

7 a. Find the constant c, such that the function $f(x) = \begin{cases} cx^2, & 0 < x < 3 \\ 0, & \text{otherwise} \end{cases}$ is a p.d.f. Also compute $p(1 < x < 2)$, $p(x \le 1)$, $p(x > 1)$. **(05 Marks)**

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

c. x and y are independent random variables, x take the values 1, 2 with probability 0.7; 0.3 and y take the values -2, 5, 8 with probabilities 0.3, 0.5, 0.2. Find the joint distribution of x and y hence find cov(x, y). **(06 Marks)**

OR

8 a. Obtain mean and variance of binomial distribution. **(05 Marks)**

b. The length of telephone conservation in a booth has been an exponential distribution and found on an average to be 5 minutes. Find the probability that a random call made from this booth (i) ends less than 5 minutes, (ii) between 5 and 10 minutes. **(05 Marks)**

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

Module-5

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

b. A die thrown 9000 times and a throw of 3 or 4 was observed 3240 times. Is it reasonable to think that the die is an unbiased one? **(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. A certain stimulus administered to each of the 12 patients resulted in the following change in blood pressure 5, 2, 8, −1, 3, 0, 6, −2, 1, 5, 0, 4. Can it be concluded that the stimulus will increase the blood pressure. ($t_{0.05}$ for 11 d.f = 2.201) **(05 Marks)**

b. It has been found that the mean breaking strength of a particular brand of thread is 275.6 gms with σ = 39.7 gms. A sample of 36 pieces of thread showed a mean breaking strength of 253.2 gms. Test the claim at 1+.. and 5–*l*. level of significance. **(05 Marks)**

c. A man's smoking habits are as follows. If he smokes filter cigarettes one week, he switches to non filter cigarettes the next week with probability 0.2. One the other hand, if he smokes non filter cigarettes one week there is a probability of 0.7 that he will smoke non filter cigarettes the next week as well. In the long run how often does he smoke filter cigarettes? **(06 Marks)**

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15EE42

Fourth Semester B.E. Degree Examination, Dec.2017/Jan. 2018
Power Generation and Economics

Time: 3 hrs. Max. Marks: 80

Note: *1.* Answer any FIVE full questions, choosing ONE full question from each module.
2. Missing data, if any, may be suitably assumed.

Module-1

1 a. With a neat schematic diagram explain the working hydro-electric power plant. **(06 Marks)**
b. Explain hydrograph and hydrological cycle. **(06 Marks)**
c. Mention the merits and demerits of hydroelectric power plant. **(04 Marks)**

OR

2 a. What are the types of turbines? With a neat diagram explain the working of reaction turbine. **(06 Marks)**
b. With a neat diagram explain the working of turbine governing. **(06 Marks)**
c. Mention the factors to be consider for the selection of site for hydro-electric power plant. **(04 Marks)**

Module-2

3 a. With a schematic diagram (layout) explain the working of steam power plant. **(06 Marks)**
b. Explain any three methods used for the disposal of ash in steam power plant. **(06 Marks)**
c. Mention the advantages and disadvantages of diesel power plant. **(04 Marks)**

OR

4 a. Explain how the use of regemerator, and reheater in gas turbine plants help in improvement in thermal efficiency. **(08 Marks)**
b. Describe the auxilliary equipment of diesel engine power plant. **(08 Marks)**

Module-3

5 a. With a neat diagram explain the working of main parts of nuclear reactor. **(08 Marks)**
b. What are the classification of nuclear reactors? Explain the operation of fast breeder reactor. **(08 Marks)**

OR

6 a. Explain the various methods of nuclear waste disposal. **(06 Marks)**
b. Mention the advantages and disadvantages of nuclear power plant. **(06 Marks)**
c. Mention the factors to be considered for the selection of site for nuclear power plant. **(04 Marks)**

Module-4

7 a. What is a protective relay? Explain its function in an electrical system. **(06 Marks)**
b. With a neat diagram explain the working of HRC (High Rupturing Capacity) fuse. **(06 Marks)**
c. Explain the working of rod gap arrester. **(04 Marks)**

OR

8 a. Draw the line diagram of 66/11 kV sub –station. **(06 Marks)**
b. With a neat sketch, explain ungrounded system in power system. **(06 Marks)**
c. Mention the advantages of neutral – grounding. **(04 Marks)**

Module-5

9 a. Define the following terms as applied to power system :
i) Load factor
ii) Demand factor
iii) Diversity factor
iv) Plant capacity factor. **(08 Marks)**
b. A power station is to supply three region of load whose peak loads are 20MW, 15MW and 25MW. The annual load factor is 50% and the diversity factor of the load at the station is 1.5. Determine the following :
i) Maximum demand on the station
ii) Installed capacity suggesting number of units
iii) Annual energy supplied. **(08 Marks)**

OR

10 a. What is power factor? Explain any one method of improving power factor. **(06 Marks)**
b. A power station has to supply load as follows.

Time (hours)	0 – 6	6 – 12	12 – 14	14 – 18	18 – 24
Load (MW)	30	90	60	100	50

i) Draw the load curve
ii) Draw load – duration curve
iii) Calculate the load factor. **(06 Marks)**
c. Define tariff. Explain :
i) Block rate tariff
ii) Two – part tariff. **(04 Marks)**

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15EE43

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.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. With usual notations derive an expression for the sag of a transmission line when the supports are at equal levels. **(06 Marks)**

b. Draw the line diagram of a typical transmission and distribution system indicating the standard voltage. **(05 Marks)**

c. Explain the various supporting structures used for the overhead transmission lines. **(05 Marks)**

OR

2 a. Derive an expression for string efficiency of a 3 disc string. **(06 Marks)**

b. What are the advantages of high voltage AC transmission line? **(04 Marks)**

c. The towers of height 30m and 90m respectively support a transmission line conductor at water crossing. The horizontal distance between the towers is 500m. If the tension in the conductor is 1600kg, find the minimum clearance of the conductor and water and also clearance midway between the supports. Weight of conductor is 1.5kg/m. Bases of the towers can be considered to be at water level. **(06 Marks)**

Module-2

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

b. The three conductors of a 3-phase line are arranged at the three corners of a triangle of sides 2m, 2.5m and 4.5m. Calculate the inductance per km of the line when conductors are regularly transposed. The diameter of each line conductor is 1.24cm. **(05 Marks)**

c. Explain the process of transposition of transmission lines and its advantages. **(05 Marks)**

OR

4 a. Obtain an expression for potential difference between two conductors a and b in a system of m conductors. **(06 Marks)**

b. Calculate capacitance of 100km long 3-ϕ, 50Hz, overhead transmission line consisting of 3 conductors each of diameter 2cm and spaced 2.5cm at the corners of an equilateral triangle. **(05 Marks)**

c. Describe composite conductors. **(05 Marks)**

Module-3

5 a. Discuss the nominal T. Model of a medium transmission line with appropriate circuit diagram and phasor diagram and hence obtain the expression for regulation and A B C D constant for the same. **(10 Marks)**

b. A 110kV, 50Hz, 3-phase transmission line delivers a load of 40MW at 0.85 lagging pf at the receiving end. The generalized constants of the transmission line are A = D = 0.95 $\angle 1.4°$, B = 96 $\angle 78°$ ohm, C = 0.0015 $\angle 90°$ mho. Find the regulation of the line and charging current use nominal T method. **(06 Marks)**

OR

6 a. A 3-phase short transmission line delivers 3MW at a pf of 0.8 lagging to a load. If the sending ends voltage is 33kV. Determine : i) Receiving end voltage ii) Line current iii) Transmission efficiency iv) Regulation. The resistance and reactance of each conductor are 5Ω and 8Ω respectively. **(10 Marks)**

b. Explain Ferranti effect. **(06 Marks)**

Module-4

7 a. What is meant by grading of cable? Explain capacitance grading. **(08 Marks)**

b. A single core lead covered cable has a conductor diameter of 3cm with insulation diameter of 8.5cm. The cable is insulated with two dielectrics with permittivities 5 and 3 respectively. The maximum stresses in the two dielectrics are 38kV/cm and 26kV/cm respectively then calculate radial thickness of insulating layers and the working voltage of the cable. **(08 Marks)**

OR

8 a. Explain the phenomenon of corona in overhead transmission line. **(05 Marks)**

b. Find the most economical diameter of a single core cable to be used on 66kV, 3-phase system, if the peak permissible stress is not to exceed 50kV/cm. Also find the overall diameter. **(05 Marks)**

c. Draw the cross sectional view of a single core cable and explain its construction. **(06 Marks)**

Module-5

9 a. Explain with neat sketch different failure modes of bath tub curves. **(05 Marks)**

b. Briefly explain radial and ring main distributors. **(05 Marks)**

c. Four lines A, B, C and D are connected to a common point O. Resistance of AO, BO, CO and DO are respectively 1, 2, 3 and 4Ω both 90 and return and feeding points A, B, C and D are maintained at 230, 250, 240 and 220V respectively. Find the potential of common point O assuming no load is tapped from there. **(06 Marks)**

OR

10 a. What is power quality? What are different power quality problems? **(05 Marks)**

b. Explain the term MTTF and MTBF. **(03 Marks)**

c. An electric train taking a constant current of 500A moves between the two substations 6 kms apart. The two substations are maintained at 580V and 600V respectively. The track resistance is 0.05Ω per km both 90 and return. Calculate :

i) The point of minimum potential

ii) The currents supplied by each substation at the point of minimum potential. **(08 Marks)**

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15EE44

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018

Electric Motors

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. What is back emf? Derive the armature torque equation of a DC metro. **(06 Marks)**

b. List the applications of DC motors. **(04 Marks)**

c. A 200V shunt motor with constant main field drives a load, the torque of which varies at the square of the speed. When running at 600 rpm, it takes 30A. Find the speed at which it will run and the current it will draw, if a 20Ω resistor is connected in series with the armature. Neglect the motor losses. **(06 Marks)**

OR

2 a. Draw the power flow diagram of a DC motor and derive the condition for minimum efficiency. **(06 Marks)**

b. Explain the characteristics of a DC shunt motor. **(05 Marks)**

c. Explain with circuit diagram, the armature control methods of DC series motors. **(05 Marks)**

Module-2

3 a. With neat diagram, explain the Swinburne's test on a DC motor. Mention the demerits of this test. **(05 Marks)**

b. Explain the test on a DC motor which determines the rotational losses **(05 Marks)**

c. Hopkinson's test on two machines gave the following results for full-load : line voltage = 230V, Line current excluding field current = 50A, motor armature current = 380A, field currents 5A and 4.2A. The armature resistance of each machine is 0.02Ω. Calculate the efficiency of each machine. **(06 Marks)**

OR

4 a. What is slip? Derive the maximum running torque equation of an induction motor. **(06 Marks)**

b. Draw and explain the torque–slip characteristics covering motoring, generating and breaking regions of operation. **(06 Marks)**

c. Explain the effect of rotor resistance on maximum torque and slip of an induction motor. **(04 Marks)**

Module-3

5 a. Derive the approximate equivalent circuit referred to stator of an induction motor. **(06 Marks)**

b. Explain with neat diagram the blocked rotor test on an induction motor. **(05 Marks)**

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

OR

6 a. Write the procedure of drawing the circle diagram. What information can be obtained from the circle diagram? **(06 Marks)**

b. With neat diagram, explain the construction of rotor of a double cage induction motor. **(05 Marks)**

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

Module-4

7 a. Why starter is necessary for an induction motor? With neat diagram, explain the operation of a start – Delta starter. **(06 Marks)**

b. Explain the stator voltage control of a three phase induction motor. **(05 Marks)**

c. A squirrel cage induction motor has a full-load slip of 4% and blocked rotor current of 6 times the full-load current. Find the percentage of tapping of the auto–transformer starter to give full-load torque on starting and the line current as a percentage of full–load current. **(05 Marks)**

OR

8 a. Explain with double –revolving field theory why the single phase induction motor is not self starting with phasor diagram. **(08 Marks)**

b. Explain with neat diagram, the working principle of capacitor start single phase induction motor. **(08 Marks)**

Module-5

9 a. Explain the operation of a synchronous motor under constant excitation and varying load. **(06 Marks)**

b. What is a synchronous condensor? What is its application? **(04 Marks)**

c. List the causes of hunting and effects of hunting in a synchronous motor. **(06 Marks)**

OR

10 a. With a neat diagram, explain the operation of a two–phase AC servomotor. **(08 Marks)**

b. What is a linear induction motor? Explain its principle of operation and draw the torque – speed characteristic. **(08 Marks)**

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15EE45

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Electromagnetic Field Theory

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Define field intensity at a point. Derive the expression for field intensity at a point due 'n' point charges kept in free space. **(05 Marks)**

b. Find the following :

i) Gradient of the scalar field $u = \rho^2 z \cos 2\phi$

ii) Divergence of the vector $\overline{A} = x^2 yz\,\overline{a_x} + xz\,\overline{a_z}$ **(06 Marks)**

c. If $\overline{D} = \rho\, z\, \cos^2\phi\ \overline{a_z}$ c/m², determine the volume charge density and the flux crossing the surface bound by $0 \le \phi \le 2\pi$; $0 \le \rho \le 1$; $-2 \le z \le 2$. **(05 Marks)**

OR

2 a. State and prove Gauss's law. **(06 Marks)**

b. Three field quantities are given by

$P = 2\overline{a_x} - \overline{a_z}$; $Q = 2\overline{a_x} - \overline{a_y} + 2\overline{a_z}$;

$R = 2\overline{a_x} - 3\overline{a_y} + \overline{a_z}$

Determine :

i) $\overline{Q} \cdot \overline{R} \times \overline{P}$

ii) Angle between $\overline{Q}$ and $\overline{R}$

iii) Unit vector perpendicular to both $\overline{Q}$ and $\overline{R}$. **(06 Marks)**

c. An infinite line charge with charge density 20 n c/m is kept along x = 2m and y = –4m. Find the electric field intensity at a point P (-2, -1, 4). **(04 Marks)**

Module-2

3 a. With usual notations derive the expression for energy required to assemble 'n' point charges in space. **(05 Marks)**

b. Derive the boundary conditions the interface between a conductor and free space. **(05 Marks)**

c. For a potential field $V = 2x^2y - 5z$, determine the following at a point $P(-4, 3, 6)$

i) Electric field intensity, $\overline{E}$

ii) Flux density, $\overline{D}$

iii) Volume charge density, ρ_v **(06 Marks)**

OR

4 a. Prove that $\overline{E} = -\nabla V$ in an electric field. **(04 Marks)**

b. Derive the expression for capacitance of a parallel plate capacitor. **(06 Marks)**

c. Find the work done in moving a charge of 2C from (2, 0, 0) to (0, 2, 0)m along a straight line path joining the two points if $\overline{E} = 120x\,\overline{a_x} + 4y\,\overline{a_y}$. **(06 Marks)**

Module-3

5 a. State and prove uniqueness theorem. **(05 Marks)**

b. State and explain Biot – Savart law. **(05 Marks)**

c. A semi infinite conducting planes at $\phi = 0$ and $\phi = \pi/6$ are separated by an infinitesimal insulating gap. If $V_{(\phi=0)} = 0$ and $V_{(\phi=\pi/6)} = 100V$. Calculate the V and $\overline{E}$ in the region between the plate. **(06 Marks)**

OR

6 a. Derive Poisson's and Laplace in Cartesian co-ordinates from Gauss's law in point form and write the expressions in cylindrical and spherical systems. **(06 Marks)**

b. Define vector magnetic potential and derive the expression for it. **(06 Marks)**

c. If $\overline{H} = 20\rho^2 \overline{a}\phi$ A/m, determine the current density $\overline{J}$ and the total current crossing a surface $\rho = 1$m, $0 \le \phi \le 2\pi$ and $z = 0$ in cylindrical co-ordinate system. **(04 Marks)**

Module-4

7 a. With usual notations, derive the equation for magnetic force between two differential current elements. **(06 Marks)**

b. Derive the boundary conditions at the interface between two magnetic materials of different permeabilities. **(06 Marks)**

c. Calculate the inductance of an air cored solenoid of 400 turns having 10cm diameter and 50cm length. **(04 Marks)**

OR

8 a. Define inductance. Derive the expression for the inductance of a toroid with usual notations. **(04 Marks)**

b. Derive the expression on for magnetic torque on a rectangular current loop. **(06 Marks)**

c. A point change of Q = 18nc has a velocity of 5×10^6 m/sec in the direction $0.6\overline{ax} + \cdot 75\overline{ay} + \cdot 3\overline{az}$. Find the magnitude of force exerted on the charge if

i) $\overline{E} = -3\overline{ax} + 4\overline{ay} + 6\overline{az}$ kv/m

ii) $\overline{B} = -3\overline{ax} + 4\overline{ay} + 6\overline{az}$ mWb/m^2 **(06 Marks)**

Module-5

9 a. List the Maxwell's equations for time varying fields in integral form and point form. **(04 Marks)**

b. Derive the wave equation from Maxwell's equation for free space. **(06 Marks)**

c. Do the fields $\overline{E} = E_m \sin x \sin t \,\overline{ay}$ V/m and $\overline{H} = \dfrac{Em}{\mu o} \cos x \cos t \,\overline{az}$ A/m satisfy Maxwell's equation? **(06 Marks)**

OR

10 a. State and explain Faraday's laws. **(05 Marks)**

b. State Poynting theorem. Prove that $\overline{P} = \overline{E} \times \overline{H}$. **(08 Marks)**

c. Find the frequency when the displacement current density and conduction current density are equal in a medium with $\sigma = 2 \times 10^{-4}$ ℧/m and $\epsilon_r = 81$. **(03 Marks)**

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15EE46

Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Operational Amplifiers and Linear IC's

Time: 3 hrs. Max. Marks: 80

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Standard resistance and capacitance data table may be used.
3. 741 Datasheet allowed.

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

Module-1

1 a. Draw the block diagram of Op-Amp and explain. **(08 Marks)**

b. In the circuit of AC inverting amplifier $R_{in} = 50\Omega$, $C_i = 0.1\mu F$, $R_1 = 100\Omega$, $R_F = 1k$, $R_L = 10k$ and supply voltages = ± 15V. Determine the bandwidth of the amplifier. (uGB = 10^6, K = 0.909 for 741 IC). **(08 Marks)**

OR

2 a. Derive the closed loop voltage gain equation for the voltage series feedback amplifier. **(08 Marks)**

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

Module-2

3 a. Derive the gain equation for first order low pass Butterworth filter. **(08 Marks)**

b. With diagram, explain the adjustable output regulator. **(08 Marks)**

OR

4 a. Explain in detail the all pass filter. **(08 Marks)**

b. Design an adjustable positive voltage regulator using LM317 for output voltage varying from 4 to 12V and output current of 1A. **(08 Marks)**

Module-3

5 a. Design a RC phase shift oscillator for an output frequency of 5 KHz. Use LM741 with ± 15V power supply. **(08 Marks)**

b. With circuit diagram and necessary derivation for load current, explain voltage – to – current converter with grounded load. **(08 Marks)**

OR

6 a. Explain the oscillator amplitude stabilization with necessary figures. **(08 Marks)**

b. Design a non inverting Schmitt trigger circuit to have uTP = +3V and LTP = –5V. Use 741 Op-Amp with V_{CC} = ± 15V. **(08 Marks)**

Module-4

7 a. Explain the precision full wave rectifier circuit as a combination of half wave rectifier and summing circuit. **(08 Marks)**

b. With neat circuit explain three bit R – 2R DAC. **(08 Marks)**

OR

8 a. With diagram explain the working of Op-Amp sample and hold circuit. **(08 Marks)**

b. Explain the dual slope ADC with the necessary figure. **(08 Marks)**

Module-5

9 a. With block diagram, explain phase locked loop in detail. **(08 Marks)**

b. Sketch the circuit diagram of an Op-Amp monostable multivibrator, draw the circuit waveforms and explain its operation. **(08 Marks)**

OR

10 a. Write a note on applications of PLL IC 565. **(08 Marks)**

b. Explain the Astable multivibrator circuit operation using Op-Amp. **(08 Marks)**

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Fourth Semester B.E. Degree Examination, Dec.2017/Jan.2018
Additional Mathematics – II

Time: 3 hrs. Max. Marks: 80

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

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

Module-1

1 a. Find the rank of the matrix $A=\begin{bmatrix} 2 & 3 & -1 & -1 \\ 1 & -1 & -2 & -4 \\ 3 & 1 & 3 & -2 \\ 6 & 3 & 0 & -7 \end{bmatrix}$ by applying elimentary row transformations. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $x-2y+3z=8$ and $2x+y-z=3$. **(05 Marks)**

c. Find the inverse of the matrix $\begin{bmatrix} 5 & -2 \\ 3 & 1 \end{bmatrix}$ using Cayley-Hamilton theorem. **(05 Marks)**

OR

2 a. Find the rank of the matrix $\begin{bmatrix} 1 & 3 & -1 & 2 \\ 0 & 11 & -5 & 3 \\ 2 & -5 & 3 & 1 \\ 4 & 1 & 1 & 5 \end{bmatrix}$ by reducing it to echelon form. **(06 Marks)**

b. Solve the following system of equations by Gauss-elimination method: $x+y+z=9$, $2x-3y+4z=13$ and $3x+4y+5z=40$. **(05 Marks)**

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

Module-2

3 a. Solve $(D^4-2D^3+5D^2-8D+4)y=0$. **(05 Marks)**

b. Solve $\frac{d^2y}{dx^2}-4y=\cosh(2x-1)+3^x$. **(05 Marks)**

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

OR

4 a. Solve $\frac{d^3y}{dx^3}-3\frac{d^2y}{dx^2}+4\frac{dy}{dx}-2y=e^x$. **(05 Marks)**

b. Solve $(D^2+5D+6)y=\sin x$. **(05 Marks)**

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

Module-3

5 a. Find the Laplace transform of $\cos t.\cos 2t.\cos 3t$. **(06 Marks)**

b. Find the Laplace transform $f(t)=\frac{Kt}{T}$, $0<t<\pi$, $f(t+T)=f(t)$. **(05 Marks)**

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

OR

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

b. Find the Laplace transform of a periodic function a period 2a, given that

$$f(t)=\begin{cases}t, & 0\le t<a\\ 2a-t, & a\le t<2a\end{cases}\quad f(t+2a)=f(t).$$ **(05 Marks)**

c. Express $f(t)=\begin{cases}1, & 0<t<1\\ t, & 1<t\le 2\\ t^2, & t>2\end{cases}$ in terms of unit step function and hence find its Laplace transform. **(05 Marks)**

Module-4

7 a. Find the inverse Laplace transform of (i) $\frac{(s+2)^3}{s^6}$, (ii) $\frac{s+5}{s^2-6s+13}$. **(06 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 transforms $\frac{d^2y}{dt^2}+k^2y=0$, given that y(0) = 2, y′(0) = 0. **(05 Marks)**

OR

8 a. Find the inverse Laplace transform of $\frac{4s+5}{(s+1)^2(s+2)}$. **(06 Marks)**

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

c. Using Laplace transforms solve the differential equation $y''+4y'+3y=e^{-t}$ with y(0) = 1, y′(0) = 1. **(05 Marks)**

Module-5

9 a. If A and B are any two events of S, which are not mutually exclusive then $P(A\cup B)=P(A)+P(B)-P(A\cap B)$. **(05 Marks)**

b. The probability that 3 students A, B, C, solve a problem are ½, ⅓, ¼ respectively. If the problem is simultaneously assigned to all of them, what is the probability that the problem is solved? **(05 Marks)**

c. In a class 70% are boys and 30% are girls. 5% of boys, 3% of girls are irregular to the classes. What is the probability of a student selected at random is irregular to the classes and what is the probability that the irregular student is a girl? **(06 Marks)**

OR

10 a. If A and B are independent events then prove that $\overline{A}$ and $\overline{B}$ are also independent events. **(05 Marks)**

b. State and prove Baye's theorem. **(05 Marks)**

c. A Shooter can hit a target in 3 out of 4 shots and another shooter can hit the target in 2 out or 3 shoots. Find the probability that the target is being hit:
(i) when both of them try (ii) by only one shooter. **(06 Marks)**

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