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17MAT11

First Semester B.E. Degree Examination, July/August 2021
Engineering Mathematics – I

Time: 3 hrs.

Max. Marks: 100

Note: Answer any FIVE full questions.

1 a. Find the nth derivative of $\cos x \cos 3x \cos 5x$. **(06 Marks)**
   b. If $\tan y = x$, then prove that
      $(1 + x^2)y_{n+2} + 2(n+1)xy_{n+1} + n(n+1)y_n = 0$ **(07 Marks)**
   c. Derive the angle between radius vector and the tangent. **(07 Marks)**

2 a. If $y = a\cos(\log x) + b\sin(\log x)$ then show that $x^2 y_{n+2} + (2n+1)xy_{n+1} + (n^2 + 1)y_n = 0$. **(06 Marks)**
   b. Find the pedal equation of the polar curve $\dfrac{2a}{r} = (1 + \cos\theta)$. **(07 Marks)**
   c. Find the radius of curvature for the folium of De-Cartes $x^3 + y^3 = 3axy$ at $(3a/2, 3a/2)$. **(07 Marks)**

3 a. Expand $e^{\sin x}$ using Maclaurin's theorem upto the term containing x^4. **(06 Marks)**
   b. If $U = \log\sqrt{x^2 + y^2 + z^2}$ show that $(x^2 + y^2 + z^2)[U_{xx} + U_{yy} + U_{zz}] = 1$. **(07 Marks)**
   c. If $x = r\sin\theta \cos\phi$, $y = r\sin\theta \sin\phi$, $z = r\cos\theta$ show that $J\left(\dfrac{x, y, z}{r, \theta, \phi}\right) = r^2 \sin\theta$. **(07 Marks)**

4 a. Expand $\log(1 + \cos x)$ by Maclaurin's series upto the term containing x^4. **(06 Marks)**
   b. If $u = f\left(\dfrac{x}{y}, \dfrac{y}{z}, \dfrac{z}{x}\right)$, prove that $x\dfrac{\partial u}{\partial x} + y\dfrac{\partial u}{\partial y} + z\dfrac{\partial u}{\partial z} = 0$ **(07 Marks)**
   c. If $u = \dfrac{yz}{x}$, $v = \dfrac{zx}{y}$, $w = \dfrac{xy}{z}$ show that $\dfrac{\partial(u, v, w)}{\partial(x, y, z)} = 4$ **(07 Marks)**

5 a. A particle moves along the curve $x = t^3 - 4t$, $y = t^2 + 4t$, $z = 8t^2 - 3t^3$ where 't' denotes time. Find the component of its acceleration at $t = 2$ along the tangent. **(06 Marks)**
   b. Find $\operatorname{div}\vec{F}$ and $\operatorname{curl}\vec{F}$ where $\vec{F} = \nabla(x^3 + y^3 + z^3 - 3xyz)$. **(07 Marks)**
   c. Prove that $\operatorname{div}(\operatorname{curl}\vec{A}) = 0$. **(07 Marks)**

6 a. A particle moves along a curve whose parametric equations are $x = e^{-t}$, $y = 2\cos 3t$, $z = 2\sin 3t$. Find the velocity and acceleration at any time 't' and also their magnitudes at $t = 0$. **(06 Marks)**
   b. If $\vec{A} = xz^3 i - 2x^2 yzj + 2yz^4 k$ find $\nabla \cdot \vec{A}$ and $\nabla \cdot (\nabla \times \vec{A})$ at the point $(1, -1, 1)$. **(07 Marks)**
   c. Find the directional derivatives of $\phi = \dfrac{xz}{x^2 + y^2}$ at $(1, -1, 1)$ along $i - 2j + k$. **(07 Marks)**

7 a. Obtain the reduction formula for

$\int \cos^n x$ and hence evaluate $\int_0^{\pi/2} \cos^n x\, dx$ (06 Marks)

b. Solve $(x^2 + y^2 + x)\, dx + xy\, dy = 0$ (07 Marks)

c. Find the orthogonal trajectories of the family of curves $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2 + \lambda} = 1$ where λ is a constant. (07 Marks)

8 a. Evaluate $\int_0^{\pi/6} \cos^4 3x \sin^2 6x$ using reduction formula. (06 Marks)

b. Solve $\dfrac{dy}{dx} + \dfrac{x + 3y - 4}{3x + 9y - 2} = 0$ (07 Marks)

c. Find the orthogonal trajectories of the family of curves $\left(r + \dfrac{k^2}{r}\right)\cos\theta = a$, 'a' being parameter. (07 Marks)

9 a. Solve the following system of equations by Gauss-Seidel method to obtain the final solution correct to three decimal places.
$x + y + 54z = 110$, $27x + 6y - z = 85$, $6x + 15y + 2z = 72$. (06 Marks)

b. Reduce the matrix $A = \begin{bmatrix} -1 & 3 \\ -2 & 4 \end{bmatrix}$ to diagonal form. (07 Marks)

c. Find the numerically largest eigen value and the corresponding eigen vector of the following matrix using power method

$A = \begin{bmatrix} 4 & 1 & -1 \\ 2 & 3 & -1 \\ -2 & 1 & 5 \end{bmatrix}$ taking initial approximation as $[1 \quad 0.8 \quad -0.8]^T$ (07 Marks)

10 a. Solve by Gauss elimination method $2x + y + 4z = 12$, $4x + 11y - z = 33$, $8x - 3y + 2z = 20$. (06 Marks)

b. Diagonalize the matrix $\begin{bmatrix} -19 & 7 \\ -42 & 16 \end{bmatrix}$. (07 Marks)

c. Using Rayleigh's power method find the numerically largest eigen value and the corresponding eigen vector of the matrix

$A = \begin{bmatrix} 25 & 1 & 2 \\ 1 & 3 & 0 \\ 2 & 0 & -4 \end{bmatrix}$ by taking $[1 \quad 0 \quad 0]^T$ as the initial vector. (07 Marks)

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USN ☐☐☐☐☐☐☐☐☐☐ 　　　　　　　　　　　　　　17MAT21

Second Semester B.E. Degree Examination, July/August 2021
Engineering Mathematics – II

Time: 3 hrs. 　　　　　　　　　　　　　　　　　　　　　　　Max. Marks: 100

Note: Answer any FIVE full questions.

1 　a. 　Solve $(D^3 + 6D^2 + 11D + 6)y = 0$ 　　　　　　　　　　　　　　**(06 Marks)**
　　b. 　Solve $y'' + 2y' + y = e^x$ 　　　　　　　　　　　　　　　　　**(07 Marks)**
　　c. 　Using the method of undetermined coefficients, solve $y'' - 5y' + 6y = e^{3x} + x$ 　**(07 Marks)**

2 　a. 　Solve $\dfrac{d^2y}{dx^2} - 4\dfrac{dy}{dx} + 13y = e^{3x}$ 　　　　　　　　　　**(06 Marks)**

　　b. 　Solve $\dfrac{d^2y}{dx^2} + 5\dfrac{dy}{dx} + 6y = x^2$ 　　　　　　　　　　　**(07 Marks)**

　　c. 　Solve $\dfrac{d^2y}{dx^2} + y = \tan x$, by the method of variation of parameters. 　**(07 Marks)**

3 　a. 　Solve $x\dfrac{d^2y}{dx^2} - \dfrac{2y}{x} = x + \dfrac{1}{x^2}$. 　　　　　　　　　　**(06 Marks)**

　　b. 　Solve $p - \dfrac{1}{p} = \dfrac{x}{y} - \dfrac{y}{x}$. 　　　　　　　　　　　　**(07 Marks)**

　　c. 　$(p-1)e^{3x} + p^3 e^{2y} = 0$ by taking the substitution $U = e^x$, $V = e^y$ by reducing into Clairaut's form. 　　　　　　　　　　　　　　　　　　**(07 Marks)**

4 　a. 　Solve $(2x + 1)^2 y'' - 3(2x + 1)y' + 16y = 8(2x + 1)^2$ 　　　　　**(06 Marks)**

　　b. 　Solve $p = \tan\left(x - \dfrac{p}{1 + p^2} \right)$ 　　　　　　　　　　　　**(07 Marks)**

　　c. 　Modify the equation into Clairaut's form and hence solve it $xp^2 - py + kp + a = 0$. **(07 Marks)**

5 　a. 　Form the PDE by eliminating the arbitrary function f from $Z = e^{ax+by} f(ax - by)$. 　**(06 Marks)**

　　b. 　Solve $\dfrac{\partial^2 z}{\partial x^2} = a^2 z$ under the conditions when $x = 0$ $\dfrac{\partial z}{\partial x} = a\sin y$, $z = 0$. 　**(07 Marks)**

　　c. 　Find the solution of one dimensional wave equation, using the method of separation of variables. 　　　　　　　　　　　　　　　　　　　　　**(07 Marks)**

6 　a. 　Form the PDE by eliminating the arbitrary functions in the form $Z = xf_1(x + t) + f_2(x + t)$ 　　　　　　　　　　　　　　　　　　　　　　**(06 Marks)**

　　b. 　Solve $\dfrac{\partial^2 z}{\partial x \partial y} = \dfrac{x}{y}$ subject to the conditions $\dfrac{\partial z}{\partial x} = \log_e x$ when $y = 1$ and $z = 0$ when $x = 1$.

　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　　(07 Marks)

　　c. 　Derive one dimensional heat equation in the form $\dfrac{\partial u}{\partial t} = c^2 \dfrac{\partial^2 u}{\partial x^2}$. 　**(07 Marks)**

7 a. Evaluation $\iint xy\,dx\,dy$ over the positive quadrant of the circle $x^2 + y^2 = a^2$. **(06 Marks)**

   b. Evaluate $\int\limits_{0}^{\pi/2} \int\limits_{0}^{a\sin\theta} \int\limits_{0}^{\frac{a^2-r^2}{a}} r\,dr\,d\theta\,dz$ **(07 Marks)**

   c. Derive the relation $\beta(m,n) = \dfrac{\Gamma(m)\Gamma(n)}{\Gamma(m+n)}$ with usual notations. **(07 Marks)**

8 a. Evaluate $\iint xy\,dx\,dy$ taken over the region bounded by $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ and $\dfrac{x}{a} + \dfrac{y}{b} = 1$. **(06 Marks)**

   b. Find by double integration the area enclosed by the curve $r = a(1+\cos\theta)$ between $\theta = 0$ and $\theta = \pi$. **(07 Marks)**

   c. Evaluate $\int\limits_{0}^{\pi/2} \sqrt{\cot\theta}\; d\theta$ by expressing in terms of gamma function. **(07 Marks)**

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

   b. Find the Laplace transform of the full wave rectifier $f(t) = E\sin\omega t,\ 0 < t > \pi/\omega$ having period π/ω. **(07 Marks)**

   c. Find the inverse transform of $\log\sqrt{\dfrac{s^2+1}{s^2+4}}$. **(07 Marks)**

10 a. Express the function $f(t) = \begin{cases} \pi - t, & 0 < t \leq \pi \\ \sin t, & t > \pi \end{cases}$, in terms of unit step function and hence find its Laplace transforms. **(06 Marks)**

   b. Employ Laplace transform to solve the equation $y'' + 5y' + 6y = 5e^{2x}$, $y(0) = 2$, $y'(0) = 1$. **(07 Marks)**

   c. Using convolution theorem, obtain the inverse Laplace transform of the function $\dfrac{1}{(s^2+a^2)^2}$. **(07 Marks)**

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USN [| | | | | | | | |]   17CHE12/22

First/Second Semester B.E. Degree Examination, July/August 2021
Engineering Chemistry

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1   a. Derive Nernst equation for single electrode potential.   **(08 Marks)**
    b. Describe the construction and working of calomel electrode.   **(06 Marks)**
    c. Explain the following battery characteristics :
        i) capacity   ii) cycle life.   **(06 Marks)**

2   a. Explain the construction and working of nickel – Metal hydride battery.   **(08 Marks)**
    b. Discuss the construction of Zinc – air battery.   **(06 Marks)**
    c. The EMF of the cell Hg | $Hg(NO_3)$ (0.01m) ‖ $Hg(NO_3)_2$(0.10m) | Hg was found to be 0.0295 V at 298K, what is the valency of mercury?   **(06 Marks)**

3   a. What is metallic corrosion? Discuss the electro chemical theory of corrosion.   **(08 Marks)**
    b. How does the following factors affect the rate of corrosion?
        i)   Nature of corrosion product
        ii) P^H.   **(06 Marks)**
    c. What is metal finishing? Mention its technological importance.   **(06 Marks)**

4   a. What is electroless plating? Discuss the electro less plating of copper on PCB.   **(08 Marks)**
    b. Give the principle of cathodic protection. Explain sacrificial anode method with example.
                                                                                            (06 Marks)
    c. Explain differential metal corrosion with example.   **(06 Marks)**

5   a. Define cross calorific value and explain determination of calorific value of a solid fuel using bomb calorimeter.   **(08 Marks)**
    b. Explain the modules, panels and arrays of photo voltaic cells.   **(06 Marks)**
    c. Define Knocking and explain its mechanism.   **(06 Marks)**

6   a. What is Photo Voltaic cell? Explain the constriction and working PV cell.   **(08 Marks)**
    b. Define reformation. Explain reformation of petrol with any four examples.   **(06 Marks)**
    c. Discuss the preparation of bio diesel. Mention its advantages.   **(06 Marks)**

7   a. What is polymerization? Explain addition and condensation polymerization with example.
                                                                                            (08 Marks)
    b. What is glass transition temperature? Explain any two factors affecting T_g.   **(06 Marks)**
    c. Give the synthesis of :
        i)   PMMA
        ii) Epoxy resin.   **(06 Marks)**

8 a. Explain the free radical mechanism taking vinyl chloride as example. (08 Marks)
   b. What are polymer composites? Explain the preparation of carbon fibre. (06 Marks)
   c. Write synthesis of polyurathane and polycarbonate. (06 Marks)

9 a. Define COD. Discuss the experimental determination of COD of waste water. (08 Marks)
   b. Discuss the softening of water by ion exchange process. (06 Marks)
   c. What are nano materials? Explain the synthesis of nano materials by Sol-gel method. (06 Marks)

10 a. Write a note on :
      i) Carbon nanotubes
      ii) Dendrimers. (08 Marks)
   b. Explain boiler scale and sludge formation. Mention any two disadvantages. (06 Marks)
   c. What are fullerenes? Explain the synthesis. (06 Marks)

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CBCS SCHEME

USN [ ][ ][ ][ ][ ][ ][ ][ ][ ][ ]   **17PCD13/23**

First/Second Semester B.E. Degree Examination, July/August 2021
Programming in C and Data Structures

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1 a. Explain the structure of C program with an example.   **(05 Marks)**
   b. List all the arithmetic operators and write a C program to demonstrate arithmetic operators.
                                                                                              (10 Marks)
   c. What is type conversion? Explain two types of type conversion with an example in C language.   **(05 Marks)**

2 a. Explain different types of input and output functions.   **(10 Marks)**
   b. Classify the following as valid/Invalid variable. If invalid give reasons.
      i) num2   ii) $sum1   iii) tadd   iv) a_2 v) auto.   **(05 Marks)**
   c. Write a C program which takes as input P, T, R compute the simple interest and display the result.   **(05 Marks)**

3 a. Write a C program to find the roots of quadratic equation.   **(10 Marks)**
   b. Explain different types of looping statements with an example.   **(10 Marks)**

4 a. Write a C program to find largest of two numbers using ternary operator.   **(05 Marks)**
   b. Write a C program to print the following series.

1				
2	2			
3	3	3		
4	4	4	4	
5	5	5	5	5

                                                                                              (05 Marks)
   c. Mention and explain different types of unconditional statements with an example. **(10 Marks)**

5 a. Write a C program to find the product of two matrices by checking the compatibility of order matrices.   **(10 Marks)**
   b. Define an array? Write a syntax for declaring single dimensional array and initialize the same with suitable example.   **(10 Marks)**

6 a. Define function. Explain function declaration, function definition and calling function with an example.   **(10 Marks)**
   b. Write a C program to read a string form the keyboard and count the number of vowels and consonants.   **(05 Marks)**
   c. Illustrate actual parameters and formal parameters with an example.   **(05 Marks)**

7 a. Explain the concept of array of structure with a suitable C program. **(10 Marks)**
   b. Write a C program to maintain a record of "n" student details using an array of structures with four fields (Roll no, Name, Marks and Grade), each field is of an appropriate data type. Print the marks of the student of given student name as input. **(10 Marks)**

8 a. Explain typedef with suitable example. **(05 Marks)**
   b. Explain fprintf( ) and fscanf( ) functions with syntax, give an example. **(05 Marks)**
   c. Write a C program to create a new file called "output·txt" and copy the contents of files "studentname·txt" and "USN·txt" into output file. Display the contents of output file "output·txt" on the screen. **(10 Marks)**

9 a. What is a pointer? Write a program in C to find the sum and mean of all elements in an array using pointers. **(10 Marks)**
   b. Explain Malloc( ) and Calloc( ) functions with an example. **(05 Marks)**
   c. Define stack. List the application of stack. **(05 Marks)**

10 a. What is preprocessor directive? Explain #define and #include preprocessor directive with an example. **(10 Marks)**
   b. Define queue. List the operations of queue. **(05 Marks)**
   c. Discuss advantages and disadvantages of pointers. **(05 Marks)**

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CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   17ELE15/25

First/Second Semester B.E. Degree Examination, July/August 2021
Basic Electrical Engineering

Time: 3 hrs.   Max. Marks: 100

Note: *Answer any FIVE full questions.*

1   a.   State and explain Kirchoff's laws with one illustration each.   **(06 Marks)**
    b.   For the network shown below in Fig.Q1(b), determine all the branch currents.
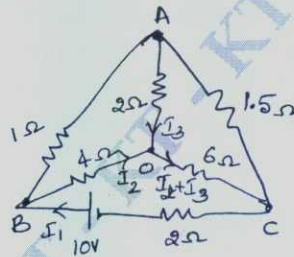

Fig.Q1(b)   **(08 Marks)**

    c.   State the following :
         i) Flemings right hand rule
         ii) Flemings left hand rule.   **(06 Marks)**

2   a.   State explain Faraday's Laws of electromagnetic induction.   **(06 Marks)**
    b.   Find the inductance of a coil of 200 turns wound on a paper core tube of 25cm length and
         5cm radius. Also calculate energy stored in it if current rises from zero to 5A ($\mu_r = 1$).
                                                                          (08 Marks)
    c.   Obtain the relation between self inductance, mutual inductance and co-efficient of coupling.
                                                                          (06 Marks)

3   a.   With a neat diagram, explain the construction of a DC generator.   **(08 Marks)**
    b.   With neat sketches explain the characteristics of a DC shunt motor.   **(06 Marks)**
    c.   A 4pole, 100V shunt generator with lap connected armature, having field and armature
         resistance of 50Ω and 0.1Ω respectively, supplies sixty, 100V, 40W lmaps. Calculate the
         total armature current, the current per path and the generated emf. Allow a contact drop of
         1volt per brush.   **(06 Marks)**

4   a.   With a neat diagram explain the construction and working of an induction type energymeter.
                                                                          (06 Marks)
    b.   A four-pole DC shunt motor takes 22.5A from a 250V supply. $R_a = 0.5\Omega$ and $R_f = 125\Omega$.
         The armature is wave-wound with 300 conductors. If the flux per pole is 0.02wb, calculate :
         i)   The speed
         ii) Torque developed
         iii) Power developed.   **(08 Marks)**
    c.   Derive the expression for armature torque developed in a DC motor.   **(06 Marks)**

5 a. With a neat connection diagram and switching table, explain 3 way control of lamp.
(06 Marks)

b. Obtain the expression for the current through the pure inductor, if the voltage across it is $v = V_m \sin\omega t$.
(06 Marks)

c. Two impedances $20|{-}45°\Omega$ and $30|30°\Omega$ are connected in series across a certain AC supply and the resulting current is found to be 10Amps. If the supply voltage remains unchanged calculate the supply current when the two impedances are connected in parallel.
(08 Marks)

6 a. Write a short note on :
i) Necessity of earthing
ii) Precautions to be taken to prevent electric shock.
(08 Marks)

b. A series circuit with R = 10Ω, L = 50mH and C = 100µF is supplied with 200V, 50Hz. Find:
i) The impedance ii) Current iii) Power iv) Power factor.
(06 Marks)

c. Define real power, reactive power, apparent power and power factor.
(06 Marks)

7 a. Obtain the relationship between line and phase voltage and current in a 3ϕ balanced star connected system.
(08 Marks)

b. A 440V, 3 phase AC motor has an output of 80Hp and operates at a power factor of 0.866 with an efficiency of 90% calculate :
i) The current in each phase of the motor if the motor is delta connected.
ii) The readings of the two wattmeters connected in the lines to measure the input power.
(06 Marks)

c. With usual notation derive the expression for EMF equation of an alternator.
(06 Marks)

8 a. Show that the power in a balanced 3-phase circuit can be measured by 2 wattmeter. Draw the circuit and vector diagram.
(08 Marks)

b. Mention different types of synchronous generator and explain the construction of each type.
(06 Marks)

c. A 3-phase, 50Hz 16-pole generator with star connected winding has 144 slots with 10 conductor/slot. The flux | pole 24.8mwb is sinusoidally distributed. The coils are full pitched. Find : i) speed ii) the line emf. Given $k_d = 0.96$.
(06 Marks)

9 a. Derive the condition for which the efficiency of a transformer is maximum. Also derive the emf equation of a transformer.
(08 Marks)

b. If the electromotive force in the stator of an 8 pole induction motor has a frequency of 50Hz and that in the rotor 1.5Hz, at what speed is the motor running and what is the slip?
(06 Marks)

c. Define slip. Derive an expression for frequency of rotor current.
(06 Marks)

10 a. With neat diagram, explain the construction of types of rotor of 3ϕ induction motor.
(06 Marks)

b. A 600KVA single phase transformer has an efficiency of 92% both at full–load and half load at unity power factor. Determine its efficiency at 75% of full load at 0.9 power factor lag.
(08 Marks)

c. Explain why induction motor never runs at synchronous speed.
(06 Marks)

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