FACULTY OF ENGINEERING

B.E. II - Semester (AICTE) (BACKLOG) Examination, March / April 2022

Subject: Mathematics - II
(Common for All Branches)

Time: 3 Hours **Max. Marks: 70**

Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each question carries 14 marks.
(ii) Answer to each question must be written in one place only and in the same order as they occur in the question paper.
(iii) Missing data, if any, may be suitably assumed.

1 (a) Find the rank of the matrix $A=\begin{pmatrix}1 & 2 & 3\\ 4 & 5 & 6\\ 7 & 8 & 9\\ 0 & 2 & 1\end{pmatrix}$.

(b) Find the values of a and b so that the differential equation $(x^2+axy-2y^2)dx+(y^2-4xy+bx^2)dy=0$ is exact.

(c) Find a differential equation of the form $ay''+by'+cy=0$ for which the functions $1, e^{-x}$ are solutions.

(d) Define error and complementary functions.

(e) Find $L^{-1}\left\{\dfrac{1}{s^2+2s+2}\right\}$.

(f) State Cayley-Hamilton theorem.

(g) Solve $2x^2y''+xy'-6y=0$.

2 (a) Determine whether the vectors (1,1,0,1), (1,1,1,1), (4,4,1,1,), (1,0,0,1) are linearly dependent.

(b) Reduce the quadratic form $Q=3x^2-2y^2-z^2-4xy+12yz+8xz$ into canonical form and find the nature of the quadratic form.

3 (a) Solve $(x^2y-2xy^2)dx-(x^3-3x^2y)dy=0$.

(b) Find the general solution of the Riccati's equation $y'=4xy^2+(1-8x)y+4x-1$, if $y=1$ is a particular solution.

4 (a) Solve $y''+2y'+2y=x^3+6\cos^2 x$.

(b) Apply the method of variation of parameters to solve $y''+y=\tan x$.

5 (a) Evaluate the following integrals using Beta and Gamma functions.

(i) $\int_0^\infty 2^{-4x^2}dx$ (ii) $\int_{-1}^{1}(1-x^2)^n dx$, where n is a positive integer.

(b) Using Rodrigue's formula, find $P_0(x), P_1(x), P_2(x), P_3(x)$ and hence express $6P_0(x)-7P_1(x)+8P_2(x)+3P_3(x)$ as a polynomial in x.

6 (a) Find the Laplace transform of the following functions.

(i) $\frac{\sinh t}{t}$ (ii) $te^{-t}\cos t$.

(b) Apply Laplace transforms to solve $y'' + 3y' + 2y = e^{-t}, \quad y(0) = 0,\ y'(0) = -1$.

7 (a) Find the characteristic equation of the matrix $A = \begin{pmatrix} 2 & -1 & 2 \\ -1 & 2 & -1 \\ 1 & -1 & 2 \end{pmatrix}$ and hence find A^4.

(b) Find the series solution of $(1-x^2)y'' - 2xy' + 6y = 0$ about $x = 0$.

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Code No. D-2010/O/AICTE

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(Missing data, if any, may be suitably assumed)

PART – A

Note: Answer all questions. **(10 x 2 = 20 Marks)**

1. Define rank of the matrix and find the rank of the matrix A= $\begin{bmatrix} 2 & 6 \\ 1 & 3 \end{bmatrix}$
2. Let $V_1 = (1,-1,0)$ $V_2 = (0,1,-1)$ and $V_3 = (0,0,1)$ be elements of R^3. Show that the set of vectors $\{V_1, V_2, V_3\}$ is linearly independent.
3. Define exact differential equation.
4. Obtain the singular solution of the equation $y = xy' + (y')^2$.
5. Find a differential equation of the form $ay'' + by' + cy = 0$, for which the function $1, e^{-2x}$ are solutions.
6. Define Cauchy- Euler equation.
7. Express the sums of Legendre polynomial $8P_4(x) + 2P_2(x) + P_0(x)$ in terms of powers of x.
8. Show that $\Gamma\left(-\frac{1}{2}\right) = -2\sqrt{\pi}$
9. Find the Laplace transform of the function $t\, sin4t$
10. Define convolution theorem in Laplace transform.

PART – B

Note: Answer any five questions. **(5 x 10 = 50 Marks)**

11. (a) Investigate the values of λ and μ so that the equations $2x + 3y + 5z = 9$, $7x + 3y - 2z = 8$, $2x + 3y + \lambda z = \mu$, have (i) no solution (ii) a unique solution and (iii) an infinite number of solutions.

    (b) Reduce the quadratic form $2xy + 2yz + 2zx$ into canonical form.
12. (a) Solve the initial value problem $e^x(cosy\, dx - siny\, dy) = 0$, $y(0) = 0$.

    (b) Solve the differential equation $\frac{dy}{dx} - y = y^2(sinx + cosx)$.
13. (a) Solve $(D^2 + 3D + 2)y = xe^x\, sinx$.

    (b) It is known that e^{-2x} is a solution of the differential equation $y'' - y' - 6y = 0$. Find the second linearly independent solution and write the general solution.

14. (a) Prove that $(n+1)\ P_{n+1}\ (x) = (2n+1)\ x\ \ P_n(x) - nP_{(n-1)}(x)$.

(b) Evaluate $\int_0^\infty \sqrt{x}\ \ e^{-x^2} dx$.

15. (a) Use the Laplace transforms to solve the initial value problem

$y'' + 2y' + 5y = 1 + t, y(0) = 4, y'(0) = -3$.

(b) Find the inverse Laplace transform of the function $\frac{5s+6}{(s-1)^2}$.

16. (a) Find the general solution of the equation $y'' - 2y' - 3y = 3e^{2x}$.

(b) Find the eigen values and the corresponding eigen vectors of the Matrix

$$A = \begin{bmatrix} 1 & 2 & 2 \\ 0 & 2 & 1 \\ -1 & 2 & 2 \end{bmatrix}$$

17. Solve $(D^2 - 2D - 3)y = x + e^{2x}\ cos2y + sin\ 5x$.

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Code No. D-3508/CBCS/BL

FACULTY OF ENGINEERING
B.E. II - Semester (CBCS) (Backlog) Examination, March / April 2022

Subject: Engineering Physics – II
(Common for All Branches)

Time: 3 Hours **Max. Marks: 70**

(Missing data, if any, may be suitably assumed)

PART – A

Note: Answer all questions. **(10 x 2 = 20 Marks)**

1. Define Inter planar spacing?
2. Define Fermi energy?
3. Explain the concept of a hole in a semiconductor?
4. What are ferrites and give two applications of them.
5. Explain the basic principle of Atomic Force Microscopy.
6. What are dielectrics? Give few examples.
7. Mention any four applications of Nano materials.
8. What is Meissner effect?
9. Give two differences between bulk, thin films and nano materials?
10. What are soft and hard magnetic materials.

PART – B

Note: Answer any five questions. **(5 x 10 = 50 Marks)**

11. Deduce Bragg's law? Explain powder diffraction method for determination of lattice constant.
12. Deduce an expression for equilibrium concentration of Schottky defects in crystals.
13. Explain Hall effect? Deduce an expression for Hall Co-efficient?
14. What is electronic polarization? Obtain an expression for electronic polarizability.
15. Explain the ball milling method of preparing nano materials and give some applications.
16. Explain the hysteresis seen in ferromagnetic materials and how is it useful to explain the nature of different magnetic materials.
17. Discuss in detail the general properties of super conductors.

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