

## FACULTY OF ENGINEERING

B. E. (AICTE) II – Semester (Suppl.) Examination, December 2019

Subject: Mathematics - II

Time: 3 hours

Max. Marks: 70

**Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.****PART – A** (20 Marks)

1. Reduce the following matrix to row echelon form and find its rank. 2

$$\begin{bmatrix} 1 & -2 & 3 \\ 2 & 1 & 2 \\ 5 & -5 & 11 \end{bmatrix}$$

2. Find the spectral radius of the matrix. 2

$$\begin{bmatrix} 3 & 2 & 1 \\ 0 & 2 & 0 \\ 1 & 2 & 3 \end{bmatrix}$$

3. Under what condition the following differential equation is exact. 2

$$[f(x) + g(y)] dx + [h(x) + d(y)] dy = 0$$

4. Write Riccati's equation and Clairaut's equation. 2

5. Find the orthogonal trajectories of the family of curve  $x^2 + 16y^2 = c$ . 2

6. Find the solution of the initial value problem. 2

$$4y'' - 8y' + 3y = 0; \quad y(0) = 1; \quad y'(0) = 3$$

7. It is known that  $\frac{1}{x}$  is a solution of the differential equation  $x^2y'' + 4xy' + 2y = 0$ . Find the second linearly independent solution and write the general solution. 2

8. Using Beta and Gamma functions, evaluate the integral 2

$$\int_{-1}^1 (1-x^2)^n dx \quad \text{where 'n' is a positive integer.}$$

9. Express  $3P_3(x) + 2P_2(x) + 4P_1(x) + 5P_0(x)$  as a polynomial in x, where  $P_m(x)$  is the Legendre Polynomial of order 'm'. 2

10. Solve the following initial value problem using Laplace transform 2

$$y'' + 4y = 0; \quad y(0) = 1; \quad y'(0) = 6.$$

**PART – B** (50 Marks)

11. Find the eigenvalues and the corresponding eigenvectors of the given matrix. 10

$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & 2 & 1 \\ 2 & 0 & 3 \end{bmatrix}$$

12. (a) Define the integrating factor of the non-homogeneous first order linear equation 1

$$\frac{dy}{dx} + p(x)y = r(x).$$

- (b) The initial value problem governing the current 'i' flowing in a series RL circuit when a voltage  $v(t) = t$  is applied, is given by 4

$$iR + L \frac{di}{dt} = t, \quad t \geq 0; \quad i(0) = 0$$

where R and L are constants. Find the current  $i(t)$  at time t.

- (c) Find the general solution of the equation  $\frac{dy}{dx} = 2xy^2 + (1-4x)y + 2x - 1$ , if  $y=1$ , is a solution. 5

13. (a) Show that  $e^x, e^{2x}, e^{3x}$  are the fundamental solutions of 5

$$y''' - 6y'' + 11y' - 6y = 0 \text{ on any interval I.}$$

- (b) Find the general solution of the equation 5

$$y'' + y = \sec x \text{ by the method of variation of parameters.}$$

14. (a) Show that the following recurrence relation. 8

$$(n+1) P_{n+1}(x) = (2n+1)x P_n(x) - n P_{n-1}(x).$$

Using above relation obtain Legendre Polynomials  $P_2(x); P_3(x); P_4(x)$  given that  $P_0(x)=1$  and  $P_1(x) = x$ .

- (b) Show that  $P_2(x)$  and  $P_3(x)$  are orthogonal functions on  $[-1, 1]$ . 2

15. (a) Find the Laplace transformation of the Piecewise continuous function 5

$$f(t) = \begin{cases} 0; & 0 \leq t \leq 2 \\ k; & t \geq 2; \quad k \text{ is a constant} \end{cases}$$

- (b) Find the inverse Laplace transform of 5

$$\frac{5s + 3}{(s-1)(s^2 + 2s + 5)}$$

16. Reduce the quadratic form  $Q = 2(xy + yz + zx)$  to canonical form by orthogonal transformation and find its nature. 10

17. (a) Find the orthogonal trajectories of the family of the Confocal Conics

$$\frac{x^2}{a^2} + \frac{y^2}{a^2 + \lambda} = 1; \text{ where } \lambda \text{ is the parameter.} \quad 5$$

- (b) Find the orthogonal trajectories of the cardioids  $r = a(1 - \cos \theta)$ . 5

**FACULTY OF ENGINEERING**

**B. E. (CBCS) II – Semester (Backlog) Examination, December 2019**

**Subject: Engineering Physics - II**

**Time: 3 hours**

**Max. Marks: 70**

**Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.**

**PART – A (20 Marks)**

1. What is meant by Crystalline material, write its two properties.
2. Classify the solids on the basis of Band theory.
3. What are para magnetic material? Mention two of them.
4. Define Transition temperature and now what is its highest value?
5. Write any two applications of P-N Junction diode.
6. Write 4 types of Polarizations.
7. Define Raman effect.
8. Discuss about Nanomaterials.
9. Explain about Top-down method of Nanomaterial preparation.
10. What are different types of carbon Nanotubes.

**PART – B (50 Marks)**

11. Define Bragg's law and explain powder method
12. Derive equation for concentration of Franckel defects.
13. Explain Weiss Molecular field theory and discuss about soft and hard magnetic materials.
14. What are Type-I and Type-II super conductors? Discuss BCS theory.
15. Derive an equation for carrier concentration in intrinsic semi conductor.
16. Explain about Atomic force Microscopy and SEM.
17. Write general properties of Nanomaterials, discuss the preparation of these materials by Sol-gel method.

\*\*\*\*\*