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FACULTY OF ENGINEERING
B.E. II-Semester (AICTE) (Backlog) (New) Examination, February / March 2023
Subject: Mathematics-II

Time: 3 Hours

Max. Marks: 70

- Note: (i) First question is compulsory and answer any four questions from the remaining six questions. Each questions carries 14 Marks.
(ii) Answer to each question must be written at 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) Determine whether the vectors $(1, -1, 2)$, $(2, 3, 0)$, $(4, 1, 4)$ are linearly dependent.
(b) Find the singular solution of the Clairaut's equation $y = x \frac{dy}{dx} + \left(\frac{dy}{dx}\right)^2$.
(c) Solve $x^2 y'' - 2xy' + 2y = 0$.
(d) Prove that $\beta(m, n) = 2 \int_0^{\frac{\pi}{2}} \sin^{2m-1} \theta \cos^{2n-1} \theta \, d\theta$.
(e) Find $L\left\{\frac{\sin ht}{t}\right\}$.
(f) Find the rank of matrix $A = \begin{bmatrix} 1 & 0 & 2 & 3 \\ 0 & -1 & 2 & 3 \\ 2 & 3 & 4 & 5 \end{bmatrix}$.
(g) Find the orthogonal trajectories of the family of curves $x^2 - y^2 = c$, where c is a parameter.
2. Reduce the quadratic form $Q = 3x^2 + 5y^2 + 3z^2 - 2xy - 2yz + 2zx$ to canonical form and find its nature.
3. (a) Solve $(3xy - 2y^2)dx + (x^2 - 2xy)dy = 0$.
(b) Solve $(x + 2y^3) \frac{dy}{dx} = y$.
4. (a) Find the general solution of $\frac{d^2 y}{dx^2} - 7 \frac{dy}{dx} + 6y = e^{2x}(1+x)$.
(b) Using the method of variation of parameters, solve $\frac{d^2 y}{dx^2} + y = x$.
5. (a) Prove that $\beta(m, n) = \frac{\Gamma m \Gamma n}{\Gamma(m+n)}$.
(b) Find the series solution of $y' - 4y = 0$ about $x = 0$.
6. (a) Find $L\{t \sin 2t \cos 4t\}$.
(b) Using Laplace transform, solve $\frac{d^2 y}{dt^2} + 2 \frac{dy}{dt} - 3y = 0$, $y(0) = 0$, $y'(0) = 4$.
7. (a) Verify Cayley-Hamilton theorem for $A = \begin{pmatrix} 1 & 3 \\ 2 & 4 \end{pmatrix}$ and hence find A^{-1} .
(b) Express $3x^3 + x^2 - 2x + 4$ in terms of Legendre polynomials.