# KERALA TECHNOLOGICAL UNIVERSITY

**08 PALAKKAD CLUSTER**

**Q. P. code :** **(pages: 3 )** **Name :.....................................**

**Reg No:.................................**

**FIRST SEMESTER M.TECH. DEGREE EXAMINATION DEC 2015**

**Branch:(EEE)** **Specialization (Power Electronics)**

**Subject id: 08EE6211** **Applied Mathematics**

**Time:3 hours** **Max. marks: 60**

**Answer all six questions.**

**Modules 1 to 4:** Part 'a' of each question is compulsory and answer either part 'b' or part 'c' of each question.

**Modules 5 to 6:** Part 'a' and 'b' of each question is compulsory and answer either part 'c' or part 'd' of each question.

(Add any other instruction specific to course here like the use of IS codes/design tables etc.)

| Q.no. | Module 1 | Marks |
|---|---|---|
| 1.a | Find the matrix of linear transformation $T : R^2 \rightarrow R^2$ given by $T(x1, x2) = (2x_1 - 5x_2, 3x_1 + 4x_2)$ with respect to the standard bases. | 3 |
| | **Answer b or c** | |
| B | i) Find the basis and dimension of the subspace of $R^4$ spanned by the vectors ( 3,9,3,5 ), ( 4,12,4,5), ( 2,6,1,0 ), ( 5,15,3,2 ) | 3 |
| | ii) Find the eigen values and eigen vectors of $A = \begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$ | 3 |
| C | Prove that a bounded linear oerator T : H→H on a Hilbert space H is self adjoint if and only if it satisfies the equations $\langle Tx, y \rangle = \langle x, Ty \rangle \ \forall x, y \in H$. Also prove that if T is self adjoint or unitary ,then T must be normal. | 6 |

| Q.no. | Module 2 | Marks |
|---|---|---|
| 2.a | Solve the ordinary differential equation $\frac{d^5y}{dx^5} - 3\frac{dy^4}{dx^4} + 3\frac{dy^3}{dx^3} - \frac{dy^2}{dx^2} = 0$ | 3 |
| | **Answer b or c** | |

| Q.no. | | Marks |
|---|---|---|
| B | i) Solve the linear differential equation $\frac{dy}{dx}+x\sin 2y = x^3\cos^2 y$ | 3 |
| | ii) Solve the differential equation ( $x^2D^2 + 2xD - 20$ ) y = $x^4$ | 3 |
| C | i) Solve $(3x+2)^2\frac{d^2y}{dx^2}+3(3x+2)\frac{dy}{dx}-36y=3x^2+4x+1$ | 6 |

| Q.no. | Module 3 | Marks |
|---|---|---|
| 3.a | Find the half range cosine series for f ( x ) = x , 0 <x < $\pi$ | 3 |
| | **Answer b or c** | |
| B | A sinusoidal voltage E sin$^{\omega}$t where t is time, is passed through a half wave rectifier that clips the negative portion of the wave. Find the Fourier series of the resulting periodic function u ( t) = $\begin{Bmatrix} 0, -l < t < 0 \\ E\sin\omega t, o < t < l \end{Bmatrix}$ $p = 2l = \frac{2\pi}{\omega}$ | 6 |
| C | Find the Fourier integral of the function $f(x) = e^{-\lvert x\rvert}$ $-\infty < x < \infty$ | 6 |

| | Module 4 | Marks |
|---|---|---|
| 4.a | Verify that u = $x^2 - y^2 - y$ i harmonic in the whole complex plane and find the harmonic conjugate v of u. | 3 |
| | **Answer b or c** | |
| B | Evaluate $\int_c \frac{z+4}{z^2+2z+5}dz$ if c is i) $\lvert z\rvert = 1$ $ii)\ \lvert z+1-i\rvert = 2$ $iii)\ \lvert z+1+i\rvert = 2$ | 6 |
| C | Show that the geometric series 1 + z + $z^2$+.......... is a) uniformly convergent in any closed disk $\lvert z\rvert \le r < 1$ b) not uniformly convergent in its whole disk of convergence $\lvert z\rvert < 1$ | 6 |

| Q.no. | Module 5 | Marks |
|---|---|---|
| | **Answer a and b** | |
| 5.a | Show that the function f (z) = $e^z$ has an isolated essential singularity at the point z = $\infty$. | 4 |
| | **Answer c or d** | |

C Find all the expansions of $\frac{z^2-1}{(z+2)(z+3)}$ about the point z . 8

D Evaluate $\int_{-\infty}^{\infty}\frac{dx}{x^4+1}$ 8

| Q.no. | Module 6 | Marks |
|---|---|---|
| | **Answer a and b** | |
| 6.a | Obtain the necessary and sufficient conditions for the optimum solution of the following non- linear programming problem Minimise Z = $3e^{2x_1+1}+2e^{x_2+5}$ subject to the constraints $x_1 + x_2 = 7$ $x_1$ , $x_2 \geq 0$ | 4 |
| | **Answer c or d** | |
| C | Using gradient method Minimise $z = \sin x_1x_2 - \cos(x_1 - x_2)$ | 8 |
| D | Use branch and bound technique to solve the following linear programming problem Minimise $z = 4x_1 + 3x_2$ subject to the conditions<br>$5x_1 + 3x_2 \geq 30$<br>$x_1 \leq 4$<br>$x_2 \leq 6$<br>$x_1, x_2 \geq 0$ and $x_1, x_2$ are integers . | 8 |