APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
07 THRISSUR CLUSTER

FIRST SEMESTER M.TECH. DEGREE EXAMINATION   MARCH 2021
Civil Engineering
Structural Engineering

07 MA 6005   **MATHEMATICAL METHODS IN STRUCTURAL ENGINEERING**

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

Answer all six questions. Part 'a' of each question is compulsory.

Answer either part 'b' or part 'c' of each question

Q.no.	Module 1	Marks
1a	Find the Extremals of the functional $\int_{x_1}^{x_2}(x + y')y'\, dx$	**4**

Answer b or c

b	Find the Extremals of $\int_{\frac{1}{10}}^{1} y'(1 + x^2 y')dx$, if $y(\frac{1}{10}) = 19$, y(1)=1	**5**
c	Find the plane curve of fixed perimeter and Maximum area.	**5**

Q.no.	Module 2	Marks
2a	Explain the Principle of virtual work.	**4**

Answer b or c

b	A Cantilever AB of length L Suppose a concentrated load of P at the free end. Determine the deflection and slope at the free end using energy principles Assume uniform flexural rigidity.	**5**
c	Discuss the concept of strain energy and complementary strain energy.	**5**

Q.no.	Module 3	Marks

3a Examine whether the set A ={(x,y,z)/2x-y+3z=0} Is a subspace of R^3 . **4**

<div align="center">

Answer b or c

</div>

b Reduced The Matrix A=$\begin{bmatrix} 1 & 3 & 1 \\ 2 & 6 & 4 \\ 1 & 3 & 2 \end{bmatrix}$ to echelon form and every solution to AX=0 **5**

c Find The Linear Transformation T: $R^2 \longrightarrow R^2$ such that T(1,3)=(5,-4), T(-1,1)=(-1.0)Also find that T(2,2) **5**

Q.no.	Module 4	Marks

4a If B has Eigen value 1,2,3 and C has an Eigen value 4,5,6 and D has an Eigen value 7,8,9 what are the Eigen values of the 6 by 6 matrix A=$\begin{bmatrix} B & C \\ 0 & D \end{bmatrix}$ **4**

<div align="center">

Answer b or c

</div>

b Diagonalize the Matrix A =$\begin{bmatrix} 7 & -1 & 3 \\ 6 & 1 & 4 \\ 2 & 4 & 8 \end{bmatrix}$ and hence find $A^{.3}$ **5**

c Find the orthonormal Basis of R^3 from the given Basis B ={(1,1,1),(0,1,1),(0,0.1)} **5**

Q.no.	Module 5	Marks

5a Find the solution of the PDE $u_x + u_y = 0$ using method of separation of variables **5**

<div align="center">

Answer b or c

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b Classify the Following PDE and reduce to the canonical from $4u_{xx} + 5u_{yy} + u_{yy} + u_x + u_y = 2$ **7**

c A tightly stretched string of length 10cms fastened at both ends is displaced from its position of equilibrium by imparting to each of its points an initial velocity given by

$$f(x) = \begin{cases} x & if\ 0 \le x \le 5 \\ 10 - x & if\ 5 \le x \le 10 \end{cases}$$

x being the t from one end. Determine the

Displacement at any subsequent time.

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Q.no.	Module 6	Marks
6a	Solve the two dimensional laplace equation By the method of separation of variables	5

Answer b or c

b Define Neuman Problem for Rectangle for solve it.

7

c Describe Interior Dirchelet's Problem for circle and hence solve it.

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