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| Semester | 2 |
| Course | Major |
| Paper Code | **C1EC230221T** |
| Paper Title | MATHEMATICAL METHODS IN ECONOMICS–II |
| No. of Credits | 4 |
| Theory/Practical / Composite | Theory |
| No. of periods assigned | 4 |
| Minimum No. of preparatory hours per week a student has to devote | Four (4) |
| Course Outcomes / Learning Outcomes | 1) A matrix provides a very powerful way of organising and manipulating data. So the students must be very well versed with matrix operations so as to apply in economic problems.<br>2) To introduce students to advanced topics like vector space,eigen values and quadratic forms which are essential for studying multivariate optimisation and dynamics.<br>3) To make students grasp the idea and techniques of higher derivatives to study concavity, convexity, quasi concavity and quasiconvexity defined on $R^n$. This will give them the tools to find extreme values and stationary values in case of functions of n variables.<br>4) Develop techniques for dealing with constraints which satisfy one or more functional equations while maximizing or minimizing a function. The fundamental objective in this section is the derivation and application of the method of Lagrange multiplier.<br>5) In line with the previous objective develop the concept of value function and envelope theorem so as to apply in economic problems.<br>6) To learn first and second order differential equations with applications |

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| Syllabus | **Module 1 (55 marks)**<br><br>**1. Linear algebra**<br>Vector spaces: Sub-space and basis, algebraic and geometric properties, scalar products, norms, orthogonality; linear transformations: properties, matrix representations and elementary operations; systems of linear equations: properties of their solution sets; determinants: characterization, properties and applications.<br><br>**2. Functions of several variables**<br>Geometric representations: graphs and level curves; differentiable functions: characterizations, properties with respect to various operations and applications; second order derivatives: Jacobian and Hessian determinants, properties and applications; the implicit function theorem, and application to comparative statics problems; homogeneous and homothetic functions: characterizations and applications.<br><br>**3. Multi-variable optimization**<br>Convex sets; geometric properties of functions: convex concave functions, their characterizations, properties and applications; further geometric properties of functions: quasiconvex and quasiconcave functions, their characterizations, properties and applications; unconstrained optimization: geometric characterizations, characterizations using calculus and applications; constrained optimization with equality constraints: geometric characterizations, Lagrange's method; value function, envelope theorem.<br>**Number of Classes per week: 3**<br><br>**Module 2 (15 marks)**<br>Differential Equations: First & Second Order with Applications<br>**Number of Classes per week: 1** |

<table>
<tr><td>Readings</td><td>1) K. Sydsaeter and P. Hammond, Mathematics for Economic Analysis, Pearson Educational Asia: Delhi, 2002.<br>2) Lawrence Blume and Carl Simon, Mathematics for Economists, W.W. Norton and Company, 1994.<br>3) Alpha Chiang and Kevin Wainwright, Fundamental Methods of Mathematical Economics, Fourth Edition, Mc-graw Hill, 2005.<br>4) Mukherjee and S.Guha, Mathematical Methods & Economic Theory, Oxford University Press, 2011.<br>5) G. Hadley, Linear Algebra, Addison Wesley</td></tr>
<tr><td>Evaluation</td><td>Continuous Internal Assessment: 30 marks<br>End- Semester Theory Examination: 70 marks</td></tr>
<tr><td>Paper Structure for Semester Exam</td><td>
<table>
<tr><th>Module</th><th>No. of Questions to be Answered</th><th>No. of Alternatives</th><th>Marks</th></tr>
<tr><td rowspan="2">Module 1</td><td>3</td><td>4</td><td>5 X 3 = 15</td></tr>
<tr><td>4</td><td>5</td><td>10 X 4 = 40</td></tr>
<tr><td rowspan="2">Module 2</td><td>1</td><td>2</td><td>5 X 1 = 5</td></tr>
<tr><td>1</td><td>2</td><td>10 X 1 = 10</td></tr>
<tr><td colspan="3">Total Marks</td><td>70</td></tr>
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