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| **Complex exam minor subject** | Model Investigation of Technical Systems |
| **Syllabus** | 1. Theory of Bond graph: (is an explicit graphical tool for capturing the common energy structure of systems) Power variables of Bond Graphs, Bond Graph Standard Elements, Basic 2-Port elements, The 3-Port junction elements.<br>2. Theory of Bond graph: Power directions on the bonds, Assigning numbers to bonds, Causality, Generation of system equations, algebraic loops, Causal loops, Power loops, and Differential Causalities<br>3. Bond graph modeling: mechanical system, two degrees of freedom mechanical system, electrical system, hydraulic system, thermal system, magnetic system, Method of Flow Map, Method of Effort Map, Method of Mixed Map.<br>4. Bond graphs of electrical circuits: Method of Gradual Uncover, Point Potential Method, Mixed Network Method.<br>5. Gyrator and transformer combinations: Combination of gyrators and sources, Combination of a gyrators and transformers with storage and resistive elements, Combination of gyrators and junction elements, Dual Models, Multi and vector bond graphs |
| **Bibliography** | 1. Arun Kumar Samantaray, Belkacem Ould Bouamama : Model-based process supervision: a bond graph approach, 2008/3/14, Publisher, Springer Science & Business Media<br>2. Jan F. Broenink : Introduction to Physical Systems Modelling with Bond Graphs Jan F. Broenink University of Twente, Dept EE, Control Laboratory PO Box 217, NL-7500 AE Enschede Netherlands<br>3. Borutzky, W: Bond Graph metolodogy Spinger 2010, ISBN 979-1-84882-881-0<br>4. W Borutzky : Bond graph modelling of engineering systems - 2011 - Springer |
| **Compulsory subjects for this minor subject** | Computer Process Control |
| **Recommended subjects for this minor subject** | |