Complex exam minor subject	Application of numerical methods in engineering
Syllabus	Connection between the real system and the calculation model, problem classes. Requirements for the calculation model (accuracy, effectiveness). Continuous system and discrete system models. Source of errors in a model, error analysis. Numerical methods of initial value and boundary value problems. Eigenvalue problems. Analysis of solids, structures, fluids, and heat transfer. Connection between the solution of the mathematical model and the physical problem Role of finite element analysis in the complete process of computer-aided design. Accuracy of the solution, refinement of solution parameters. Application areas of neural networks: approximation of non-linear mappings, modelling of non-linear systems. Pattern recognition, prediction of the behaviour of complex systems, data mining. Non-algorithmic solutions. Learning, generalization, and classification capacity of neural networks.
Bibliography	Zeigler, B. P., Kim, T. G., Praehofer, H., *Theory of modelling and simulation*, Academic Press, 2000. Bathe, K. J., *Finite Element Procedures*, Prentice Hall, 1996 Hutton, D. V., *Fundamentals of Finite Element Analysis*, McGrawHill, 2004 Rao, S. S., *The Finite Element in Engineering*, Elsevier Science & Technology Books, 2004 Chrapra, S. C., *Numerical Methods for Engineers*, McGrawHill, 2006 Haykin, S., *Neural Networks and Learning Machines*, Prentice Hall, 2008
Compulsory subjects for this minor subject	
Recommended subjects for this minor subject	Computer aided modelling, finite element analysis and simulation of gear pairs Finite element modelling of metal forming processes