AGH UNIVERSITY OF SCIENCE AND TECHNOLOGY

Module name: Advanced Planning in Operations Management

Academic year: 2016/2017 Code: ZZP-2-405-ZF-s ECTS credits: 5

Faculty of: Management

Field of study: Management Specialty: Financial Management

Study level: Second-cycle studies Form and type of study: Full-time studies

Lecture language: English Profile of education: Academic (A) Semester: 4

Course homepage: http://home.agh.edu.pl/~waldek/apom/

Responsible teacher: dr hab. inż. Kaczmarczyk Waldemar (wkaczmar@zarz.agh.edu.pl)

Academic teachers: dr hab. inż. Kaczmarczyk Waldemar (wkaczmar@zarz.agh.edu.pl)

Module summary

This course provides an accessible introduction to standard quantitative methods for planning and scheduling of production and logistic operations.

Description of learning outcomes for module

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Connections with FLO	Method of learning outcomes verification (form of completion)
Social competence			
M_K001	Students are able to acquire knowledge by oneself.	ZP2A_K07	Execution of a project
M_K002	Students can be leaders of small project teams and are able to cooperate with professionals of different fields.	ZP2A_K02	Execution of a project
Skills			
M_U001	Students are able to determine basic plans and schedules for typical production and logistic operations.	ZP2A_U08, ZP2A_U12	Test, Execution of exercises, Execution of a project
M_U002	Students are able to identify the type of a production or logistic process, to choose and implement appropriate optimisation model for arising planning or scheduling problem.	ZP2A_U04	Test, Execution of exercises, Execution of a project
Knowledge			

M_W001	Students know standard quantitative methods, optimisation models and information systems applied to enterprise wide operational planning and supply chain coordination.	ZP2A_W13	Test, Execution of a project
M_W002	Students know basic modelling techniques of management science applied in planning and scheduling of production and logistic operations.	ZP2A_W12	Test, Execution of a project

FLO matrix in relation to forms of classes

MLO code	Student after module completion has the knowledge/ knows how to/is able to	Form of classes										
		Lectures	Auditorium classes	Laboratory classes	Project classes	Conversation seminar	Seminar classes	Practical classes	Fieldwork classes	Workshops	Others	E-learning
Social competence												
M_K001	Students are able to acquire knowledge by oneself.	-	+	-	-	-	-	-	-	-	-	-
M_K002	Students can be leaders of small project teams and are able to cooperate with professionals of different fields.	-	+	-	+	-	-	-	-	-	-	-
Skills												
M_U001	Students are able to determine basic plans and schedules for typical production and logistic operations.	+	+	-	-	-	-	-	-	-	-	-
M_U002	Students are able to identify the type of a production or logistic process, to choose and implement appropriate optimisation model for arising planning or scheduling problem.	+	+	-	+	-	-	-	-	-	-	-
Knowledge												
M_W001	Students know standard quantitative methods, optimisation models and information systems applied to enterprise wide operational planning and supply chain coordination.	+	+	-	+	-	-	-	-	-	-	-
M_W002	Students know basic modelling techniques of management science applied in planning and scheduling of production and logistic operations.	+	+	-	-	-	-	-	-	-	-	-

Module content

Lectures

Managers and information technology professionals should understand basic methods of enterprise wide operational planning and supply chain coordination. This course provides an accessible introduction to standard quantitative methods for planning and scheduling of production and logistic operations, basic modelling techniques, optimisation models and information systems applied in operational planning. Basic outcome of this course is understanding of various planning problems and models, their objectives and constraints, chances which give us advanced planning systems and their limitations. Mathematical models are in the background. Assignments give students hands-on experience at developing models and solving problems. Course software and e-books are available to download.

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1. Mixed integer programming (MIP): standard models and tools.
2. Sales and operations planning (SOP) .
3. Operational planning:
. 3.1master production scheduling (MPS),
. 3.2 material requirements planning (MRP I),
. 3.3 manufacturing resource planning (MRP II).
4. Optimisation models for replenishment planning:
. 4.1 economical order quantity (EOQ),
. 4.2 inventory policies for probabilistic demand,
. 4.3 dynamic lot-sizing problem.
5. Optimisation models for production planning:
. 5.1 lot-sizing and scheduling problems,
. 5.2 resource-constrained project scheduling problems (RCPSP),
. 5.3 machine scheduling problems,
. 5.4 safety stocks, lead times and due date setting.
6. Optimisation models for distribution planning:
. 6.1 inventory routing problems,
. 6.2 production and distribution coordination models.
7. Advanced planning systems (APS):
. 7.1 general characteristics and structure,
. 7.2 decomposition and aggregation,
. 7.3 integration and coordination,
. 7.4 collaboration,
. 7.5 implementation,
. 7.6 case studies.

Project classes

(In computer laboratory, in the first part of the semester)
1. Introduction to mixed integer programming (MIP): standard models and tools. Determining plans “by hand” in spreadsheet and with help of solver for models described in spreadsheet (OpenSolver) or in algebraic modelling language (AMPL, GLPK):
2. SOP,
3. MRP II,
4. lot-sizing and scheduling problem,
5. resource-constrained project scheduling problem (RCPSP).
“Optimisation” of policy parameters with help of Monte Carlo and discrete simulation

for:
6. inventory control,
7. lead time setting,
8. due date setting,
9. capacity planning.

Auditorium classes

Determining plans “by hand” on the whiteboard:
1. MRP II,
2. resource-constrained project scheduling problem (RCPSP),
3. (classic) scheduling problems,
4. inventory control,
Case studies.

Method of calculating the final grade

Exercise assignments 10%, project (case study) 30%, written tests 60%.

Prerequisites and additional requirements

This course is addressed to postgraduate students of management, engineering and computer science. Basics of mathematics including logic and algebra are required to participate.

Recommended literature and teaching resources

Literature
1. Silver E. A., Pyke D. F., Peterson R., Inventory Management and Production Planning and Scheduling, Wiley, 1998
2. Vollmann T. E., Berry W. L., Whybark D. C., Jacobs F. R., Manufacturing Planning and Control for Supply Chain Management, McGraw-Hill/Irwin, 2004.
Literature available for download in AGH library
3. Drexl A., Kimms A., Lot sizing and scheduling – survey and extensions, European Journal of Operational Research, 99(2), 1997, str. 221-235.
4. Hartmann S., Project Scheduling under Limited Resources, volume 478 of Series, str. Lecture Notes in Economics and Mathematical Systems, Springer Berlin, 1999.
5. Neumann K., Schwindt Ch., Activity-on-node networks with minimal and maximal time lags and their application to make-to-order production, OR Spektrum, 19, 1997, str. 205-217.
6. Stadtler H., Kilger Ch., editors, Supply Chain Management and Advanced Planning, Springer, Berlin, 2008.
7. Voß S., Woodruff D. L., Introduction to Computational Optimization Models for Production Planning in a Supply Chain, Springer, 2006.
Course software available for download:
8. OpenSolver for Excel: http://opensolver.org/
9. SolverStudio for Excel: http://solverstudio.org/
10. GPLK (with Scite): http://home.agh.edu.pl/~waldek/glpk/

Scientific publications of module course instructors related to the topic of the module

1. Kaczmarczyk, W. (2008). Partial coordination may increase overall costs in supply chains, Decision Making in Manufacturing and Services 2(1-2): 47-62.
2. Kaczmarczyk, W. (2009b). Practical tips for modelling lot-sizing and scheduling problems, Decision Making in Manufacturing and Services 3(1-2): 37-48.
3. Kaczmarczyk, W. (2009c). Modelling multi-period set-up times in the proportional lot-sizing problem, Decision Making in Manufacturing and Services 3(1-2): 15-35.
4. Kaczmarczyk, W. (2009d). Inventory cost settings in small bucket lot-sizing and scheduling models, Total Logistic Management 2: 27-36.
5. Kaczmarczyk, W. (2011). Proportional lot-sizing and scheduling problem with identical parallel machines, International Journal of Production Research 49(9): 2605-2623.

6. Kaczmarczyk, W., Sawik, T., Schaller, A. i Tirpak, T. (2004). Optimal versus heuristic scheduling of surface mount technology lines, International Journal of Production Research 42(10): 2083-2110.
7. Kaczmarczyk, W., Sawik, T., Schaller, A. i Tirpak, T. (2006). Production planning and coordination in customer driven supply chains, Wybrane Zagadnienia Logistyki Stosowanej, Tom 3, Komitet Transportu Polskiej Akademii Nauk, s. 81-89.

Additional information
None

Student workload (ECTS credits balance)

Student activity form	Student workload
Participation in lectures	30 h
Participation in auditorium classes	15 h
Participation in project classes	15 h
Preparation for classes	35 h
Completion of a project	30 h
Summary student workload	125 h
Module ECTS credits	5 ECTS