


7.27 Annexure 5E: Taking graph theory to the people

<p style="text-align: center;">Short Course: Graphs in Supply Networks ANNEXURE A</p> <div style="text-align: center;">  <p>UNIVERSITY OF KWAZULU-NATAL</p> </div> <p style="text-align: center;">Template for the Internal Approval of Short Courses</p> <hr/> <p>Title of Short Course: Graphs in Supply Networks School/Department: School of Mathematics, Statistics and Computer Science Executive Budget Holder: UKZN Extended Learning</p> <p>Short courses may only be offered after approval has been obtained through the decision flow outlined below.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 15%;">Activity</th> <th style="width: 15%;">Name (Print)</th> <th style="width: 15%;">Signature</th> <th style="width: 15%;">Date</th> <th style="width: 40%;">Comment (Recommended/ Approved)</th> </tr> </thead> <tbody> <tr> <td>Course Owner/Developer¹</td> <td>School of Mathematics, Statistics and Computer Science</td> <td></td> <td></td> <td></td> </tr> <tr> <td>QPA College Consultant</td> <td>Lianne Browning</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Independent Evaluator</td> <td>Prof D Day</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Dean & Head of School/Dept</td> <td>Prof K. Govinder</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DVC & Head of College (or nominee)</td> <td>Prof D Jaganyi</td> <td></td> <td></td> <td></td> </tr> <tr> <td>UEL Short Courses Development and Quality Manager</td> <td>Roger Chetty</td> <td></td> <td></td> <td></td> </tr> <tr> <td>Proposed date of first offering</td> <td colspan="4">August 2013</td> </tr> <tr> <td>QPA date of Review/Evaluation</td> <td colspan="4">Review after three years</td> </tr> </tbody> </table> <p><small>¹ The course owner/developer can also be a group with a course leader within a School or the School itself, which should be stated.</small></p>	Activity	Name (Print)	Signature	Date	Comment (Recommended/ Approved)	Course Owner/Developer ¹	School of Mathematics, Statistics and Computer Science				QPA College Consultant	Lianne Browning				Independent Evaluator	Prof D Day				Dean & Head of School/Dept	Prof K. Govinder				DVC & Head of College (or nominee)	Prof D Jaganyi				UEL Short Courses Development and Quality Manager	Roger Chetty				Proposed date of first offering	August 2013				QPA date of Review/Evaluation	Review after three years				<p style="text-align: right; font-size: small;">Quality Management of SHORT COURSES</p> <p>SHORT COURSE INFORMATION</p> <ol style="list-style-type: none"> 1. Title of the short course Graphs in Supply Networks 2. What is the motivation for offering the short course? <p style="font-size: small;">The course, which mainly targets professionals in the power supply industry, aims at introducing and developing the fundamentals of the mathematical underpinnings of power distribution networks (PDN). It will study transmission network theory, as related to mathematical graphs. This exposure could then lead interested participants into further research, with the aim of developing a full Graph model representing the Southern African Power Grid with power stations, transmission networks, and distribution networks.</p> 3. Is this a credit bearing short course? No 4. What are the total credits for the short course if credit bearing? 0 5. What is the duration of the short course (in hours)? 87.75 hours 6. What is the estimated HEQF level of the short course? Level 6 7. What is the mode of delivery of the short course? Contact 8. Is it a CPD short course? NO 9. How many CPD points/units are allocated to the course? NA 10. If a CPD course, is the service provider accredited? NA 11. What is the name of accredited service provider? NA <p>A. SHORT COURSE DESIGN AND CURRICULUM</p> <ol style="list-style-type: none"> 12. What is the rationale for offering the short course? <p style="font-size: small;">With the ever-increasing demand for electricity in all sectors of the South African population, industries, as well as governmental bodies, would serve the country well to use all possible means to optimize present usage, as well as have more tools when planning for the power needs of future generations. This short course would give</p> <p style="text-align: right; font-size: x-small;">page 1</p>
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professionals in the field an opportunity to learn how the innate structural properties of their networks can be quantified and studied, in order to maximize efficiencies.

13. What is the purpose/objectives of the short course?

To introduce and develop graph theoretic techniques which can be used in the management of flows in networks.

14. Explain how the short course fits in with the vision and mission of UKZN.

Supply of utilities such as water and electricity, as well as the establishment and maintenance of road and communication networks are fundamental to the prosperity and sustainability of all communities in South Africa. Satisfying the ever-increasing demand for these services is an integral part of nation building, as well as being crucial to the redressing of imbalances of the past. This course aims to deepen the knowledge of utility suppliers, and to inform their managerial decisions, in order to optimize service delivery countrywide.

Furthermore, subsequent innovative research is envisaged, to generate a wholistic database of the service grid covering the entire nation, which could then critically engage with society at its foundations.

15. State the intended learning outcomes of the short course.

At the end of the course, the students will be able to:

- Understand basic concepts of graphs, and how transmission networks are represented as a mathematical model.
- Interpret the concept of distance in weighted graphs, and be able to algorithmically find shortest distances. The students will be able to apply the maximum-flow minimum-cut theorem to solve the real-world problem of managing flows in networks.
- Determine the radius, centres and other graph theoretical parameters to a power network. Apply these concepts to determine optimal locations for power stations or distribution terminals.
- Identify measures of vulnerability in a network. Study power routing to minimize zones of power deficit during forced, or scheduled outages. Determine graphical techniques for service optimization when faults such as cable theft and node failure occur.
- Formulate the notion of Network Reliability. Explore the relationship between average distance and the minimization of network losses. Network failure prediction.

16. Describe the topic(s) / content to be covered in the short course.

- Basic introduction to graphs, digraphs and transmission networks.
- Distances in Weighted graphs, Dijkstra's Algorithm.
- Managing flows in networks, the Max-Flow Min-Cut Theorem and Algorithm.
- Facility location problems, radius, diameter, centres, periphery, Minimization of total distance, and medians, with applications to PDN.
- Measures of network vulnerability and analysis, with applications such as faulty nodes and cable theft or attack.
- Minimization of network losses, and failure prediction.

17. Can credits from this short course be used towards an approved programme/qualification? If so, please name the programme/qualification

Not applicable.

B. SHORT COURSE TEACHING AND ASSESSMENT

18. What teaching approach and strategies will be used for the delivery of this short course?

The traditional method of delivering lectures will be used, in conjunction with tutorials or workshops. Tutorials are designed for students to engage with the content, and self study; whereas workshops encourage students in their problem-solving strategies.

19. What assessment methods will be used in this short course?

An attendance register will be kept and students will be issued with a certificate of attendance.

20. What criteria will be used to decide whether students have achieved the learning outcomes for this short course?

A student must attend at least 80% of lectures and tutorials to successfully achieve the outcomes of the short course.

21. What arrangements are made for the moderation of assessment?

Not applicable.