CONTENT ON DEMAND FOR FOURTH YEAR ADVANCED MATERIALS AND MANUFACTURING STUDENTS

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Assignment

You are a process engineer for a multi-international organisation that wishes to introduce an advanced manufacturing technology for one of their new advanced material based products.

From the lists below, choose a manufacturing process and a material that can be used with that process. Explain the process steps, control and specifications in the manufacturing process that you have chosen. Discuss the benefits of this process, concentrating on technological benefits from the process and material used with that process, relative to competing processes and materials.
Advanced manufacturing processes available to choose from

- Semi-solid metal processing (SSM)
- Vacuum casting
- Electromagnetic forming
- Electro Discharge Machining (EDM)
- Rapid Manufacturing (RM)
- Thin Film Deposition processes
- Explosive cladding or joining
- Hydrostatic extrusion
- Laser machining, welding, or cladding
- Electron Beam Processing
- Ultrasonic machining or welding
- Friction welding
- Magnetic arc welding
Advanced materials available to choose from

<table>
<thead>
<tr>
<th>Material</th>
<th>Application Type</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silicon Nitride - Si$_3$N$_4$</td>
<td>Structural components</td>
<td>in heat exchangers</td>
</tr>
<tr>
<td>Titanium nitride - TiN</td>
<td>Hard coating</td>
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<td>Cubic boron nitride – c-BN</td>
<td>Hard cutting tools</td>
<td>inserts</td>
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<td>Zirconia - ZrO$_2$</td>
<td>Thermal barrier coating</td>
<td>in jet and diesel engines</td>
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<tr>
<td>Alumina - Al$_2$O$_3$</td>
<td>Medium</td>
<td>in chromatography and hip replacements</td>
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<td>Tungsten carbide – WC</td>
<td>Cutting tool</td>
<td>inserts</td>
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<td>A Bulk Metallic Glass</td>
<td>High modulus and corrosion resistant</td>
<td>application</td>
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<td>A Nickel based superalloy</td>
<td>Jet engine turbine blade</td>
<td>material</td>
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<td>Shape Memory Alloys</td>
<td>Catheters and for</td>
<td>robotic element manipulation</td>
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<td>High purity metal</td>
<td>Hydrogen absorbing systems</td>
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<td>High temperature dies</td>
<td>For semi-solid metal</td>
<td>forming</td>
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<td>Aluminum Silicon Carbide</td>
<td>For heat dissipation</td>
<td>from computer chips</td>
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<tr>
<td>Polyketone</td>
<td>High corrosion resistance</td>
<td>and dielectric properties</td>
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<tr>
<td>Polysulfone</td>
<td>High temperature</td>
<td>thermoplastic and hydrolysis stability</td>
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<td>Polyimide</td>
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<td>Bismaleimide</td>
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<td></td>
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</table>
Assignment

• Composites of these materials which are not listed above are also applicable for the choice of advanced material.

• Above examples of material possible usage are only indicative examples of possible uses for these materials and do not have to be the product chosen for this assignment.
Assignment e-mail

• The main content of the assignment report should not exceed ten pages. Appendices may be used for other content. Use 12 size Times New Roman font and single line spacing.

• Please find attached also a guide to use of the Moodle Help Block to aid completion of this assignment.

• This Moodle Help Block has between 140 resources specific to this assignment. Include between 7 and 17 references from these resources.

• The Moodle Help Block can be found at the following link: http://kdeg-vm-42.cs.tcd.ie/moodle/
Moodle Help Block

- A Moodle block plug-in that provides learners with Just-In-Time context relevant learning material
- Uses combination of Semantic and Social Web tech
- Conducts a dialogue with learner to extrapolate knowledge gaps and generate learning episodes
- Purpose – to assist learners with targeted help when needed
Benefits

• Less or no wasted time searching Web or repositories
• Directed autonomous learning
• Can be extended with more relevant resources
• System can learn to provide appropriate materials
# Ontology

<table>
<thead>
<tr>
<th>File name</th>
<th>Type</th>
<th>Episode</th>
<th>Level</th>
<th>Ontology</th>
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<th>Extra / Pedagogy</th>
<th>Source</th>
<th>Introduction / Overview</th>
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<td>surf</td>
<td>Lesson</td>
<td>Adv. (Additional for beg.)</td>
<td>Metal</td>
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<td>Cast and Soldering</td>
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<td>Metal phase transformations</td>
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**Case Studies**
Help Block user interface design

(a) Help Block
(b) Learning Episode
(c) User feedback
(d) Post-confidence scores

Pre-confidence Learning episode User feedback Post-confidence scores
System architecture for Help Block plugin to Moodle
Pre-trial questionnaire

• 6 questions
How do you usually find content online?

Check at most 5 answers

- [x] Search Engines (e.g. Google, Yahoo, Bing)
- [ ] Online Social Networks (e.g. Facebook, Twitter, Bebo)
- [ ] Social Bookmarking (e.g. XMarks, Delicious)
- [ ] RSS Feeds (e.g. GoogleNews, browser bookmark feed)
- [ ] Other: [ ]

(Select all that apply)

How often do you use search engines?

Check at most 1 answers

- [ ] Every day
- [ ] Several times per week
- [ ] Several times per month
- [ ] About once a month or less

How good a searcher do you think you are?

Check at most 1 answers

- [ ] Very poor
- [ ] Poor
- [ ] Average
- [ ] Good
- [ ] Very good

How often do you find search engine results to be relevant?

Check at most 1 answers

- [ ] Almost never
- [ ] Never
- [ ] Sometimes
- [ ] Always
- [ ] Almost always
How good a searcher do you think you are?

Check at most 1 answers

☐ Very poor
☐ Poor
☐ Average
☐ Good
☐ Very good

How often do you find search engine results to be relevant?

Check at most 1 answers

☐ Almost never
☐ Never
☐ Sometimes
☐ Always
☐ Almost always

How would you rate your ability to search: information databases to solve engineering problems?

Check at most 1 answers

☐ Very poor
☐ Poor
☐ Average
☐ Good
☐ Very good

Please indicate your Gender

Check at most 1 answers

☐ Male
☐ Female
Post-trial questionnaire

• 42 questions
Indicate which of the Social and collaborative technologies you use or have used either inside or outside the workplace.

Check any that apply

- Forums
- Facebook
- Twitter
- LinkedIn
- Blogs
- Wikis

Do you browse the Internet using your phone?

Check at most 1 answers

- Almost never
- Never
- Sometimes
- Always
- Almost always

How often do you use Search engines such as Google, Bing, Yahoo?

Check at most 1 answers

- Every day
- Several times per week
- Several times per month
- About once a month or less

How often do you find what you are looking for in the first Search?

Check at most 1 answers

- Almost never
- Never
- Sometimes
- Always
- Almost always
When working on the assignment, how often did you use the Help Block?

Check at most 1 answers

- Very frequently
- Frequently
- Occasionally
- Rarely
- Very rarely

Was the help block easy to find within the Moodle interface?

Check at most 1 answers

- Very difficult to find
- Difficult to find
- Neither difficult nor easy to find
- Easy to find
- Very easy to find

In terms of ease of use, please enter a score for each of the following questions.

<table>
<thead>
<tr>
<th>Question</th>
<th>1</th>
<th>2</th>
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<tr>
<td>I think that I would like to use this system frequently</td>
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<tr>
<td>I found this system unnecessarily complex</td>
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<tr>
<td>I think that I would need the support of a technical person to be able to use this system</td>
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<tr>
<td>I found the various functions in this system were well integrated</td>
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<tr>
<td>I thought that there was too much inconsistency in this system</td>
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<tr>
<td>I would imagine that most people would learn to use this system very quickly</td>
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<tr>
<td>I found this system very cumbersome to use</td>
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<td>I felt very confident using the system</td>
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<tr>
<td>I needed to learn a lot of things before I could get going</td>
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</table>
How often did you use the Personalised Help content returned by the Help Block?

Check at most 1 answers

☐ Very frequently
☐ Frequently
☐ Occasionally
☐ Rarely
☐ Very rarely

How often was the Personalised Help content returned by the Help Block relevant to your search?

Check at most 1 answers

☐ Very frequently
☐ Frequently
☐ Occasionally
☐ Rarely
☐ Very rarely

Was the sequence of the Personalised Help content logical starting with the Test your Knowledge > Introduction > Lesson?

Check at most 1 answers

☐ Definitely not
☐ No
☐ Not sure
☐ Yes
☐ Definitely yes

Would you describe the amount of Personalised Help content provided by the Help Block as being...

Check at most 1 answers

☐ Far too little
☐ Too little
☐ Just right
☐ Too much
☐ Far too much

Would you describe the Personalised Help content provided by the Help Block as being...

Check at most 1 answers

☐ Too difficult
☐ Difficult
☐ Just right for me
☐ Easy
☐ Too easy
Help Block usage statistics

(a) by date

(b) by user
Questionnaire responses

(a) How often were Test Your Knowledge (TYK), Introduction and Lesson resources relevant to your search?

(b) How would you describe the level of difficulty of Learning Episode resources?
Questionnaire responses

(a) Was the Learning Episode easy to navigate?

(b) I would imagine that most people would learn to use this system very quickly

(a) Was the Learning Episode easy to navigate?
## CA Results

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<td>6.4</td>
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## Overall Results

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<td>55.3</td>
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<td>65.1</td>
<td>63.2</td>
<td>63.7</td>
<td>60.2</td>
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Summary

• Semantic and social search components to address the just-in-time learning needs of students in a personalised manner

• Made available resources for completing assignment, for which the number of solutions and range of reference material was vast

• Facilitated the linking of a particular set of relevant resources to course content
Summary

• System should allow more time to focus on learning what was relevant, analyse material and to present work

• Lesson, introduction and test your knowledge presented = ordered in terms of most interest for student
Future work

• Include a broader range of resources

• Include ability to save and retrieve previous browsing history

• Implement modeling techniques to implicitly capture learners’ knowledge levels based on their interaction with the application
Acknowledgements

• Science Foundation Ireland, Grant No. 07/CE/I1147
Thanks for listening