MEC7236: Advanced Manufacturing Materials:

Hours per semester				Weighted Total Mark	Weighted Exam Mark	Weighted Continuous Assessment Mark	Credit Units
LH	**PT**	**TH**	**CH**	**WTM**	**WEM**	**WCM**	**CU**
45	00	00	45	100	60	40	3

Course Description

Engineers are often involved in materials selection decisions, which necessitates that they have some familiarity with the general properties and characteristics of a wide variety of materials. In addition, knowledge of their fabrication characteristics is vital. In most cases, also, the engineer will have access to data bases containing property values for a large number of materials. This course introduces the properties, characteristics and applications of advanced materials (ceramics, metals, polymers and composites). Methods of optimization of material properties for some alloys, as a guide in material selection, will also be introduced.

Course Objective

The aims of this course are to:

§ Introduce the properties and application of various advanced materials and alloys
§ Guide students through the process of optimization of material properties within an alloy system, and hence material selection.

Learning Outcomes

At the end of this course, students should be able to:

- Understand the properties/characteristics
- The application limitations of advanced engineering materials
- Broaden their knowledge of engineering materials
- Make better assessment of materials for various applications

Course Content

- Properties of ferrous alloys and their application as engineering materials (4 hours)
- Compositions, Properties, and typical Applications for Austenitic, Ferritic, Martensitic, and Precipitation-Hardenable Stainless Steels (4 hours)
- Non ferrous alloys: properties and applications (5 hours)
- Super alloys: properties, applications and compositions (4 hours)
- Property optimization, materials selection and specification. (4 hours)
- Biomaterials: Properties and application (4 hours)
- Advanced ceramics: Characteristics and application (4 hours)
- Advanced polymeric materials: properties, applications e.g. LCD polymers (4 hours)
- Crystallization, melting and glass transition phenomena in polymers (4 hours)
- Composites: properties, Applications, fabrication and joining methods (4 hours)
- Nano materials: Properties, fabrication and applications (4 hours)

Delivery Method
The teaching will be conducted through lectures, case studies and group discussions among the students. The lecture material will be availed to the students in advance to enable them have prior reading.

Assessment Method
Assessment will be done through coursework which will include assignments, class room tests and a written examination. Course work will carry a total of 40% and written examination carries 60%.

References

1) Callister W.D (2005). Fundamentals of Materials Science and Engineering, an Integrated Approach. 2nd Ed. John Wiley & Sons. ISBN: 0-471-47014-7
2) Groover, M.P (2007). Fundamentals of Modern Manufacturing: Materials, Processes, and Systems. 2nd Ed. John Wiley & Sons, Inc. ISBN-13: 978-0-471-74485-6
3) Kalpakjian, S. Schmid, S. (2006). Manufacturing Engineering and Technology. 5th Ed. Pearson Education Inc. ISBN: 0-13-148965-8
4) Degarmo, E.P., Black, J.T and Kohser, R.A. (2003). Materials and Processes in Manufacturing. 9th Ed. John Wiley & Sons, Inc. ISBN: 0-471-03306-5
5) Smallman R.E and Bishop R. J (1999). Modern Physical Metallurgy and Materials Engineering: Science, Process and Applications, 6th Ed. Butterworth Heinemann ISBN: O- 7506 4564- 4
6) Mazumdar S. K (2002). Composites Manufacturing: Materials, Product, and Process Engineering, CRC Press LLC. ISBN 0-8493-0585-3