Attachment III

The Hong Kong Polytechnic University

Subject Description Form

Subject Code	AP616
Subject Title	Smart Materials and Structures
Credit Value	3
Level	6
Pre-requisite / Co-requisite/ Exclusion	None
Objectives	To introduce knowledge in material science including • the fundamentals of smart materials, devices and electronics, in particular those related to the development of smart structures and products; and • the skills, knowledge and motivation in the design, analysis and manufacturing of smart structures and products, to research students from different disciplines.
Intended Learning Outcomes	Upon completion of the subject, students will be able to: a) understand the physical principles underlying the behavior of smart materials; b) understand the engineering principles in smart sensor, actuator and transducer technologies; c) use principles of measurement, signal processing, drive and control techniques necessary to developing smart structures and products; and d) appreciate and suggest improvement on the design, analysis, manufacturing and application issues involved in integrating smart materials and devices with signal processing and control capabilities to engineering smart structures and products.
Subject Synopsis/ Indicative Syllabus	• Overview of Smart Materials, Structures and Products Technologies • Smart Materials (Physical Properties) • Smart Sensor, Actuator and Transducer Technologies • Measurement, Signal Processing, Drive and Control Techniques • Design, Analysis, Manufacturing and Applications of Engineering Smart Structures and Products
Teaching/Learning Methodology	In order to stimulate and motivate the students' interest in the study of material science and related topics, three experiments on piezoelectric, electrostrictive, magnetostrictive, magnetoelectric, magnetorheological fluid, electrorheological fluid, shape memory and fiber-optic sensor materials will be introduced in the studies. These proposed practical examples will demonstrate the importance of material science in our everyday life.

Assessment Methods in Alignment with Intended Learning Outcomes

Specific assessment methods/tasks	% weighting	Intended subject learning outcomes to be assessed (Please tick as appropriate)					
		a	b	c	d	e	
1. Examination	60	✓	✓	✓	✓		
2. Continuous assessment	40	✓	✓	✓	✓		
Total	100 %						

Students should have a) a basic understanding on the physical principles of smart materials, b) an engineering principles of using smart materials as devices and applications, c) a basic understanding in measurement techniques and d) some knowledge to advance the engineering of smart structures and products – these are the intended learning outcomes.

Assignments will strengthen the students' basic knowledge and the analytical skill to solve the problems related to material science. Tests will review their understanding of the course and examination will accelerate their knowledge's understanding and improve their manipulation on problem solving. Hence, the proposed assessment methods are necessary to assess the intended learning outcomes (i.e., items a, b, c & d).

Student Study Effort Expected

Class contact:	
▪ Lectures	27 Hrs.
Other student study effort:	
▪ Self-study	81 Hrs.
▪ Laboratory	12 Hrs.
Total student study effort	120 Hrs.

Reading List and References

- M.V. Gandhi and B.S. Thompson, Smart Materials and Structures, Chapman & Hall, London; New York, 1992 (ISBN: 0412370107).
- B. Culshaw, Smart Structures and Materials, Artech House, Boston, 1996 (ISBN: 0890066817).
- A.V. Srinivasan, Smart Structures: Analysis and Design, Cambridge University Press, Cambridge; New York, 2001 (ISBN: 0521650267).
- A.J. Moulson and J.M. Herbert, Electroceramics: Materials, Properties, Applications, 2nd Edition, John Wiley & Sons, Chichester, West Sussex; New York, 2003 (ISBN:0471497479).
- G. Gautschi, Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic Emission Sensors, Materials and Amplifiers, Springer, Berlin; New York, 2002 (ISBN:3540422595).
- K. Uchino, Piezoelectric Actuators and Ultrasonic Motors, Kluwer Academic Publishers, Boston, 1997 (ISBN: 0792398114).
- G. Engdahl, Handbook of Giant Magnetostrictive Materials, Academic Press, San Diego, Calif.; London, 2000 (ISBN: 012238640X).
- K. Otsuka and C.M. Wayman, Shape Memory Materials, Cambridge

	University Press, Cambridge; New York, 1998 (ISBN: 052144487X). • Eric Udd, Fiber Optic Sensors: An Introduction for Engineers and Scientists, John Wiley & Sons, New York, 1991 (ISBN: 0471830070). • André Preumont, Vibration Control of Active Structures: An Introduction, 2nd Edition, Kluwer Academic Publishers, Dordrecht; Boston, 2002 (ISBN: 1402004966). • Hojjat Adeli, Control, Optimization, and Smart Structures: High-Performance Bridges and Buildings of the Future, John Wiley, New York, 1999 (ISBN: 047135094X). • T.T. Soong, Passive Energy Dissipation Systems in Structural Engineering, Wiley, Chichester; New York, 1997 (ISBN: 0471968218). • Robert E. Newnham, Properties of Materials, Oxford University Press, 2005 (ISBN-10:019852076X).