

EFFECTIVE ENGINEERING TEACHING IN PRACTICE

MULTI-FACULTY

INTENDED AUDIENCE : All engineering teachers and aspiring teachers

INDUSTRIES APPLICABLE TO : Any industry or start-up interested in education

COURSE OUTLINE :

Traditionally, teachers are not trained to teach professional courses. Thus, they learn even the essential principles of teaching through experience, 'on the job'. This leads to a less than satisfactory in-class learning experience for most students in many courses, except if the teacher has a natural orientation to teaching. This course is aimed to introduce the essentials of facilitation of student learning ('teaching') in an interesting way to any teacher of professional courses, with a special focus on engineering. Further, education is a vast, old area of research, with rigorous, evidence-based knowledge that is useful for the facilitation of learning. However, the knowledge is not in an easily accessible form for teachers without experience in education research. This course also aims to begin bridging that gap, by appropriately introducing research in education to engineering teachers.

ABOUT INSTRUCTOR :

Prof. G. K. Suraishkumar is a Professor in the Department of Biotechnology, Indian Institute of Technology Madras (IITM). He has been at IITM as a Professor since May 2004, and was earlier a faculty member in the Department of Chemical Engineering at the Indian Institute of Technology Bombay (IITB) from April 1993 until mid-May 2004. He was also an Associate Faculty member in the erstwhile Centre for Biotechnology, which is now the Department of Biosciences and Bioengineering, at IITB, between 1995 and 2004.

He earned his Ph.D. from Drexel University, Philadelphia, USA in 1993, and his B.Tech. in Chemical Engineering from IITM in 1986. He also did his Masters work at the University of Cincinnati, USA, between 1986 and 1988.

He is passionate about improving student learning and has published papers in reputed international journals on the methods that he had developed for the same. He is the author of a book, *Continuum Analysis of Biological Systems: Conserved Quantities, Fluxes, and Forces*, which was published worldwide by Springer Publishing in March 2014; the foreword has been written by the reputed author of the famous textbook, *Transport Phenomena*, Professor R. B. Bird. Recently, he created two 10-h MOOCs on Bioreactors, and Biology for Engineers and other Non-biologists as NPTEL online certification (NOC) courses. Earlier, he created a 40-lecture NPTEL video course on Classical Thermodynamics for Biological Systems. He has also created other short videos on biochemical engineering principles.

His major area of research is reactive species – currently, the relevance of them in cancer and nanoparticle toxicity. Earlier, his research group had made significant, original contributions in the area of reactive species applied to improve bioreactor productivities and bio-oil which were financially supported through many sponsored research grants. The research contributions have been better disseminated through publications in reputed international journals– the complete list of publications is available as a link from his Department webpage, <https://biotech.iitm.ac.in/faculty/suraishkumar-g-k/>). He is also the inventor on 3 (granted) + 3 (under process) patents. Further, the technology developed in his group was successfully applied at Biocon industries, and has been featured in prestigious technology alerts such as the one by Frost and Sullivan. He has guided many Ph.D., and Masters theses. Some recognitions of his work by others are listed in his web-page given above.

Administratively, he played pivotal roles in the set-up of the Departments of Biotechnology, as the first formal Department Head, first at IIT Madras and later, at IIT Hyderabad. He was one of the main architects of the first postgraduate program in Clinical Engineering in India, which is a multi-Institute program, and a first of its kind in India. In addition, he contributed as the Head of the Sophisticated Analytical Instrumentation Facility, Chennai. He continues to contribute on National level faculty selection/advisory/institution level committees in relevant areas.

E. PRASAD, Head, Teaching Learning Centre (TLC) and Associate Professor, Department of Chemistry, Indian Institute of Technology Madras, Chennai 600 036, INDIA

Phone: ++91-44-2257 4232 ; Email: pre@iitm.ac.in

Educational Qualification: BSc., & MSc. From Calicut University, Kerala, India during 1990-1995; Ph.D. from NIIST, Thiruvananthapuram, Kerala, India in Photophysical Chemistry in 2000. Post Doctoral

Research Experience: (2001 to 2006) Texas Tech University & Lehigh University, USA and University of Bonn, Germany (Alexander von Humboldt Fellow)

Professional Experience (11 years): Faculty at Department of Chemistry, IIT Madras since 2006; (8 years):

Core team member, Teaching Learning Centre, IIT Madras; (3 years): Head, Teaching Learning Centre, IIT

Madras. Specialization and Expertise: Chemistry: Photophysical Chemistry, Design and Synthesis of organic and hydro gelators for various applications; Education/Teaching: Designing Learning Outcomes for

Courses, Conducting Classes using Active and Collaborative Learning Techniques. Awards and

Distinctions: AvH Fellowship (2002), Young Faculty Recognition Award (IIT Madras, 2011). Research

Publications in Peer Reviewed Journals: 65. Conference Paper: Development of a Teaching Learning

Centre and Ongoing Faculty Development Programs - A Case Study, Prasad Edamana, Ajith Kumar Kolar, Pramod S Mehta, Sujatha Srinivasan and Jeffrey Froyd, American Society for Engineering

Education, USA, June, 2012.

Richa Verma (TLC)

Professional summary

Currently Prof. Richa Verma work as Senior Project Officer, at Teaching Learning Centre- IIT- Madras. For last 4 years I was faculty in Vision Science at the School of Medicine, Deakin University, Australia. Since 2013, I have been actively involved in optometry education at Deakin University where hybrid model of Problem Based Learning (PBL) is used for the entire course. During this time, I have gained experience in curriculum design, assessment and various pedagogies. I have also received formal training in Designing, Teaching and Assessing Higher Education Programs My area of research is Visual neuroscience with specific focus on retinal physiology. I completed my PhD at The University of Melbourne and post-doctoral fellowship in Visual Neuroscience at Monash University, Australia. I graduated as an optometrist from the Birla Institute of Technology and Science, Pilani, India. Since then, I have used various experimental models to understand the nuances of the visual system ranging, from psychophysics, electrophysiology in humans to single-unit electrophysiology in non-human primates.

Key attributes

In unique position with specialized training in pedagogical teaching strong research background in optometry & vision science. Research area- retinal physiology & anatomy, system neuroscience Formal training in: Designing, Teaching and Assessing Higher Education Programs Contextualizing Learning and Teaching in Higher Education Higher Degree Research Supervision Team Based Learning Designing of formative and summative assessment tasks .

Experience in: Curriculum development Running of Problem Based learning Team based learning Flip Classrooms Published papers in international peer reviewed journals

Reviewer for peer reviewed journals and Australian Research Council (ARC) grant applications

Educational qualifications

- 2015-2016 Graduate Certificate in Higher Education Learning & Teaching (GCHLT), Deakin University, Australia.
- 2012 Good Clinical Practice (GCP) course for research professionals, Nucleus Network, Melbourne, Australia.
- 2008 Doctorate (PhD) in Vision Science, The University of Melbourne, Australia.
- 2008-2010 NHMRC Post-Doctoral fellow, Dept of Physiology, Monash University, Australia.
- 2006 Post graduate coursework in statistics (SPSS) for researchers, The University of Melbourne, Australia.
- 2001 Bachelor of Science in Optometry (B.S.Optom)- Elite school of Optometry, Birla Institute of Technology and Science, Pilani India

COURSE PLAN :

Week 1: An inexperienced engineering teacher's view (GK); From traditional lecturing to helping students learn (GK); Better learning (Bloom's taxonomy) (GK); Problem based learning (PBL) and problem solving (GK)

Week 2: Learning outcomes (TLC – E. Prasad); Active learning (GK); Co-operative group learning (GK)

Week 3 : Flipped classroom (GK); Lab courses (GK); Evaluations/assessments (TLC – Richa Verma)

Week 4 : How can we use research in education? (GK); Class composition ;Psychological type and learning;Models of cognitive development ; Learning theories