

**THE UNIVERSITY OF HONG KONG
FACULTY OF ENGINEERING**

Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7001
Course title	Mechanical Engineering Research Seminar
Curriculum offered to Rpg students	For ALL years of students
Option	Compulsory or Elective
Course unit/credit	24 contact hours (2- semesters)
Teaching Load	100 % Department of Mechanical Engineering
Semester	1st semester / 2nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester /
Description	<p>A compulsory seminar course for all research postgraduate students in Mechanical Engineering. Lectures on current developments are presented by staff members, graduate students, and visiting scientists and engineers. Students are required to register for at least two of the following groups defined by research areas:</p> <ol style="list-style-type: none"> 1) Devices 2) Robotics and control 3) Sound and vibration 4) Additive manufacturing & design 5) Advanced materials 6) Natural & built environment 7) Thermofluids 8) Medical engineering 9) Energy
Pre-requisites	None

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Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7002
Course title	Advanced topics in Fluid Flows and Transport Phenomena Research
Curriculum offered to Rpg students	For ALL years of students
Option	Compulsory or Elective
Course unit/credit	30 contact hours
Teaching Load	100 % Department of Mechanical Engineering
Semester	1 st semester / 2 nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester / To be confirmed
Description	<p>A broad introduction to the concepts and techniques commonly used in the field of fluid mechanics will be given. Starting from the basic principles of mass and momentum conservation, advanced concepts and topics like vorticity and turbulence will be introduced. Depending on the background of the students and interests of the instructor, in-depth treatment of a special field in hydrodynamics will be provided. Topics may vary from year to year and representative samples will be given. In geophysical flows, the effects of rotation and the significance of potential vorticity will be examined.</p> <p>In transport phenomena, flows through porous media and Darcy law will be presented. In wave propagation, the emergence of solitons and localized modes in evolution systems will be pointed out. In thermal science, the role played by convection and interactions with fluid flows will be elucidated. In low Reynolds number flows, the dynamics of bubble encapsulation and other achievements in microfluidics will be highlighted.</p>
Pre-requisites	Students who have completed MECH 3408 Mechanics of fluids or the equivalence.

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Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7003
Course title	Advanced topics in Materials Research
Curriculum offered to Rpg students	For Year _____ students or ALL years of students
Option	Compulsory or Elective
Course unit/credit	30 contact hours
Teaching Load	100 % Department of Mechanical Engineering
Semester	1 st semester / 2 nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester / To be confirmed
Description	Selected topics on materials science which will cover some of the following topics: diffusion and related phenomena, defect theory, physical examination of materials by X-ray and electron microscopy, processing techniques, thermal and mechanical behaviour of materials, introduction to specific classes of new materials, etc. The topics presented may differ from year to year depending on the needs of the students and the interests of the instructor.
Pre-requisites	None

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Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7004
Course title	Advanced topics in Solids Mechanics Research
Curriculum offered to Rpg students	For Year _____ students or ALL years of students
Option	Compulsory or Elective
Course unit/credit	30 contact hours
Teaching Load	100 % Department of Mechanical Engineering
Semester	1 st semester / 2 nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester / To be confirmed
Description	Selected topics on mechanics of solids which will cover some of the following topics: mechanics of electromagnetic solids, anisotropic elasticity, complex stress functions for 2-D elasticity, fracture mechanics, finite element methods, phase field methods, etc. The topics presented may differ from year to year depending on the needs of the students and the interests of the instructor(s).
Pre-requisites	Students who have completed MECH3409 Mechanics of solids or the equivalence

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Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7005
Course title	Advanced topics in Control Engineering Research
Curriculum offered to Rpg students	ALL years of students
Option	Compulsory or Elective
Course unit/credit	30 contact hours
Teaching Load	100 % Department of Mechanical Engineering
Semester	1 st semester / 2 nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester / To be confirmed
Description	Selected topics on control engineering which will cover some of the following topics: Control of multivariable systems, linear system theory, limitations of performance, robust stability and performance analysis, LQG, H2 and H-infinity design, robust pole assignment, model reduction, singular systems, state estimation and filtering, for instance. The topics presented may differ from year to year depending on the needs of the students and the interests of the instructor(s).
Pre-requisites	Students who have completed MECH4404 Automatic control or the equivalence

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Syllabus of course(s) for RPG students

Department	Mechanical Engineering
Course number	MECH7006
Course title	Advanced finite difference/volume methods
Curriculum offered to Rpg students	<i>or</i> ALL years of students
Option	Compulsory <i>or</i> Elective
Course unit/credit	30 contact hours
Teaching Load	100 % Department of Mechanical Engineering
Semester	1 st semester / 2 nd semester / Full semester / Summer semester / Both 1 st and 2 nd semester / To be confirmed
Description	<p>To broaden students with advanced concepts and methods in the finite difference/volume approaches with applications to typical engineering research problems such as thermal-fluids, environmental (air and water flows), magnetohydrodynamics, acoustics, etc. The detailed topics and examples may vary depending on the background and the research interests of the enrolled students. Implementation will include use of MatLab, C or FORTRAN programming.</p> <p>Possible topics are conservation laws and (partial) differential equations, one-dimensional and multi-dimensional problems, high-order accuracy schemes, explicit or implicit schemes, surface and volume integrals, consistency, convergence and stability, non-linear equations, Navier-Stokes equations, boundary conditions, solution of linear equation systems (e.g. multi-grid, conjugate gradient), parallel computing, unsteady problems, and examples.</p>
Pre-requisites	Basic numerical methods