

机械与动力工程学院博士生资格考试笔试大纲

Syllabus of Ph.D. Qualification Examination (SJTU-ME)

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| *笔试主题 Exam Topic | 核反应堆热工水力 |
| | Nuclear Thermal Hydraulics |
| *考核形式 Exam Format | 闭卷考试, 1 小时 Closed-book exam, 1 hour |
| *考核目标 Exam Target | <p>1. 理解和掌握核反应堆热工水力的基本理论、术语表达和理论模型;</p> <p>2. 能用运用热工水力的基本理论和方法解决水堆核心设备特别是堆芯内的流动传热现象;</p> <p>3. 能够识别水堆一回路系统中关键设备和子系统的热工水力现象以及这些热工水力现象的关键影响因素;</p> <p>4. 能够对水堆一回路系统中关键设备和子系统的热工水力现象进行数学描述和初步的设计分析。</p> <p>After successful completion of the course students will be able to</p> <p>(a) describe the thermal and thermodynamic processes that take place in a nuclear power plant,</p> <p>(b) formulate, analyze and solve simple problems in heat transfer in complex systems,</p> <p>(c) formulate, analyze and solve simple problems in single- and two-phase flows,</p> <p>(d) analyze dynamic and thermal loads in complex systems,</p> <p>(e) perform a simple thermal design of a nuclear power plant,</p> <p>(f) Reflect on thermal limitations in nuclear power plant.</p> |
| *考核内容 Exam Contents | <p>热工水力行为广泛存在于核工程系统和设备中,因而反应堆热工水力是支撑反应堆设计和安全分析的基础,是核科学与工程专业一门重要的专业必修课程。</p> <p>核反应堆热工水力课程采用课堂授课和课后作业报告相结合的教学方法。通过课堂授课教学,使得学生掌握反应堆系统热工水力的研究背景、知识体系、基本概念与计算分析方法,并对反应堆系统核心设备特别是堆芯内的热工水力现象具备初步的建模和分析能力。通过课后作业报告以及答辩,使学生具备热工水力基础知识的综合应用能力,使学生对反应堆堆芯具有稳态分析和子通道分析计算的能力,为今后的反应堆工程设计和分析打下坚实的学科基础。</p> <p>热工水力课程的主要围绕反应堆流动过程的分析计算基础知识,需要掌握的基本理论及分析方法包括:反应堆热工水力系统、热工设计准则、堆芯热量产生与分布、反应堆系统热力过程、燃料元件传热过程、单相流体流动传热过程、两相流体流动传热过程、堆芯热工水力分析、系统热工水力分析等。通过该课程的学习可使学生具备分析反应堆内发生的热工水力过程能力。</p> <p>This course is one of the required courses of nuclear engineering</p> |

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| | <p>and nuclear technology major (undergraduate). Heat transfer and fluid flow (otherwise termed thermal hydraulics) is central to the conversion of nuclear energy into thermal energy by extraction of heat from the nuclear fuel elements and in the utilization of this heat in electrical power production. This course is aimed at presenting the bases of flow and heat transfer in both single phase and two phase systems, and the applications of these bases in the nuclear reactor context. The course is focusing on the thermal and thermodynamic processes in nuclear systems. The covered topics includes: Thermal design principle, reactor heat generation, Formulation of the reactor thermal hydraulic design problem, single phase and two phase flow, critical heat flux, sub-channel analysis. The objective of the course is to provide an overview of the basic thermal processes that take place in nuclear systems.</p> |
| *参考书目 References | <p>[1] 于平安等，反应堆热工水力学，北京：清华大学，2002 [2] 俞冀阳，反应堆热工水力学，北京：清华大学出版社，2003 [3] Neil E . Nuclear Systems I- Thermal Hydraulic Fundamentals. New York. , Taylor & Francis Group. 1990</p> |
| 备注 Notes | |