PROGRAM for Distant Learning Energy Engineering

NUCLEAR POWER PLANT

Presentation

.....

Lecture 1 Prof. Mario Silvestri - Politecnico di Milano Present and future energy needs Introduction Variables on which the energy needs depend Energy for future infrastructures Near term energy forecasts Possible trends in the selection of primary energy sources Long term energy predictions Summary and conclusions	3 4 6 8 12 12 14	pag.	1
Lecture 2 Prof.Marino Giannini - Dr. Romolo Remetti Università degli Studi di Roma 'La Sapienza' Principles of nuclear physics related to fission and fusion Basic nuclear properties Nuclear binding energy and systematic overall trends Radioactive decay Nuclear reactions Neutron induced reactions andfission Reactions of interest for future fusion applications Nuclear data Bibliography	pag. 1 18 21 24 33 37 44 48 48 48	6	
Lecture 3 Dr. Marco Caira - Universitài degli Studi di Roma 'La Nuclear fusion tests and devices Part 1 Physical principles of nuclear fusion Inertial confinement Magnetic confinement Part 2 Experimental devices andfuture power reactors Design problems of the blanket. first wall and divertor References	51 61 67 81 91 100	pag.	49
Lecture 4 Prof. Rafael Caro - Consejo de Seguridad Nuclear (1 Fundamentals of nuclear reactors Historical background Nuclear fission Fissile and fertile elements Fission chain reaction. Critical size General transport equation References	Madrid) 104 106 108 109 114 122	pag.	102
Lecture 5 Prof. Augusto Gandini - ENEA (Roma) Reactor kinetics and control Introduction Point kinetic equation Reactivity effects Fission product poisoning Nonlinear kinetics Control requirements References	130 131 146 149 151 151 157	pag.	128

Lecture 6 Prof. Naim H. Afgan - Instituto Superior Técnico (Lis	bon)	
Thermo-hydraulic core design		pag. 172
Introduction	174	10
The volumetric thermal source intensity in the fuel	177	
Heat transport in the fuel element	181	
Axial temperature distribution in fuel, cladding and coolant	184	
Selection of the reactor coolant	193	
Lecture 7 Dr. Gian Piero Celata - ENEA (Roma)		204
Design limitations of water cooled reactors		pag. 204
Introduction	206	
Two phaseflows	206	
Critical powers in water reactors	214 224	
Two-phase flow instabilities	224 231	
Coolant mixing in water cooled reactors core Hot channels factors	231 236	
Pros channels factors Pressure drops in cores	230 244	
Orificing in cores	251	
Origicing in coles	201	
Lecture 8 Prof. Carlo Fizzotti - ENEA (Roma)		
Core design technology		pag. 267
Introduction	269	r • 8• = • •
The fuel elements	271	
Behaviour of the fuel under irradiation	273	
Behaviour of cladding tubes under irradiation	274	
Behaviour of pressure vessels under irradiation	278	
Conclusion	280	
Lecture 9 Dr. Hi. Matzke Institute for Transuranium Element	s (Karlsrı	
Nuclear fuel, design and characteristics		pag. 294
Introduction	296	
Details on fuel design and characteristics, with emphasis on fuel		
for light water reactor, LWRs	<i>302</i>	
Basic physical and chemical processes and mechanisms occuring	007	
during reactor operation	307 311	
Fuel performance modelling	312	
Effect of burnup and limits for the Iifetime of the fuel References suggested for further reading	312 317	
References suggested for further reading	017	
Lecture 10 Prof. Enzo Lo Prato - ENEA (Roma)		
Pressurized water reactors		pag. 334
Part 1 - The basic PWR concept and its current realizations		10
Preface	337	
Status of the PWR technology	<i>338</i>	
General composition of a PWR plant	341	
Realization of components and systems for PWR plants	345	
The PUN design	410	
Part 2 - Aspects of PWR plant operation		
Introductory remarks	443	
Operational features of a PWR core	445	
PWR plants operation at power and control	467 480	
PWR plant performance in fault conditions	400	
Lecture 11 Dr. Giuseppe Grossi - ANPA (Roma)		
Nuclear wastes	1	pag. 503
Introduction	505	
What is radioactive waste?	505 507	
What is failuactive waste: Where does radioactive waste come from?	513	
What is the cumulative andlor annual production of radioactive waste?	522	
How is radioactive waste managed?	529	
International cooperations	565	
Present trends in advanced R&D activities	569	

Lecture 12 Dr. Luigi Frittelli - ANPA (Roma) Radiation protection in nuclear plants Introduction Biological effects of ionising radiation The system of radiological protection Protection against internal irradiation Protection against external irradiation Sources of radiation exposure	575 576 579 592 597 611	pag. 573
Lecture 13 Prof. Agostino Mathis - ENEA (Roma) Reactor control and instrumentation Introduction Definitions Control specifications Control schemes The development of a control scheme Dynamical models of nuclear power plants The transfer function of the neutron kinetics Feedbacks from thermal power The "controlled risk" design procedure	635 636 638 639 642 645 645 648 650 656	pag. 633
Lecture 14 Prof. Maurizio Cumo - Universitàddegli Studi di Rom Reactors safety analysis and methods Introduction Nuclear reactor safety features Basic design safety principles Nuclear reactor safety measures Human aspect of nuclear reactor safety Safety and risk assessment References	a 'La Sapi 663 665 667 669 672 675 680	pag. 661
Lecture 15 Prof. Bruno Panella - Politecnico di Torino Design basis accidents Design basis and beyond design basis accidents Loss of coolant accidents Engineered safety systems Severe accidents Natural and man-made external events Man-machine interface and human reliability	683 691 702 707 713 719	pag. 681
Lecture 16 Prof. E.F. Hicken - Institut für Sicherheitsforschung Forschungszentrum (Jülich) Design of Reactor Containment Systems Introduction Design requirements Containment designs Experimental studies and code developments Loads from core melts Trendsforfuture containments	740 741 746 748 749 751	ortechnik, pag. 738
 Lecture 17 Prof. Antonio Naviglio - Università degli Studi di Ro Reactors with passive and inherent safety features part1 Introduction The concepts of passive safety and of inherent safety features Reasons for the development of new designs of nuclear reactors relying on simplicity, passivity, inherent safety features A short review of engineered safeguards of traditional PWR's Innovative trends common to most designs proposed Part2 Examples of new designs proposed Economic and market aspects Conclusions and perspectives for the future References 		pienza' g. 789