Michele Anatone

PROGRAMME OF "MACCHINE 2" "*TURBOMACHINES AND INTERNAL COMBUSTION ENGINES*"		
• CODE: I0601 • TYPE OF COURSE UNIT: COMPULSORY • LEVEL OF COURSE UNIT: 2ND CYCLE, MECHANICAL ENGINEERING • YEAR OF STUDY: 2ND YEAR, 2ND SEMESTER		
NUMBER OF ECTS CREDITS: 9		
Teacher: Prof. Michele Anatone		
1	**Course objectives**	THE COURSE AIMS TO GIVE DEEPEN AND BROADEN KNOWLEDGE OF THE THERMAL POWER PLANTS, TURBOMACHINES AND INTERNAL COMBUSTION ENGINES, CONSIDERING ASPECTS BOTH OPERATIONAL AND OF DESIGN. IT DEALS WITH THE STUDY OF THE OFF-DESIGN CONDITIONS OF THE GAS TURBINE PLANTS AND THE CONDITIONS OF INSTABILITY OF COMPRESSORS. THE DESIGN CONCERNS WITH THE RADIAL EQUILIBRIUM THEORY. FOLLOWS THE STUDY OF INTERNAL COMBUSTION ENGINES, TREATING THE THERMODYNAMICS AND THE MOST RELEVANT PHENOMENA THAT CHARACTERIZE ITS PERFORMANCE.
2	**Course content and Learning outcomes (Dublin descriptors)**	TOPICS OF THE MODULE INCLUDE: **THEORY OF SIMILARITY AND DIMENSIONAL ANALYSIS**. DEFINITION OF DIMENSIONLESS GROUPS FOR THE DESCRIPTION OF THE PERFORMANCE OF INCOMPRESSIBLE AND COMPRESSIBLE FLOW TURBOMACHINES. CHARACTERISTIC CURVES OF TURBINES AND COMPRESSORS. SPECIFIC SPEED. TOTAL THERMODYNAMIC PARAMETERS. **MACHING OF THERMO-FLUIDYNAMIC SYSTEMS.** EQUILIBRIUM OF A SINGLE-AXIS AND DOUBLE-AXIS GAS TURBINE PLANT. EQUILIBRIUM OF THE GAS GENERATOR AND THE POWER TURBINE. ANALYSIS OF OFF-DESIGN CONDITIONS. **INSTABILITY OF COMPRESSORS.** STABLE, UNSTABLE, AND INDIFFERENT EQUILIBRIUM. STALL. SURGE, GREITZER MODEL. **RADIAL EQUILIBRIUM THEORY.** ISRE AND NISRE EQUATIONS. BOUNDARY CONDITIONS AND INFLUENCE OF THE DESIGN LAW ON THE BLADES SHAPE. FREE VORTEX, FORCED VORTEX AND THREE PARAMETERS LAWS. DESIGN OF THE STAGE OF AN AXIAL FAN. **INTERNAL COMBUSTION ENGINES.** CLASSIFICATION AND THERMODYNAMIC CYCLES. IDEAL, AND REAL THERMODYNAMIC CYCLES. EQUATIONS FOR THE POWER. VOLUMETRIC EFFICIENCY AND ANALYSIS OF PHENOMENA THAT INFLUENCE IT. ORGANIC (MECHANICAL) EFFICIENCY. FLOW FIELD INSIDE THE CYLINDER. TURBULENCE AND ORGANIZED MOTIONS OF THE CHARGE. SUPERCHARGING. ANALYSIS OF COMBUSTION IN SPARK IGNITION AND COMPRESSION IGNITION ENGINES. ON SUCCESSFUL COMPLETION OF THIS MODULE, THE STUDENT SHOULD - HAVE PROFOUND KNOWLEDGE OF THE OPERATING CHARACTERISTICS OF THE TURBOMACHINES, - DEMONSTRATE SKILL TO SELECT THE MOST APPROPRIATE TURBOMACHINE, - DEMONSTRATE SKILL TO ASSEMBLE THERMO-FLUIDYNAMICS DEVICES (TURBOMACHINES, HEAT EXCHANGERS, COMBUSTION CHAMBERS), - HAVE THE SKILL TO INVESTIGATE THE INSTABILITY OF TURBOMACHINES, - HAVE KNOWLEDGE AND UNDERSTANDING THE PHENOMENA TAKING PLACE IN INTERNAL COMBUSTION ENGINES,
3	**Prerequisites and learning activities**	THERMODYNAMICS, HEAT TRANSFER, CHEMISTRY, BASIC NOTIONS CONTAINED IN THE COURSE OF MACCHINE OF THE FIRST DEGREE LEVEL.
4	**Teaching methods and language**	LECTURES AND EXERCISES. LANGUAGE: ITALIAN / ENGLISH **REF. TEXT BOOKS** DIXON, FLUID MECHANICS, THERMODYNAMICS OF TURBOMACHINERY, BUTTERWORTH-HEINEMANN. COHEN, ROGERS, SARAVANAMUTTOO, GAS TURBINE THEORY, LONGMAN. HORLOCK, AXIAL FLOW COMPRESSORS, KRIEGER. HEYWOOD, INTERNAL COMBUSTION ENGINES, MCGRAW HILL.
5	**Assessment methods and criteria**	ORAL EXAMINATION, REALIZATION AND DISCUSSION OF A TECHNICAL REPORTS REALIZED BY STUDENTS DURING THE COURSE