Università degli Studi della Basilicata
Scuola di Ingegneria

COURSE: Fluid flow machines and power generation systems

TEACHER: Bonfiglioli A. (6 ECTS) e Magi V. (3 ECTS)

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Language: italian

ECTS: 9	n. of hours: 90	Academic year: 2014-2015	Campus: Potenza	Semester: second

TOPICS

Volumetric machines and turbomachines: classification. Review of fundamental concepts in thermodynamics. Converging-diverging nozzles. Hydraulic turbines: Pelton, Kaplan, Francis. Centrifugal pumps. Reciprocating engines. Reciprocating volumetric compressors. Turbogas power plants. Axial steam and gas turbines.

TEACHING METHODS (please tick one or more options)

× Theoretical lessons
× Tutorials in classroom
□ Tutorials in laboratory
□ Project works
□ Technical visits
Other activities (please specify) _____

TEXTBOOKS

Catalano L.A., Napolitano M. Elementi di Macchine Operatrici a Fluido. Pitagora Editrice, Bologna. ISBN:88.371.1241.6 Capetti A. Macchine Termiche. UTET, Torino. M. Napolitano, P. De Palma, and G. Pascazio. Coursenotes available on the website of the Technical University of Bari (www.poliba.it)

ON-LINE EDUCATIONAL MATERIAL

web address: http://oldwww.unibas.it/utenti/bonfiglioli/www.html

LEARNING OUTCOMES

Give the student a basic understanding and calculation methodologies of volumetric fluid machinery and turbomachines, both work-adsorbing and power generating.

REQUIREMENTS

EVALUATION METHODS (please tick one or more options)

□ Intermediate verifications
× Written examination
□ Discussion of a project work
□ Practical test
× Oral examination
Further information can be found on http://oldwww.unibas.it/utenti/bonfiglioli/www.html

DETAILED CONTENT

Classification: volumetric and turbomachines.
Review of thermodynamics:
- First and second principle of thermodynamics;
- Eulerian and lagrangean viewpoint;
- Stationary and inertial reference frame;
- Hydraulic and thermal fluid machinery;
- Positive Displacement(or Volumetric) machines and turbomachines;
- Thermodynamic cycles: efficiency
- Calorically and thermally perfect gases;
- Pressure-volume and entropy-temperature thermodynamic planes;
- Isentropic, isobaric, constant temperature, constant volume transformations;
- Specific heat: definition and graphical interpretation;

Polytropic processes;
Compression and expansion efficiencies.

Q1D flow of a compressible fluid:
Hypothesis and limitations
Isentropic flow;
Total and critical properties;
Area law;
Mass flow;
Converging and converging-diverging nozzles.

Velocity triangles: Euler's formula

Work-absorbing turbomachinery:
Classification

Centrifugal pumps:
Importance of the centrifugal forces;
Impeller;
Slip factor;
Diffuser;
Hydraulic and geometric similarity;
Characteristic curves;
Cavitation: Net Positive Suction head (NPSH);
Multistage centrifugal pumps;
Pump specific speed: criteria for selecting a pump.

Hydraulic turbines:
Classification
Turbine specific speed;

Pelton wheel:
Components;
Velocity triangles;
Torque, power and efficiency;
Maximum head.

Francis turbine:
Components;
Velocity triangles;
Degree of reaction;
Turbine specific speed;
Power control.

Kaplan turbine:
Components;
Velocity triangles: free vortex;
Power control;
Diffuser;
Cavitation.

Positive Displacement(or Volumetric) compressor:
Components;
Ideal, real and conventional cycle;
Power control;
Multi-stage compressors.

Turbogas power plant:
Baseline cycle:
ideal and real cycles;
efficiencies.

Axial and radial flow turbines

Reciprocating engines

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SEMINARS BY EXTERNAL EXPERTS	YES □ NO ×
FURTHER INFORMATION	