Curse name: **Forming of internal environment**		
Programme: **Environmental Engineering**		Code:
Type of course: **selected, module 5.4**	Course level: **II stage, 7th EQF**	Semester: **II**
Form of classes : **lecture, exercise, project**	Number of hours per week: **2L, 2E, 2P**	Credit points: **5 ECTS**

GUIDE TO THE SUBJECT

I. COURSE CARD

COURSE OBJECTIVES

C.1. Transfer of knowledge in forming internal environment
C.2. Determination of parameters describing the indoor microclimate
C.3. Analysis of indoor thermal and moisture comfort

COURSE REQUIREMENTS

1. General knowledge in statistics, fluid mechanics, process engineering
2. General knowledge in environmental engineering
3. Particular ability to carry out engineering calculations
4. General ability to develop reports
5. General ability to independently search in literature

LEARNING OUTCOMES

EK 1 -   Student will collect knowledge of the parameters of indoor microclimate
EK 2 -   Student will be able to determine values of indoor microclimate parameters
EK 3 -   Student will have the ability to determine the PMV and PPD indices
EK 4 -   Student will have the ability to read and use of PN/EN ISO standards
EK 5 -   Student will have the ability to collect measurement data and to elaborate a report

COURSE CONTENT

Form of classes - lecture	Hours
L 1-3 – Basic definitions, Polish and European Standards (PN/EN)	3
L 4-7 – Humidity of air (definition, fundamentals in physics, graph i-x)	4
L 8-15 – Parameters of indoor microclimate (definitions, measurement techniques, measurement apparatuses)	8
L 16-20 – Thermal comfort (equation of thermal comfort, thermal stress, PMV and PPD factors)	5
L 21-24 – Indoor microclimate perceptible by human (thermal-moisture balance)	4
L 25-27 – Lights and lighting	3
L 28-30 – Noise and vibrations	3
Form of classes – exercise	**Hours**
E 1,2 – Introduction to statistical analysis – error calculations	2

E 3,4	– Error calculations – particular calculations	2
E 5,6	– Statistical data analysis – confidence intervals	2
E 7,8	– Moist air	2
E 9,10	– Moist air - i-x diagram	2
E 11,12	– Microclimate parameters	2
E 13,14	– Partial test	2
E 15,16	– Measurement of air temperature	2
E 17,18	– Measurement of air moisture	2
E 19,20	– Measurement of air pressure	2
E 21,22	– Measurement of air velocity	2
E 23,24	– Calculations of thermal comfort –PMV and PPD factors	2
E 25,26	– Calculations of thermal comfort - additionals	2
E 27,28	– Calculations of indoor air pollution	2
E 29,30	– Final test	2
Form of classes – project		**Hours**
P 1,2	– Rules for elaboration of individual projects	2
P 3,4	– Rules for standard use	2
P 5-8	– PN-EN ISO 7730 standard	4
P 9-12	– Elaboration of temporal tables	4
P 13-24	– Development of the calculation algorithm and software tool for PMV and PPD factors calculation, and performing calculations.	12
P 25-28	– Report elaborations	4
P 29,30	– Report assessments	2

COURSE STUDY METHODS

1. Lectures using multimedia presentations
2. Exercises
3. Materials to develop a project (standards, sets of tables, private communications)
4. Computer software tools

METHODS OF ASSESMENT (F; P)

F1. – Self-assessment for preparation for classes
F2. – Evaluation within working teams in solving tasks
F3. – Assessment of project preparation
P1. –Tests covering two groups of exercises
P2. – Assessment of the project implementation

STUDENT WORKLOAD

Form of activity	Workload (hours)
Participation in class activities…………………………………	30L, 30E , 30P $\rightarrow$ 90 h
Preparation for tutorials ……………………………………...	……………………... 10 h
Preparation for project ………...……………………………..	……………………….25h
Preparation for tests…………………………………………...	………………………15 h
Contact hours with lecturer …………………………………..	………………………10 h
Total	Σ **150 h**
Total ECTS	**5 ECTS**

TEXTBOOKS

Bell A.A., HVAC Equations, Data, and Rules of Thumb, 2nd Ed, McGraw-Hill Professional, US, 2007
Databases: BazTech, Biblio, Bubl Link, Chemical Abstracts, Ebsco, Elsevier, Emerald, Nature, Sicence, Scircus, Scopus, Sympo, Synaba, Web of Knowledge. Patent databases.
Fanger P.O., Thermal comfort, McGraw-Hill, US, 1973
Faye C. McQuiston, Jerald D. Parker, Jeffrey D. Spitler, Heating, ventilating, and air conditioning: analysis and design, Wiley and Sons, 2000
Recknagel H., Sprenger E., Schramek E.R.: Taschenbuch für Heizung + Klimatechnik. Oldenburg Verlag Münchem, 2001
Standards: PN-ISO 6242-1, PN-ISO 6242-2, PN-EN ISO 7726, PN-EN ISO 7730

NAME OF LECTURER (s) (NAME, SURNAME, E-MAIL ADDRESS)

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Learning outcome	In relation to the learning outcomes specified for the field of study	Course objectives	Course content	Course study methods	Methods of assesment
EK 1	K_W16, K_K01	C.1, C.2	L1 – L30	1	F1.
EK 2	K_W16, K_U16	C.1, C.2	L8 – L30 E7 – E22	1, 2	F1., F2.
EK 3	K_W16, K_U16, K_K01	C.1, C.2, C.3	L16 – L20 E23 – E26, P9 – P24	1, 2, 3, 4	F2., F3., P1., P2.
EK 4	K_U16, K_K01	C.2, C.3	L2 – L3 P3 – P12	1, 2, 3	F2., F3., P2.
EK 5	K_U16, K_K01	C.2, C.3	E1 – E6 E27 – E30 P25 – P30	2, 3	F3., P2.

II. EVALUATION

Learning outcome description	Mark 2	Mark 3	Mark 4	Mark 5
EK 1 - He/she has knowledge about parameters of indoor microclimate	He/she has no knowledge of the processes and phenomena occurring in indoor microclimate	He/she knows only two parameters and poorly understands their meaning physical	He/she knows the parameters of indoor microclimate but does not fully understand	He/she understands the meaning of the physical parameters describing the indoor

			their physical meaning	microclimate
EK 2 - He/she is able to determine values of indoor microclimate parameters	He/she cannot determine the indoor microclimate parameters	He/she makes mistakes in the determination of indoor microclimate parameters	He/she shall measure correctly but calculations include few errors	He/she is properly carried out measurements and calculation of parameters of indoor microclimate
EK 3 - He/she has the ability to determine the PMV and PPD factors	He / she cannot determine the PMV and PPD factors	He/she has difficulties with the assignment of PMV and PPD factors	He/she determines values of PMV and PPD making a few mistakes	He/she correctly calculates values of PMV and PPD factors
EK 4 - He/she has the ability to read and use ISO standards	He / she isn't able to use ISO standards	He/she can understand provisions of ISO standards but cannot make use of theme	He/she can use ISO standards, but poorly understands provisions	He/she applies ISO standards fluently
EK 5 - He/she is able to collect the measurements and elaborate a report	H /she is not able to elaborate the report	He/she has difficulties with data collection and make mistakes in the report	He/she commits a few errors in the preparation of the report	He / she properly collects data and draws up the report

III.   <u>OTHER USEFUL INFORMATION</u>

1. All information for students on the schedule are available on the notice board and on the website: www.is.pcz.czest.pl
2. Information on the consultation shall be provided to students during the first lecture and will be placed on the website of the **Institute of Advanced Energy Technologies**
3. Terms and conditions of credit courses will be provided to students during the first lecture