

The Study Program in the Education of Mining Engineering – Mechanical Engineering

Jaromir Polak

Vice-Rector, Technical University of Ostrava, Czech Republic, <http://www.vsb.cz>
Tel.: +420 69 6994354, Fax: +420 69 6918507, jaromir.polak@vsb.cz

Abstract: The article suggests the teaching plan of mechanical engineering subjects for the education of mining engineers. This part of study is divided into six subjects included in the 4th, 5th, 6th and 7th semesters. Main emphasis is placed on the understanding of principles of mining machines, their operating conditions, technology and safety of their use and economical problems. Possible syllabuses of the subjects are presented according to the long-termed experience with the education of mining engineers at the Faculty of Mining and Geology of Technical University of Ostrava.

Keywords: education, subjects, syllabuses, mechanical engineering

1. Introduction

The idea of an individual study program for mining engineering studies originated from a discussion at the ICEE 99 international conference. In the majority of countries in the world a proportionally small number of mining engineers are educated at universities and therefore their significance for the life of people in the world is great. Their work and their knowledge is connected with people's approaches to nature, towards the use of raw materials and energetic sources, towards building transport systems in the countryside, and with other areas.

The significance of an individual program for the education of mining engineers can be seen. It enables to issue top quality textbooks for most of the countries round the world. It also allows the short-term exchanges of teaching stuff between universities, the exchange of knowledge, the exchange of students, co-operation in working out of diploma works, and other activities.

It is almost obvious that this is the stimulation for the establishment of an international, university - mining society founded on the co-operation between universities and mining industry.

2. Mechanical engineering subjects in the study program of mining engineering

Mining of today is highly based on mechanisation and automation of working processes. That is, why the proposed study program includes 315 hrs of mechanical engineering. Emphasis is placed on the systems of mining machines, their operating conditions, safety of a work and technology of their use. The knowledge of basic machine components and their stress will be included as well.

According to the project which was submitted at the conference ICEE '99, the mechanical engineering subjects were included in the 4th, 5th, 6th and 7th semesters. Subjects of mathematics and physics in the first three semesters are considered as prerequisites for the part of a study. Possible schedule of the mechanical engineering subjects might be as follows:

4 th semester: ME 401 Fundamentals of mechanical engineering	extent 2 - 2	total of 60 hours
5 th semester: ME 501 Mechanics and strength of materials	extent 2 - 2	total of 60 hours
ME 502 Machine parts and components	extent 3 - 2	total of 75 hours
6 th semester: ME 601 Mining machines and complexes	extent 2 - 2	total of 60 hours
7 th semester: ME 701 Mine winding and transport	extent 2 - 2	total of 60 hours

ME 702 Equipment of processing plants

extent 2 - 2

total of 60 hours

All subjects are determined both for surface and underground mining.

3. Syllabuses of projected mechanical engineering subjects

ME 401 Fundamentals of mechanical engineering

Fundamentals of technical drawings, standardisation, reading of drawings.
Technical materials and their utilisation.
Surface grade (roughness, tolerancing for form and position).
Principles and parts of removable and permanent joints.

ME 501 Mechanics and strength of materials

Static force systems, centre of gravity, rigid bodies, passive resistance, stability of bodies, solving of statically determinate systems (beams, frames, lattice).
Kinematics – point motion, kinematics of a body, kinematics of body systems, mechanisms.
Dynamics – mass point, mass point system, dynamics of rigid body, fundamentals of theory, of mechanisms, fundamentals of motion.
Mechanics of materials-concepts of strength of materials, simple stress and strain tension and compression, second moments of a plane area, shear and torsion, simple bending theory (shearing forces, bending moments)-

ME 502 Machine parts and components

Design and strength calculations of basic machine components such as shafts, axles, gears and chain wheels, bearings, fittings of rotating elements, couplings, ropes, chains etc. Principles and design of basic machine parts such as electro-motors and hydro-motors, gear boxes, brakes, etc.
Fundamentals of design by the AutoCad.

ME 601 Mining machines and complexes

Principles, design, basic calculations and conditions of application of mining machines and complexes both for surface and underground mining. Theory of disintegration.
Machines and complexes for surface mining:
Shovel excavators and drag-lines. Bucket wheel excavators, digging wheel excavators and other kinds of excavators. Machines and equipment for dredging, for disintegrating of hard rocks. Overburden dumping and filling machines. Pumps, hydro-motors, compressors. technological complexes. Auxiliary equipment and supplementary mechanisation.
Machines and complexes for underground mining:
Mechanical-physical properties of rocks. Drives of mining machines.
Machines and complexes for driving workings: Drilling machines, principles, force characteristics, stability of drill carriages. Loading machines, principles, kinematic and force characteristics, stability. Driving machines, driving complexes, tunnelling machines.
Machines and complexes for underground extraction: Longwall complexes, mechanical supports, face conveyors, ploughs, shearer-loaders, scrapers etc. Complexes for other extraction methods.

M 701 Mine winding and transport

Importance and goals of mining transport. Fundamentals of mechanics of bulk materials. Principles and basic technological calculations of transport and winding equipment.
Belt conveying systems, main parts, conveyor calculations.
Armoured flexible conveyors, main parts, conveyor calculations.
Cable belt conveyors, screw conveyors, vibratory and apron conveyors.
In-pipe transport, hydraulic and pneumatic transport.

Locomotive haulage, track, locomotives, cars, locomotive calculations.
Wire rope haulage systems. Free steered vehicles, road haulage.
Heavy materials handling, monorails, duorails, lifting devices.
Winding systems, drum winders, Koepe and multi-rope friction winding, winding engine braking, winding calculations. Shafts, headgears, cages, skips, ropes, mine car circuits, skip complexes.

M 702 Equipment of processing plants

Bulk storage, bunkers, stockyards, hoppers, chute gates, stresses in a bulk body.
Transport equipment in processing plants, running chutes, conveying troughs, belt and chain conveyors, bucket elevators.
Principles of crushing and grinding processes. Main types of crushers and mills.
Separation of bulk materials. Main types of separators, working conditions. Jigging.
Heavy-liquid separation. Flotation, hydro-cyclones, water systems. Bulk dewatering, filters, centrifuges, filter pressers, waste treatment.

4. Conclusion

Technical University of Ostrava has a very long tradition both in the education of mining engineers and in the close co-operation with a mining industry. Many of our graduates have been working abroad (South Africa, South American countries etc.). We very closely co-operate and co-ordinate our curricula namely with Polish (Silesian University of Technology Gliwice, University of Mining and Metallurgy Kraków, Wrocław University of Technology) and Slovak (Technical University of Košice) universities.

The M 601, M 701 and M 702 subjects are designed in a flexible way. It is possible to form them rather closer either to the surface or underground mining and either to the coal, ore or other types of mining according to the need and the real situation.

I was working for 25 years in the Ostrava – Karviná coal mine basin in the Department of mining transport before I came to the University. Since the year 1974 I was teaching in an external way and since the year 1986 in a full-time way subjects concerning mining transport at the Faculty of Mining and Geology. That is why

I believe that the idea of an individual study program for mining engineers studies is fully real and vital and is worth to be continually worked out.

5. References

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