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The technology of oil fields development

Classroom

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Name of indexes	Total		Distribution for semesters			
			Semester 7		Semester 8	
	Full-time form of training (FTFT)	Part-time (distance) form of training (PTFT)	Full-time form of training (FTFT)	Part-time (distance) form of training (PTFT)	Full-time form of training (FTFT)	Part-time (distance) form of training (PTFT)
Amount of credits ECTS	8		4		4	
Amount of modules	4		2		2	
Total volume of time, hours	240		120		120	
Auditorium classes, hours, including:	102		54		48	
lecture classes	68		36		32	
seminar classes	-		-		-	
practical classes	34		18		16	
laboratory classes	-		-		-	
Self-contained work, hours, including:			66		72	
fulfilment of course project (work)	30		30		-	
fulfilment of control (cal-culation and graphic) works			-		-	
studying the material given at lectures	40		10		30	
studying the material for self-contained study	18		6		12	
preparation to labo-ratory classes and control measures	50		20		30	
preparation of reports on laboratory works	-		-		-	
preparation to examina-tion	-		-		+	
Form of semester cont-rol	Course project+credit, Examination		Course project+credit		Examination	

The sum of points for all types of educational activity	ECTS Mark	Mark in accordance with the national scale for examination, differentiated test, course project (work), practice
90 – 100	A	excellent
82 – 89	B	good
75 – 81	C	
67 – 74	D	satisfactory
60 – 66	E	
35 – 59	FX	unsatisfactory with possibility of reexamination
0 – 34	F	unsatisfactory with the obligatory repeat of the course of the discipline

LECTURE №1-2
OBJECT, SYSTEM AND TECHNOLOGY DEVELOPMENT

Oil field development includes the following steps needed to bring the oil to the surface:

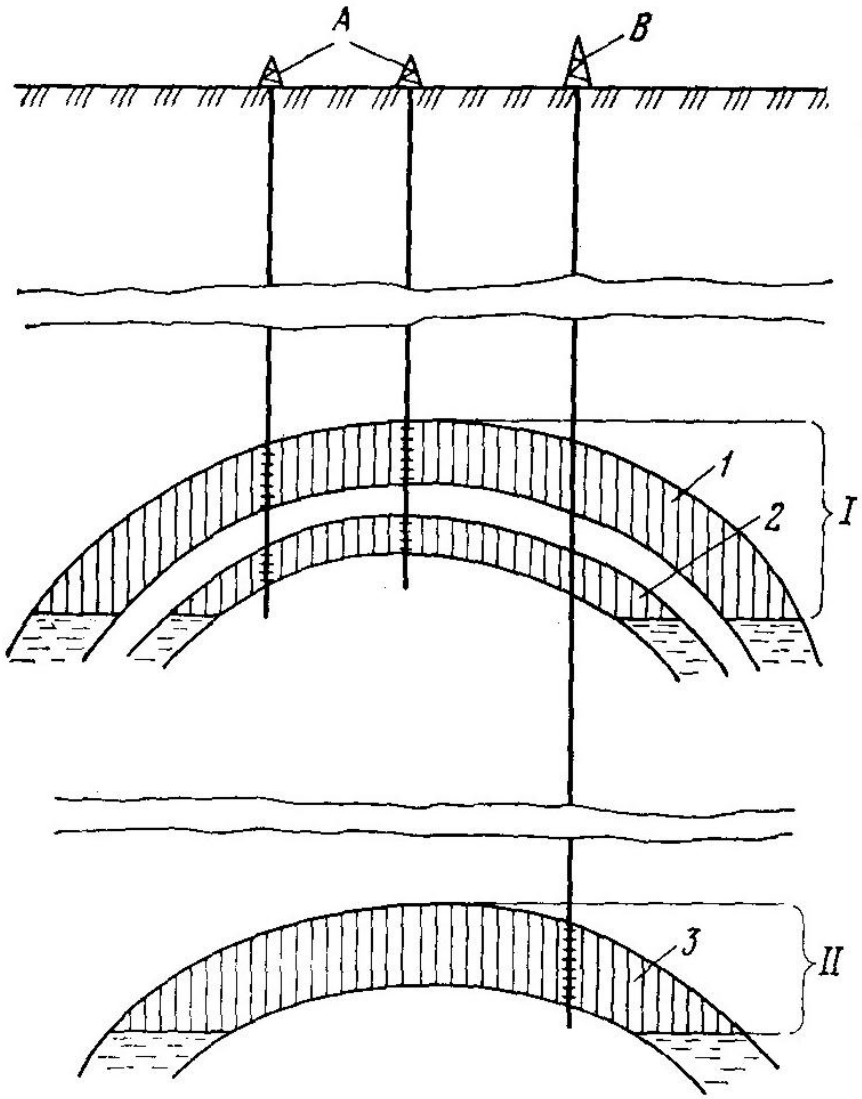
1. Drilling over a reservoir.
2. Control of the movement of oil and gas to the wells by proper spacing patterns and operating conditions.
3. Reservoir energy control.

The development of oil fields offers a set of measures related to the drilling of wells, control seepage in the reservoir, the location of wells, setting the mode of operation of wells.

The **"system development"** - commonly understood set of activities carried out in the fields, comprising:
1) drilling deposit;
2) control seepage in the reservoir by placing the wells and the default mode of operation;
3) the regulation of energy balance reservoir by pumping water or gas;
4) the rise of liquid from downhole to the surface.

The **object development** is artificially allocated within the technological field of education (layer, an array, a set of layers) which contains reserves of hydrocarbons are extracted from the depths of a defined group of wells.

Main features of the object - its industrial presence in the oil wells and the group with which it developed.



Geological and physical properties	Layer		
	1	2	3
Recoverable oil reserves, mln. tons	200	50	70
Thickness, m	10	5	15
Permeability, mD	100	150	500
Viscosity, mPa*sec	50	60	3

Figure 1 Section of multilayers oil field

Combining layers 1 and 2 in one object development due to the fact that they have similar values of permeability and viscosity of the oil, and are a short distance from each other vertically. By this recoverable reserves of oil in the reservoir 2 are relatively small.

In addition, if the layer 3 contains low-viscosity oil can be developed using conventional water flooding, then the development of layers 1 and 2, which marked the high-viscosity oil, will have to apply from the beginning of the development of other technology.

However, it should be noted that despite the significant difference of parameters of layers 1, 2 and 3, the final conclusion of the selection of objects taken from the development of technology and technical and economic indicators of options combining layers in object development.

Objects development is divided into the following types: **independent**, that is being developed now and **back object**, that is the one that will be developed wells are currently operating in another object.

The main purpose of the theory and practice of oil field development - the most complete and cost efficient extraction of oil from the depths.

Discipline "Technology development of oil fields" is a technology because it is directed at improving technology, increasing real economically profitable oil recovery.

Consider what oil recovery factor. Determines the degree of extraction of oil from oil reservoirs and is a measure of degree of oil usage. Getting maximum value - it is one of the main objectives of rational development of oil fields. Its oil recovery ratio of oil produced to the initial oil in the reservoir. Initial oil is volume defined by the Zhdanov's formula

$$Q_{init}=F\cdot h\cdot m\cdot \rho_0\cdot \theta\cdot \gamma, \quad (1)$$

where F - oil-bearing area, m^2; h – effective layer thickness, m; m – coefficient of porosiry, fractions of unity, (f.u.); ρ_0 - initial oil saturation, (f.u.); θ - average recalculating factor, (f.u.); $\theta=1/b$ (b – volume formation factor); γ - specific density of oil after decontamination, t/m^3.

Coefficient of oil recovery depends on many factors: the geological structure and mode of deposit; properties of rocks-collector; its degree of heterogeneity; properties of reservoir fluids, indicators development, drives reservoir and

others. Oil recovery factor depends on the amount of free gas, which is in the reservoir. For determination of oil recovery used in industrial and laboratory methods.

What does it mean developing reservoir?

Develop reservoir to cause movement of reservoir fluids into wells. This can be done by drilling and injection wells operating. You need only install the needed their number, location, time of commissioning and operating modes.

These issues must be addressed in the design of field development system, and the system is designed to be rational. In justification Selecting and development field governed by criteria of rationality.

What is a rational development system?

Rational development system - a system that provides the needs of the state in the oil at the lowest cost possible and high oil recovery.

In establishing these criteria the following basic points must be considered:

1. The minimum degree of well interaction.
2. Maximum recovery factor.
3. Minimum production cost.

A rational development plan must ensure the prescribed production at minimum cost and with the highest possible recovery factor.

Planning the development system consists of selecting a variant which meets all the above requirements. On this basis the problem of establishing a rational development plan should be subdivided into a number of problems to be solved one after another:

- establishing the geological-physical data;
- establishing the technical indices for some particular development plan by means of hydrodynamic calculations;
- evaluating the economic effectivity of the different development plans;
- choosing the most rational development plan by comparing the geological-technical and economic characteristics involved in different plans.

To select rational development field conditions at the design stage different options for development are calculated. Options are not only for systems development or by action on the layer, but the parameters for the development of the same systems.

What is the technology of extracting oil from the depths?

The technology of extracting oil from the depths defined mechanism that drives the oil and gas in the reservoir. In natural conditions this oil displacement by water or gas contained in the gas cap or released from oil. Performance Technology development is characterized by the fullness of extraction of oil. In order to increase oil recovery using various methods of influence on them, water injection, gas and various chemicals, coolants and others.

What is called the technology development of oil fields?

Technology development of oil fields is the set of methods used to extract oil from the depths.

How can you regulate the process of field development?

The process governing the development of the field, changing the total number of wells, the ratio producing and injection wells, their relative position in the square, setting various modes wells during their operation.

The diversity of geological and physical conditions in which the process of development of oil fields requires the use of different oil recovery technology and various systems development.

At one and the same the deposit depending on the location, number, order commissioning and mode of production wells, and depending on the application download working agent into the reservoir and pumping system can hold various processes put operation with different rates of development.

LECTURE №3
INDICATORS OF DEVELOPMENT

Indicators of oil field development

To characterize the process of extracting oil from the depths using indicators that determine the time intensity, the degree of extraction of oil, water and gas. Among the indicators of development are the following.

Production oil Qoil - the main indicator, the total for all producing wells drilled in the object per unit time, and **average daily production** - mining, which accounts for one well. The variation in time of these indicators depends not only on the properties of the reservoir and fluid but also from manufacturing operations which are carried out in the fields at various stages of development.

Production liquid Qlig - the total production of oil and water per unit time. From purely petroliferous wells in the reservoir for some time (waterless period of operation of wells) producing clean oil. For most fields, sooner or later their production begins to increase the water content. Since then, the production liquid exceeds oil production.

Considered indicators reflect the dynamic characteristics of the process of producing oil. To characterize the development process for the entire past period of time using the integral indicator - **summary production.**

There are the following parameters: **summary production oil**, **liquid** and **water**. **Summary production oil (liquid, water)** reflects the amount of oil (liquid, water), which is extracted by the object for a certain period of time from the beginning of development, i.e. since the start of the first production well.

Unlike dynamic indicators, summary production can only increase.

It is absolute indicators. But there are also relative indicators which characterize the process of extraction products in parts of the initial oil reserves. One of the important indicators of technological development of oil deposits is **rate development**. This indicator varies over time, reflects the impact on the development of all technological operations carried out on the field. Using the indicatoris obtained graph

There are four periods of the oil field, called stages