CURRICULUM

OF

PETROLEUM/PETROLEUM & GAS ENGINEERING

BS/BE/BSc
&
MS/ME/MSc

(Revised 2012)

HIGHER EDUCATION COMMISSION
ISLAMABAD

CURRICULUM DIVISION, HEC

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PREFACE

The curriculum of subject is described as a throbbing pulse of a nation. By viewing curriculum one can judge the stage of development and its pace of socio-economic development of a nation. With the advent of new technology, the world has turned into a global village. In view of tremendous research taking place world over new ideas and information pours in like of a stream of fresh water, making it imperative to update the curricula after regular intervals, for introducing latest development and innovation in the relevant field of knowledge.

In exercise of the powers conferred under Section 3 Sub-Section 2 (ii) of Act of Parliament No. X of 1976 titled **"Supervision of Curricula and Textbooks and Maintenance of Standard of Education"** the erstwhile University Grants Commission was designated as competent authority to develop, review and revise curricula beyond Class-XII. With the repeal of UGC Act, the same function was assigned to the Higher Education Commission under its Ordinance of 2002, Section 10, Sub-Section 1 (v).

In compliance with the above provisions, the HEC undertakes revamping and refurbishing of curricula after regular intervals in a democratic manner involving universities/DAIs, research and development institutions and local Chamber of Commerce and Industry. The intellectual inputs by expatriate Pakistanis working in universities and R&D institutions of technically advanced countries are also invited to contribute and their views are incorporated where considered appropriate by the National Curriculum Revision Committee (NCRC).

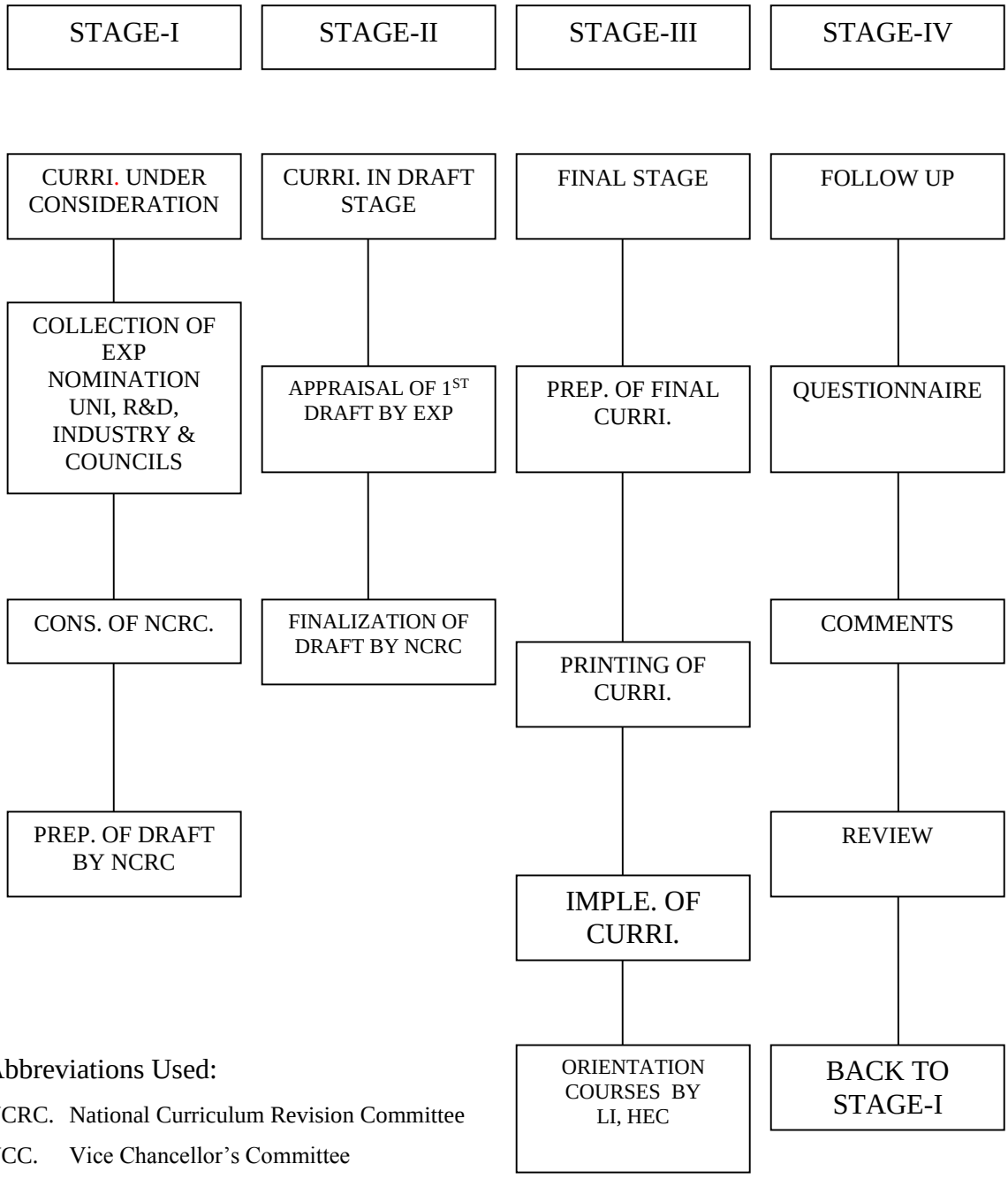
A committee of experts comprising of conveners from the National Curriculum Revision Committees of HEC in the disciplines of Basic, Applied, Social Sciences, Agriculture and Engineering met in 2007 & 2009 and developed the unified templates to standardize degree programmes in the country so as to bring the national curriculum at par with international standards, and to fulfill the national needs. It also aimed to give a basic, broad based knowledge to the students to ensure the quality of education.

In line with above, NCRC comprising senior university faculty and experts from various stakeholders and the respective accreditation councils has finalized the curriculum for Petroleum Engineering. The same is being recommended for adoption by the universities/DAIs channelizing through relevant statutory bodies of the universities.

MUHAMMAD JAVED KHAN
Adviser (Academics)

April, 2012

CURRICULUM DEVELOPMENT



Abbreviations Used:

NCRC. National Curriculum Revision Committee

VCC. Vice Chancellor's Committee

EXP. Experts

COL. Colleges

UNI. Universities

PREP. Preparation

REC. Recommendations

LI Learning Innovation

R&D Research & Development Organization

HEC Higher Education Commission

INTRODUCTION

1. The final meeting of National Curriculum Revision Committee in the subject of Petroleum & Gas Engineering was held on March 26-28, 2012 at HEC Regional Centre, Karachi. The purpose of the meeting was to finalize the draft curriculum of Petroleum & Gas Engineering reviewed in its preliminary meeting. Following members attended the meeting:

i. Prof. Dr. Obed-ur-Rehman Paracha, — Convener
Professor,
Department of Petroleum & Gas Engineering,
University of Engineering & Technology,
Lahore

ii. Prof. Dr. Syed Muhammad Mahmood,
Member
Professor / Chairman,
Department of Petroleum & Gas Engineering,
University of Engineering & Technology,
Lahore

iii. Prof. Dr. M. Yakoob Soomro, — Member
Professor/Chairman,
Department of Petroleum and Gas Engineering,
Balochistan University of Information Technology,
Engg. & Management Sciences,
Quetta

iv. Prof. Dr. Abid Murtaza Khan, — Member
Professor/Chairman,
Department of Petroleum Engineering,
NED University of Engineering & Technology, Karachi

v. Dr. Suhail Qadeer — Member
General Manager Joint Venture
Pakistan Petroleum ltd.
PIDC House, Dr. Ziauddin Ahmed Road,
Karachi

vi. Prof. Dr. Abdul Haque Tunio — Member
Professor,
Institute of Petroleum and Natural Gas Engineering,
Mehran University of Engineering & Technology,
Jamshoro

vii. Engr. Mohammad Hanif Sahito — Member
Assistant Professor,
Institute of Petroleum and Natural Gas Engineering,
Mehran University of Engineering & Technology,
Jamshoro

viii. Engr. Faisal Mehmood, Member
Lecturer,
Department of Petroleum & Gas Engineering,
University of Engineering & Technology,
Lahore

ix. Engr. Rashid Mustafa Member
Lecturer
Department of Petroleum & Gas
Dawood College of Engineering & Technology
Karachi

x. Engr. Faizan Ali Member
Lecturer,
Department of Petroleum Engineering,
NED University of Engineering & Technology,
University Road,
Karachi

xi. Engr. Azam Khan, Secretary/Member
Assistant Professor,
Department of Petroleum & Gas Engineering,
University of Engineering & Technology,
Lahore

2. The meeting started with recitation from the Holy Quran by Mr. Muhammad Hanif Sahto, Assistant Professor, MUET, Jamshoro. Mr. Muhammad Javed Khan, Adviser (Acad.), HEC welcomed the participants and briefed them about the earlier meeting of NCRC. He informed the participants on the aim and objectives of the meeting with a particular focus on revising the course outlines of BE/BS (4-year) and ME/MS Petroleum & Gas Engineering so as to make it compatible with international standards and demands as well as ensuring the uniformity of academic standard within the country.

3. Engr. Aftab Hussain Arain, who elected as Secretary in preliminary meeting of NCRC, could not attend the final meeting due to his personal engagement. Therefore, the Committee unanimously elected Engr. Azam Khan, Assistant Professor, UET, Lahore as Secretary in the final meeting of NCRC. The Adviser (Acad.) then requested the Convener to conduct proceedings of all technical sessions of meeting for three days.

4. On the request of the Convener, all the members gave their perspective on the implementation of BE/BS (4-year) and ME/MS programme in their respective universities / institutions. The Committee, while proceeding of the meeting, considered the inputs given by the expatriate Pakistani expert in the draft curriculum and incorporated his suggestions where necessary. The Committee during its deliberation achieved the following objectives:

i. Finalized the curriculum in the discipline of Petroleum & Gas Engineering so as to bring it at par with international standards.

ii. Incorporated latest reading & writing material against each course.

iii. Brought uniformity and develop minimum baseline courses in each and every course of study.

iv. Made recommendations for promotion/development of the discipline.

5. After three days long deliberation, the Committee unanimously approved the final curriculum of BE/BS (4-year) and ME/MS Petroleum & Gas Engineering. The Convener of the Committee thanked all members of the Committee for sparing their valuable time and quality contribution towards preparation of the final curriculum.

6. The Committee also appreciated the contribution of expatriate Pakistani expert Prof. Dr. Khalid Aziz, Professor, Stanford University, USA for critical reviewing the draft curriculum. The Committee highly admired the efforts made by the officials of the Higher Education Commission for making excellent arrangements to facilitate the forming of the Committee and their accommodation at Karachi.

7. The meeting ended with the vote of thanks to the Chair as well as participants of the meeting.

Rationale

A key source of energy is oil and natural gases. Efficient recovery of these resources requires Petroleum Engineers with a sound knowledge of fundamentals and latest technological developments relevant to this field. The mission of the Petroleum Engineering education is to produce graduates who can not only satisfy the current needs of the Pakistani petroleum industry, but are also able to develop indigenous technologies.

Goal

1. To equip the graduates with job oriented knowledge, skills and perception through sound fundamentals and petroleum engineering practices.
2. Develop an understanding and comprehension of regional energy resources and their use.
3. Instill in the graduates high ethical standards and practices.
4. Develop critical thinking in the graduates so that they are able to identify and solve new problems.
5. Develop effective communication skills and ability to work in teams.

Scheme of Studies
For BE/BS/BSc Petroleum/Petroleum & Gas Engineering

Semester-I

Sr. No	Course Code	Course Title	Lecture Hrs	Lab Hrs	Credit Hours
1	HU-101	Functional English	2	0	2
2	HU-102	Islamic Studies	2	0	2
3	PG-101	Fundamentals of Petroleum Engineering	3	0	3
4	Phy-103	Applied Physics	3	3	4
5	MA-104	Applied Mathematics-I	3	0	3
6	WS-105	Workshop Practices	0	6	2
		Total	**13**	**09**	**16**

Semester-II

1	HU-106	Pakistan Studies	2	0	2
2	Geo-107	Applied Geology	3	3	4
3	Chem-108	Applied Chemistry	3	3	4
4	MA-109	Applied Mathematics-II	3	0	3
5	ME-110	Engineering Drawing & Graphics	1	3	2
6	HU-111	Communication Skills	1	3	2
		Total	**13**	**12**	**17**

Semester-III

1	Geo-212	Stratigraphy and Structural Geology	2	3	3
2	CS-213	Computer Programming and Software applications	2	3	3
3	EE-214	Introduction to Electrical Engineering	2	3	3
4	MA-215	Applied Mathematics-III	3	0	3
5	CE-216	Fluid Mechanics	2	3	3
6	HU-217	Technical Writing & Presentation Skills	2	0	2
		Total	**13**	**12**	**17**

Semester-IV

1	PG-202	Drilling Engineering-I	3	3	4
2	Ch. E-218	Applied Thermodynamics	2	3	3
3	MA-219	Applied Statistics	3	0	3
4	PG-203	Petroleum Geology & Geophysical Exploration	3	3	4
5	CE-220	Mechanics of Materials	2	3	3
		Total	**13**	**12**	**17**

Semester-V

1	PG-304	Petrophysics	3	3	4
2	PG-305	Properties of Reservoir Fluids	3	3	4
3	PG-306	Drilling Engineering-II	3	3	4
4	CS-321	Applied Numerical Methods	2	3	3
5	HU-322	Social Sciences	3	0	3
		Total	**14**	**12**	**18**

Semester-VI

1	PG-307	Well Logging	2	3	3
2	PG-308	Reservoir Engineering	3	3	4
3	PG-309	Petroleum Production Engineering-I	3	0	3
4	PG-310	Natural Gas Engineering	3	3	4
5	Man-323	Environment and Safety Management	3	0	3
		Total	**14**	**09**	**17**

Semester-VII

1	PG-411	Well Testing	3	3	4
2	PG-412	Petroleum Production Engineering-II	3	3	4
3	PG-413	Gas Reservoir Engineering	3	3	4
4	Man-424	Project Planning & Management	2	0	2
5	Ch. E-425	Instrumentation and Process Control	3	3	4
	PG-414	Project	0	6	0
		Total	**14**	**18**	**18**

Semester-VIII

1	PG-415	Principles of Enhanced Oil Recovery	3	3	4
2	PG-416	Reservoir Simulation	3	3	4
3	PG-417	Petroleum Economics	3	0	3
4	Ch. E-426	Petroleum Refinery Engineering	3	3	4
5	PG-414	Project	0	6	2
		Total	**12**	**15**	**17**
		Grand Total	**106**	**99**	**137**

DETAIL OF COURSES

SEMESTER-I

HU-101 **FUNCTIONAL ENGLISH**
Credit Hours: 2+0
Pre-requisites: Nil

Specific Objectives of Course: To recall English learning, enhance language skills and develop critical thinking.

Course Outline:
Basics of Grammar: Parts of speech and use of articles, sentence structure, active and passive voice, practice in unified sentence, analysis of phrase, clause and sentence structure, transitive and intransitive verbs, punctuation and spelling.

Comprehension: Answers to questions on a given text.

Discussion: General topics and every day conversations (topics for discussion to be at the discretion of the teacher keeping in view the level of students).

Listening: To be improved by showing documentaries/films carefully selected by subject teachers.

Translation skills: Local language to English.

Paragraph writing: Topics to be chosen at the discretion of the teacher.

Presentation skills: Introduction.
Note: Students should be encouraged to read daily news papers and journals.

Lab Outline: N/A

Recommended Books:

a) Grammar

1. Practical English Grammar: Exercises 1 by A. J. Thomson and A. V. Martinet. Third edition. Oxford University Press. ISBN: 0194313492

2. Practical English Grammar: Exercises 2 by A. J. Thomson and A. V. Martinet. Third edition. Oxford University Press. ISBN: 0194313506

b) Writing

Oxford Supplementary Skills Writing, by A Haley. Oxford University Press. ISBN: 0194534057

c) Reading/Comprehension

Reading Advanced (Oxford Supplementary Skills), By Brian. Tomlinson and Rod Ellis. Third Impression ISBN: 0194534030.

Journals/Periodicals:
World Wide Web:

HU-102 ISLAMIC STUDIES

Credit Hours: 2+0
Prerequisites: Nil

Specific Objectives of Course: To instill Islamic ideology and ethics in students.

Course Outline:

Al-Quran-ul-Karim:

Significance of the Holy Quran, Compilation of the Holy Quran, Ijaz-ul-Quran.

Textual Study of Surah Al-Hujurat (Complete), (Translation & Explanation: Manners of meeting with the Holy Prophet; Brotherhood; Equality; Backbiting; Blame and foolery)

Textual Study of Surah Al-Maidah (Verses 1-26), (Translation & Explanation: Commands of Halal & Haram; The importance of cleanliness in Islam; The relations between Muslims and Ahl-e-Kitab; Attitude of Ahl-e-Kitab towards Muslims)

Textual Study of Surah Al-Furqan (Verses 63-77), (Translation & Explanation: Characteristics of Ibad-ur-Rehman)

Textual Study of Holy Quran: Surah Luqman (Complete), Translation & Explanation: Lahv-o-La'ab; Azmat-e-Quran; Taskheer of the Universe;

Disobedience of parents is forbidden; To see the parents with love is as Hajj; Intense care of parents in old life; Treatment and behavior with parents; Amr Bil Maruf-o-Nahi An'il Munkar; Need & importance of preaching (Dawat-din); Methods of preaching; Characteristics of a preacher.

Note: Teacher may select any number of Surah as per his discretion.

Al-Hadith Al-Sharif

The need and importance of Hadith, an introductory note about compilation of Hadith; a brief introduction of Sihah Sittah and their compilers, Balugh-ul-Maram; Kitab-ul-Jami: Bab-ul-Adab; Bab-ul-Bir Wa Salah, Rights of individuals in Islam; Relations with the relatives.
Textual Study of Ahadith (Arba'een-e-Nava'vi: 1-21 Translation & Explanation).

Deen-e-Islam:

The Study of Cardinals/Articles of Faith: Touheed, Fundamentals of Touheed, Types of Touheed, Prophet-hood and finality of Prophet-hood, The day of judgment.

Pillars of Islam: Prayer: Imposition of Prayer; Orders; Shariah's point of view; Significance; Fasting: Meaning of fasting; Obligation of fasting; Significance; Disbursement; Physical and spiritual advantages; Zakat: The economic system of Islam; Importance of Zakat; Prohibition of (Riba) Sood; Comparison between Islamic economic system and Socialism, Capitalism & Communism; Hajj: Imposition of Hajj; Commands and rites of Hajj; Financial, Social, Spiritual advantages of Hajj; Jihad: Importance and significance; Necessity of Jihad in modern age; Kinds of Jihad.

Seerat-un-Nabi

Life of the Holy Prophet (S. A. W. W): From Prophet-hood to Hijrah, at Madina, Madina Pact, Holy Prophet as a complete person; Mohammedan Revolution.

Islam and Modern Science

Quran as a guide for the modern scientific development: Surah Al-Baqarah: 164; Surah Aal-e- Imran: 190-191; Importance of science education in the modern age; Introduction of Muslim scientists; Contribution of Muslim scholars towards development of science.

Principles of Tafseer

Hadood-o-Tazirat: Rape; Qadaf; Liaan; Ifk; Privacy and Hijab – Al-Baqarah: 178 – 179; Al- Nisa: 92 – 93; Al-Maidah: 8, 31 – 34, 38; Al-Noor: 2 – 6, 27 – 29, 31 – 60; Al-Ahzab: 32 – 33, 53, 55, 59.

Ethics

Ethics and Religion: Ethical behavior of the Prophet; Impact of belief on ethics; Concept of worship and manners / social relation in religion and their impact on ethics; Ethics and character building significance of moral values: Charity; Tolerance; Simplicity; Respect of mankind; Social etiquettes; Etiquettes of meeting; Etiquettes of eating & drinking; Etiquettes of conversation; Rights of people; Verses of the Holy Quran about ethics: Aal-e-Imran: 112; Al-Nisa: 43, 90 – 91; Al-Aaraf: 35; Al-Ra'ad: 30; Al-Nahal: 90 – 91; Bani Israil: 29 – 37; Al-Fatah: 26; Moral values in the light of Hadith: Bab-ul-Zuhad wal Wara: Ahadith 2, 6; Bab-ul-Tarheeb Min Masavi Al-Akhlaq: Ahadith 1, 6, 9.

Recommended Books:

Journals/Periodicals:
World Wide Web:

PG-101 FUNDAMENTALS OF PETROLEUM ENGINEERING

Credit Hours: 3+0
Prerequisites: Nil

Specific Objectives of Course: To familiarize the students with the basics of petroleum engineering and the working of local and international petroleum industry.

Course Outline:

Sources of energy, national and international energy requirements and the contribution of petroleum in global energy requirements. History of the petroleum industry and its influence on international politics.
Overview of Petroleum Engineering including geological, geochemical and geophysical prospecting. Introduction to drilling operations, formation evaluation, reservoir engineering, production engineering, processing, transportation and refining.
Highlights of local petroleum industry, employment opportunities, petroleum engineering literature and role of professional societies like SPE (Society of Petroleum Engineers).

Lab Outline: N/A

Recommended Books:

1. Petroleum Engineering Drilling & Well Completion, by Carl Gatlin. ISBN: 9780136621553
2. A First Course in Petroleum Technology by David A. T. Donohue, Karl R. Lang, ISBN: 9780133183795
3. Introduction to Petroleum Production Vol. I, II, III, by D. R. Skinner, ISBN: 0872017672
4. Handbook of Natural Gas Engineering, by Donald L. Katz, ISBN: 9780070333840

5. Fundamentals of Petroleum Engineering, by Kate Van Dyke, ISBN: 9780886982317 5th ed. 2011.
6. Petroleum Production Engineering: A Computer Assisted Approach, by Boyun Guo, William V. Lyons, Ali Ghalambor, ISBN: 0750682701.

Journals/Periodicals: Journal of Petroleum Technology. Oil and Gas Journal and other such journals.

World Wide Web: www.spe.org, www.onepetro.org

Phy-103 APPLIED PHYSICS

Credit Hours: 3+1
Prerequisites: Nil

Specific Objectives of Course: To learn principles of physics and its application to engineering.

Course Outline:

Electricity. Electric field & electrical forces, Electric field calculations, Gauss's Law, Applications of Gauss's Law, Charges on conductors, Electrical Potential, Energy, Potential, Calculate of Potentials, Potential gradient, Cathode-ray tube. Sources of Magnetic Field. Magnetic field of a moving charge, Magnetic field of a current element. Ampere's Law, Magnetic field of a long straight conductor, Force between parallel conductors, Magnetic field of circular loops solenoid. Magnetism. Magnetic field and displacement current, Magnetic properties of materials. Electromagnetic Induction. Induction phenomena, Motional electromotive force, Faraday's law Induced electric fields, lenz's Law, Eddy currents, Maxwell's equations. Electromagnetic Waves. Introduction, speed of and electromagnetic wave, Energy in electromagnetic waves, Electromagnetic Waves in matter, Sinusoidal Waves, Standing. Interference & Diffraction. Waves and Oscillations. Sound Waves. Resultant of simple Harmonic Motions Resonance and Beats. Units and Measurement of Sound Waves. Reflector, Refraction of sound. Interference, Diffraction grating, Interference in Thin film X-ray Diffraction of sound waves. Atomic Physics. Structure of atom, Line spectra, Energy levels, Atomic spectra, The laser, continuous spectra, X-ray production and scattering. Nuclear Physics. The nuclear atom, properties of nuclear. Nuclear stability, Radioactive transformations, Nuclear reactions, Nuclear fission, Nuclear fusion, reaction, Neutron thermalization, Radiation Detectors. Natural radioactivity, Artificial radioactivity, Three distinct types of radiation's Radioactive series, Laws of radioactive disintegration, decay constant. Half period and mean constant, Interaction of rays with matter.

Lab Outline:

1. Ionization Potential of Mercury.
2. To study the state characteristics of a transistor.
3. To find the value of "H" by tangent galvanometer.
4. To find the E/M of electron by deflection methods.

5. To draw B-H curve of a given material.
6. To find the velocity of sound waves in different media.
7. To find the surface tension of a given liquid.
8. C.R.O. demonstration.

Recommended Books:

University Physics by Hugh D. Young, Roger A. Freedman, Lewis Ford, Addison Wesley, ISBN: 9780805321876

Journals/Periodicals:

World Wide Web:

MA-104 APPLIED MATHEMATICS – I

Credit Hours: 3+0
Prerequisites: Nil

Specific Objectives of Course: To learn principles of mathematics and its application to engineering.

Course Outline:

Complex Numbers and Hyperbolic Functions: Exponential and polar forms, De Moiré's theorem, Roots of complex numbers, Hyperbolic and inverse hyperbolic functions.

Matrix Algebra: Solution of systems of linear equations, Eigenvalues and Eigenvectors.

Differentiation and its applications: Velocity and acceleration, Tangents and normal, Mclaurin and Taylor series, Maxima and minima of a function of one variable, Curvature and radius of curvature.

Integration and its applications: Methods for evaluating indefinite integrals, Definite integrals and their properties, Arc length, area, surface area and volume of solids of revolution, Moment of inertia and centroid of plane areas, Pappus theorem.

Partial differentiation: Functions of two or more variables, Total differentials and their applications, Differential of implicit functions, Chain rule, Maxima and minima of a function of two variables, Taylor and Mclaurin series for a function of two variables.

Ordinary Differential Equations: Formulation of differential equations, First and higher order differential equations with constant coefficients, Systems of ordinary differential equations, Engineering Problems.

Vector algebra and applications: Vector products, Vector functions, Differentiation and integration of vectors, Application to lines, planes and spheres, Polar coordinates and polar curves.

Lab Outline: N/A

Recommended Books:

1. Advanced Engineering Mathematics, by Erwin Kreysizg, ISBN: 9780470458365
2. Calculus and Analytic Geometry, by Thomas & Finney, ISBN: 9780201531749
3. Brief Calculus & its Applications by Daniel D. Benice, ISBN: 9780395824641
4. Calculus by Monty J. Strauss, Gerald L. Bradley And … , ISBN:9780130918710

Journals/Periodicals:
World Wide Web:

WS-105 WORKSHOP PRACTICES

Credit Hours: 0+2
Pre-requisites: Nil

Specific Objectives of Course: To provide the practical training to the students with various workshop operations.

Lab Outline:

Machine Shop: Learn to operate lathe, milling, drilling, cutting, grinding and make a work piece.

Fitting Shop: Make a small hand tool, including marking out from blue-print, filing to size, and punching marks.

Electrical Shop: Learn wiring circuits of a mechanically propelled vehicle, connection of single and three phase motors, battery, and charging. Make an electric circuit work piece.

Carpentry and Pattern Shop: Introduction to pattern making practice, different types of pattern, shrinkage and other allowances, preparation of patterns with core print and core box, Wood turning practice. Make a wooden work piece from blue-print of a given design specifications.

Smithy and Foundry Shop: Introduction and use of moulding tools, preparation of a mould and a core, method of melting/shaping metals. Cast a work piece from a simple pattern in metal.

Welding: Fabrication exercises in electrical and gas welding. Inspection of welding joints steel metal work.

Recommended Books:

Journals/Periodicals:
World Wide Web:

SEMESTER-II

HU-106 PAKISTAN STUDIES

Credit Hours:2+0
Prerequisites: Nil

Specific Objectives of Course: To teach the students history of Pakistan.

Course Outline:

Ideology of Pakistan
Definition & Explanation; Aims & objectives of formation of Pakistan; Ideology of Pakistan in the light of the sayings and speeches of Allama Iqbal and Quaid-e-Azam.

A Brief History of Muslim Society in Subcontinent

The arrival of Muhammad Bin Qasim; The Afghan invasions from north; The domination of Islam in the sub-continent; The downfall of Muslim rulers and renaissance of Muslim rule in sub-continent.

Historical Background of the Ideology of Pakistan: National & Reformative Movements

Sh. Mujaddad Alf-e-Sani: Biography of Sheikh; Social & religious Services; Jihad against non- Islamic fundamentals; Difficulties of imprisonment; Effects of the movement; Shah Wali Ullah: Biography of Jihad against non-Islamic fundamentals; Reforms, social and religious services; Jama'at-ul-Mujahiddeen; Sayyed Ahmad Shaheed: Biography; Jihad against Sikhs; Opposition from Afghan tribes; Martyrdom at Balakot; Mujahiddeen Movement.

Educational Efforts

Ali Garh; Deoband; Nadwah; Anjaman Himayat-e-Islam; Sindh Madrassat-ul-Islam; Islamia College, Peshawar and other educational institutions.

Political Struggles

Constitutional reforms and Muslims' separate electorate.

The Pakistan Movement

Muslim Nationality: Evolution of two-nation theory; Independence of India & Muslims: Presidential Address of Allama Iqbal at Allah Abad in 1930; 1937 Elections: Congress's behavior; The Pakistan Resolution; 1946 Elections and transfer of power; How to safeguard the ideological state in present era?

Creation of Pakistan

Role of scholars & Mashaikh, students and women, Journalists and Adeebs in the creation of Pakistan; Initial difficulties after creation of Pakistan; Anti-Muslim riots in India; Massacre in East Punjab; Canal water and distribution of assets; Annexation of states: Hyderabad; Junna Garh; Kashmir: Background and danger for the peace of South Asia.

The Land of Pakistan

Geographical unity; Location and importance; Rural and urban areas; Resources of agriculture, industry, workforce and education.

Efforts for Execution of Islamic System in Pakistan

Objectives Resolution; Islamic clauses of the constitutions of 1956, 1962 and 1973; Implementation of Shariah: Practical steps; Our Destination – Establishment of complete Islamic society.

Foreign Policy of Pakistan

Principles of Pakistan's foreign policy; Importance of Pakistan in Islamic world; Formation of Islamic Summit; Rabita-e-Alam-e-Islami; Formation of Muslim Bank and Bloc; Economic and defence planning; Pakistan in the changing world.

Recommended Books:

1. State & Society in Pakistan, by Burki, Shahid Javed, The Macmillan Press Ltd.
2. Issue in Pakistan's Economy by Akbar, S. Zaidi Oxford University Press, Karachi. ISBN: 9780195979145.
3. Pakistan's Foreign policy: A Historical analysis. by S. M. Burke and Lawrence Ziring Oxford University Press, Karachi. ISBN: 9780195774078
4. Pakistan Political Roots & Development by Mehmood, Safdar Lahore. ISBN: 9788120711259
5. The emergence of Bangladesh;: Problems and opportunities for a redefined American policy in South Asia (Foreign affairs study) by Wilcox, Wayne American Enterprise, Institute of Public Policy Research, Washington. ISBN: 9780844731124
6. Ethno – National Movement in Pakistan, by Amin, Tahir Institute of Policy Studies, Islamabad.
7. History & Culture of Sindh, by Zahid, Ansar Karachi: Royal Book Company.
8. Political Parties in Pakistan, Vol. I, II & III, by Afzal, M. Rafique National Institute of Historical and cultural Research, Islamabad.
9. The Political System of Pakistan, by Sayeed, Khalid Bin Houghton Mifflin, Boston. ASIN: B0000D5J2X

10. Party Politics in Pakistan 1947-1958,by Aziz, K. K. National Commission on Historical and Cultural Research, Sang-e-Meel Publications ISBN: 9789693519808
11. Pakistan Under Martial Law, 1977-1985,by Muhammad Waseem, Vanguard Lahore.ASIN: B005BT0SY8
12. Making of Pakistan: The Military Perspective, by Haq. Noor ul, National Institute of Historical and Cultural Research (1993). ASIN: B0042LK526

Journals/Periodicals:
World Wide Web:

Geo-107 APPLIED GEOLOGY

Credit Hours: 3+1
Prerequisites: Nil

Specific Objectives of Course: To teach the students about the basic geological concepts.

Course Outline:

Introduction to various branches of geology, the origin of earth and its place in universe, interior of the earth and chemical composition of the earth's crust, mountain building and valley formation, drainage pattern and their types, agents of weathering and erosion, theories of plate tectonics, earth quakes and volcanism, formation of rocks and minerals, occurrence of mineral deposits in Pakistan.

Lab Outline:

1. Introduction of Minerals and Rocks.
2. Study of mohs scale of hardness and identification of its minerals.
3. Study and identification of igneous rocks.
4. Study and identification of metamorphic rocks.
5. Study and identification of sedimentary rocks.

Recommended Books:

1. Principles of Engineering Geology by K. M. Bangar, ISBN: 8180141152.
2. Physical Geology by Anatole Dolgoff, Houghton Mifflin Harcourt, ISBN: 9780669463118

Journals/Periodicals:
World Wide Web:

Chem-108 APPLIED CHEMISTRY

Credit Hours: 3+1
Prerequisites: Nil

Specific Objectives of Course: A refresher course of chemistry.

Course Outline:

Periodic classification of elements, structure of atoms, physical principles involved in the study of properties of metals and non metals, solution,

solubility, Raoult's law, azeotropic solution, vapor pressure and distillation of partially-miscible and miscible liquids, diffusion, osmosis, theory of dilute solutions, relation with vapour pressure. Electrochemistry: electrolysis, electrolytic conductance, transport number and transport phenomena determination of transport number, ionic equilibria, activity co-efficient electrolyte, Debye-Huckel theory, solubility products, galvanic cells, potentiometric titrations, ph, buffer solution, acid base indicators, molecular properties, surface tension, interfacial tensions, surface films surface-active agents, free energy and equilibrium, chemical equilibrium surface phenomena and catalysis, organic chemistry, electron displacement, resonance and its applications, mechanism and methods of determining, stereo chemistry, organic reaction, electrophillic substitution in aromatic system, addition to carbon-carbon and carbon-oxygen double bond, elimination reactions, inter-conversion of functional group, organic nitrogen compounds and heterocylic system, aromatic series, analytical chemistry, to familiarizes students with the concept of accuracy of analysis, separation techniques and gas chromatography, geochemistry, geo-chemical classification of elements, chemical weathering geo-chemical description, geo-chemical prospecting, significance and techniques.

Lab Outline:

1. Determination of Heat of Solution of a given salt solution.
2. Determination of the Heat of Neutralization of given Acid-Base pair.
3. Determination of the Surface Tension of a given Liquid by using Stalagmometer.
4. Determination of Viscosity (absolute & relative) of a given liquid by using Ostwald's Viscometer.
5. Determination of the %age composition of colored ions by using Photoelectric Colorimeter.
6. Determination of the %age composition of two liquids by viscosity.
7. Determination of the %age composition of two liquids by Refractive Index.
8. Determination of the strength of Acid/base by pH-Metric Titration.
9. Determination of the Molecular weight of a given substance by Depression in Freezing Point (Cryoscopic) methods.
10. Determination of Transition Temperature og a substance by thermometric method.
11. Determination of the Molecular weight of a given substance by Elevation of Boiling Point (Ebullioscopic) methods.
12. Determination of adsorption of a solute by activated charcoal.
13. Determination of the strength of Acid/base by Conductometric Titration.
14. Preparation of Buffer solutions of various pH ranges (by pH-metric methods)

Recommended Books:

1. Principles of Physical Chemistry by Samuel H. Maron by Carl F. Maron & Prutton ASIN: B000RRO9N0 1967
2. Physical Chemistry by Ghulam Nabi

3. Analytical Chemistry by G. D. Christan, ISBN: 0471214728
4. Petroleum Geochemistry and Geology by John Hunt, ISBN: 0716724413
5. Experiments in Physical Chemistry by Garland & Shoemaker ASIN: B0028IBE1G

Journals/Periodicals:

World Wide Web:

MA-109 APPLIED MATHEMATICS-II

Credit Hours: 3+0

Prerequisites: Applied Mathematics-I

Specific Objectives of Course: To learn advance mathematical concepts.

Course Outline:

Laplace Transformation. Laplace transforms of elementary functions. Unit step function, Dirac's delta function, Periodic functions, Inverse Laplace transforms, Convolution. Applications.

Fourier Series. Periodic functions, Fourier series for the function of period 2-Pie, even and odd functions. Fourier series for functions having arbitrary period, Half range expansions, complex form of Fourier series, Application to physical problems.

Double Integrals and its Applications. Double Integrals, Geometrical interpretation. Their applications in determining areas, volumes, centroids and moments of inertia, Double integrals in polar coordinates.

Series solution of Differential Equations & Special Functions. Beta and Gamma Functions, Power series, Method of Frobenius, Lengendre's differential equation, Legendre polynomials, Generating function, Recurrence formulas, Orthodonality, Bissell's differential equation, Bissell functions of first and second kind, Generating functions, Recurrence formulas, Orthogonality, Modified Bissell functions.

Partial differential Equations (PDEs). Basic concepts, Derivation (modeling) of ID equations, solution using method of separation of variables, D' Alembert solution of the wave equation, Classification of linear second order P.D. equations, Two dimensional partial differential equations (wave, heat and Laplace), General solutions, Laplace equation in Polar coordinates, Laplace equation in cylindrical and spherical polar coordinates.

Lab Outline:

N/A

Recommended Books:

1. Advanced Engineering Mathematics, H. K. Dass, ISBN: 8121903459
2. Advanced Engineering Mathematics, Dr. B. S. Grewal ISBN: 8174091955

3. Advanced Engineering Mathematics, Erwin Kreyszig, ISBN: 9780470458365
4. Theory and Problems of Laplace Transforms, Schaum's Outline Series, ISBN: 9780070602311
5. Differential Equations, Schaum's Outline Series, ISBN: 0071611622
6. Schaum's Outline of Fourier analysis with Applications to Boundary Value Problems ISBN: 0070602190

Journals/Periodicals:
World Wide Web:

ME-110 ENGINEERING DRAWING AND GRAPHICS

Credit Hours: 1+1
Prerequisites: Nil

Specific Objectives of Course: To learn graphical concepts and design in engineering.

Course Outline:

Introduction. Types of lines, lettering, dimensioning, and drawing instruments. Projection, Types of projection, orthographic projection. Plan of projection, four quadrants. Traces of a line, true length of line, inclination to both the planes, projection of planes. Loci of Points. Loci of points and straight line, loci of crank mechanism. Curves Used in Engineering Practice. Cycloid, Throchoid, epicyclide, Pitrochoid, hypotrochoid (superior and inferior). Involute, evolute, archemedian, spiral. Development of solids. Types of solids, polyhedra, solids of revolution, construction, of polygon, prism, pyramid, cylinder, cones sphere, (development of all solids with passing cutting plane). Intersection of Surfaces. Intersection of cylinder and cylinder, cone and cylinder., cone and prism. Axonometric Projection. Types isometric projection of solids, planes and typical examples. Projection of Auxiliary Planes. Auxiliary planes and views, Projection of points, plane, true length of line. Projection of solids. True shape of section on auxiliary plane of various solids. Introduction and implementation of engineering drawing techniques in Auto CAD.

Lab outline:

1. Introduction to the subject use of instruments.
2. Planning of a drawing sheet, the projector of simple solids simple position, and the oblique and auxiliary planes.
3. Lettering and dimensioning the principal requirement of a working drawing.
4. Isometric and pictorial projection of solid figures, making of freehand sketches from solid objects and from orthographic projection.
5. Section of solids, riveted joints.
6. Screw thread systems, nut and bolt, keys and cotter, coupling and simple bearings.
7. Pipe connections, engine detail.

Recommended Books:

1. Fundamentals Of Engineering Drawing: With An Introduction To Interactive Computer Graphics For Design And Production by Warren J. Luzjader ISBN: 9788120308855
2. Elementary Engineering Drawing By Bhatt, N D ISBN: 9788185594316
3. Baker, Arthur Latham. The Elements of Solid Geometry. Boston, MA: Ginn and Co., 1893.
4. A first year Engineering Drawing by A. C. Parkinson, ASIN: B000S6CBPI
5. The Fundamentals of Engineering Drawing: With an Introduction to Interactive Computer Graphics for Design and Production, Warren J. Luzadder, Jon M. Duff, ISBN: 0133350509
5. Auto CAD, Release Ver. 30 for Practical Purpose.

Journals/Periodicals:

World Wide Web:

HU-111 COMMUNICATION SKILLS

Credit Hours: 1+1

Pre-requisites: Functional English

Specific Objectives of Course: To enhance language skills and develop critical thinking.

Course Outline:

Introduction to Communication Skills

Communication principles; Process of communication; Importance of good communication skills in business environments; Communication in business organizations: Internal-operational; External-operational; Personal; Challenge of communication in the global market.

Study Skills

Brainstorming; Time-management; Effective reading strategies; Notes-taking; Organization; Summarizing.

Components of Communication

Sender – Encoder; Message; Medium; Receiver – Decoder; Feedback.

Non-verbal Communication

Appearance and dress codes; Body language; Silence time and space; Importance of listening in communication.

Public Speaking

Difference between speech and writing; Reading texts of good public speeches and analysis of their components; Listening to famous public speeches; Exercises in public speaking.

Formal Presentations

Difference between informal and formal presentations; Modes of formal presentation: Extemporaneous; Prepared; Reading out from a written text; Combination of the above- mentioned methods.

Lab Outline:
Practice of different skills through presentations.

Recommended Books:
1. Introduction to Business Communication by Zane K. Quible, Margaret H. Johnson & Dennis L. Mott, ISBN: 0134790723
2. Business Communication Today by Courtland L. Bovée, John V. Thill & Barbara E. Schatzman ISBN: 0130928585
3. Effective Business Communication by Herta A. Murphy, Herbert W. Hildebrandt & Jane P. Thomas, ISBN: 007044398X
4. Business Presentation by Lani Arredondo, ISBN: 0070028400

Journals/Periodicals:
World Wide Web:

SEMESTER-III

Geo-212 STRATIGRAPHY AND STRUCTURAL GEOLOGY

Credit Hours: 2+1
Prerequisites: Applied Geology

Specific Objectives of Course: To learn dynamics of earth structural formations.

Course Outline:
Principles of Stratigraphy: Concepts of geological time and its scale. Correlation techniques, isostasy and continental drift. Stratigraphy of Pakistan with special emphasis on salt range. Introduction to structural geology and its objectives. Primary and secondary structures of sedimentary rocks and the determination of dip, strike, and thickness of beds. Completion of outcrops and construction of cross sections. Modes of deformation of rocks, parts. Classification of Folds, faults, joints and unconformities. Expression of the above features on geological field maps and construction of cross sections. Geological mapping and the application of photogrammetry.

Lab Outline:
1. To study the different parts of Brunton Compass.
2. To measure the dip and strike of an inclined plane with the help of Brunton Compass.
3. To draw the cross-section of a contour map and also show the drainage pattern of the area.
4. To determine the true dip value by the help of two apparent dips.
5. Three point problem for measuring dip and strike if three outcrop are located on a contour map.
6. To calculate the thickness of beds.
7. To study various features on a Geological map.
8. To study folds, faults and joints on a given Geological map.
9. To study various aspects of Photogrammetry.

Recommended Books:

1. Structural Geology by M. P. Billings Prentice Hall of India, ASIN: B000HC61CW
2. Physical Geology by Anatole Dolgoff, Houghton Mifflin Harcourt, ISBN: 9780669463118
3. Stratigraphy & Sedimentation by William .C. Krumbein, L. L. Sloss, ISBN: 9780716702191.
4. Principles of Engineering Geology by K. M. Bangar, ISBN: 8180141152.

Journals/Periodicals:

World Wide Web:

CS-213 COMPUTER PROGRAMMING AND SOFTWARE APPLICATIONS

Credit Hours: 2+1
Prerequisites: Nil

Specific Objectives of Course: To teach students programming languages and software application.

Course Outline:

Introduction to Digital computer Hardware. Elements of Programming. Programming Languages, Introduction to Operating systems and Compilers. Problem analysis. Flow charts. Programming Examples and Exercises using C language with application to Engineering Problems. Debugging Techniques.

Lab Outline:

Programming exercises leading to developments of programs for engineering applications.

Recommended Books:

1. Programming with C++, Schaum's Outline Series, ISBN: 0071353461
2. Series Object oriented programming in C++, by Robert Lafore, Sams, ISBN 0672323087

Journals/Periodicals:

World Wide Web:

EE-214 INTRODUCTION TO ELECTRICAL ENGINEERING

Credit Hours: 2+1
Prerequisites: Nil

Specific Objectives of Course: To learn basic concepts of electrical engineering.

Course Outline:

Electric and Magnetic Circuits; AC Poly Phase systems, DC Machines, AC Synchronous Machines, AC Induction Machines.
Induction Motors: Construction, Types, Rotating field theory principle of working, Slip and its effect on motor current quantities. Losses Efficiency

and performance curves Starting, Full load maximum torque relations, and Torque slip characteristics.
Transformers; Converting Machines; Rotary Converters; Construction; . Principle of working; Transformer connections, Voltage and current ratings of single and three phase converters; Mercury arc rectifiers, Construction, Operation; Transformer connections, Voltage and current ratios of single phase and three phase rectifiers.

Lab Outline:

Study and Use of Oscilloscope.

Resistance Measurement by Color Code and its Comparison with the Ohm-Meter Reading.

Study of Ohm's Law.

Study and Proof of Kirchhoff's Current Law (Nodal Analysis)

Study and Proof of Kirchhoff's Voltage Law (Loop Analysis). RC Time Constants.

To Plot the Capacitor Charging and Discharging Curves using Oscilloscope.

To Draw Vector Diagram of an A.C circuit containing,

1. Resistance and Inductance in Series,
2. Resistance and Capacitance in Series,
3. Resistance, Inductance and Capacitance in Series.

To study the Effect of Frequency Variation on an R-L-C series Resonant Circuit.

Power Measurement in a 3-Phase

Star Connected Balanced Resistive Load by Two Wattmeter Method and Verification of Relations:

1. Line Voltage = 3 Phase Voltage,
2. The current in the neutral conductor is zero
3. Sum of Two Wattmeter Readings Total power in the Circuit

Recommended Books:

1. Electrical Technology, by B. L. Theraja, ISBN: 8121924413
2. Electrical Technology, by E. D. Hughes, ISBN: 0582305640
3. Objective Electrical Technology, by V. K. Mehta, ISBN: 9788121920971.
4. Basic Engineering Circuit Analysis by J. David Irwin, ISBN: 0470633220
5. Electric Machinery Fundamentals by Stephen J. Chapman, ISBN: 0073529540
6. Examples in Electrical Calculations by Admiralty, ASIN: B003MR22VS

Journals/Periodicals:

World Wide Web:

MA-215 APPLIED MATHEMATICS-III

Credit Hours: 3+0
Prerequisites: Applied Mathematics-II

Specific Objectives of Course: To learn advance mathematical concepts (Vector and tensor analysis).

Course Outline:

Complex Variables: Functions, Limits and Continuity, Derivatives, Analytic functions, Cauchy-Reimann equations, Elementary complex functions (Exponential, Trigonometric, Hyperbolic, Logarithmic etc), simply multiply connected regions, complex integration, Cauchy's theorem, Cauchy's integral formula, Convergence and Radius of Convergence of Power Series, Taylor's and Laurent's series, Zeros and singularities, poles, Residues, The residue theorem, Contour integration, Conformal mapping.
Advanced Vector Analysis: Scalar and vector point functions, Gradient and its geometrical interpretation, Directional derivative, Divergence and Curl and their physical interpretations, Vector identities, Line integrals, Conditions for a line integral to be independent of path, surface and volume integrals, Green's theorem in the plane, Gauss' divergence theorem and Stocks theorem.
Cartesian Tensors: Summation convention, Kronecker delta, Alternating symbol, Relation between alternating symbol and Kronecker delta, Tensor of first, second and tensors, Differentiation of tensors, Application to vector analysis, Eigenvalues and Eigenvactors of a tensor.

Lab Outline:

Recommended Books:

1. Advanced Engineering Mathematics, H. K. Dass, ISBN: 8121903459.
2. Advanced Engineering Mathematics, Dr. B. S. Grewal. ISBN: 8174091955
3. Advanced Engineering Mathematics, Erwin Kreysizg, ISBN: 9780470458365
4. Complex Analysis by Schaum's Outline Series, ISBN: 0071615695.
5. Vector Analysis by Schaum's Outline Series ISBN 0071615458
6. Tensor Calculus by Schaum's Outline Series ISBN 0071756035

Journals/Periodicals:

World Wide Web:

CE-216 FLUID MECHANICS

Credit Hours: 2+1
Prerequisites: Applied Chemistry

Specific Objectives of Course: to learn static and kinematic behavior of fluids.

Course Outline:

Properties of fluids. Determination of viscosity and its application to lubricated bearings. Fluid Statics. Pressure intensity, pressure head, and their measurements. Hydrostatic forces on a submerged surface.

Buoyancy and flotation. Fluid Kinematics. Classifications of fluid flow. Continuity equation. Bernoulli's equation. Fluid mass under acceleration. Forced vertex. Flow Measurement. Venturimeter, orifices, mouthpieces, nozzles, pitot tube and sharp crested weirs/notches. Steady flow through pipes. Darcy-Weisbach equation. Losses in pipelines. Hydraulic and energy gradients. Transmission of Energy. Uniform flow in open Channels. Chezy's and Manning's Equations. Economical rectangular and trapezoidal cross-sections. Compressible fluids. Isothermal and adiabatic flow. Energy equations. Steady Flow of gasses through venturimeters and pipes.

Lab Outline:

1. Measurement of following liquid properties
   i) Density
   ii) Specific Weight
   iii) Specific Volume
   iv) Surface Tension
   v) Viscosity
2. To determine the stability of floating bodies and measure the meta centric height
3. To determine the magnitude of hydrostatic force and center of pressure
4. To validate the Bernoulli's theorem
5. To measure flow rate through pipe using venture meter and to calibrate it
6. To measure flow rate through an orifice and to calibrate it
7. To measure flow rate in an open channel by Notch and to calibrate it

Recommended Books:

1. Fluid Mechanics for Petroleum Engineers, Elemer Bobok, ISBN: 0444556192.
2. Fluid Mechanics, Walther Kaufmann, ISBN: 0070333890
3. Fluid Mechanics with Engineering Application, E. Finnemore and Franzini, ISBN: 0072432020.

Journals/Periodicals:

World Wide Web:

HU-217 TECHNICAL WRITING & PRESENTATION SKILLS

Credit Hours: 3+0

Pre-requisites: Communication Skills

Specific Objectives of Course: To teach presentations and report writing skills.

Course Outline:

Written Communication

Organized writing of communicative paragraphs; Coherence and cohesive devices; Strength of unit in writing.

Correctness of Language
Importance of clarity in writing; Elements of clear writing: Directness; Brevity; Pitfalls to avoid; Hackneyed phrases; Redundancies; Slang; Passive voice; E-language; Sentence length; Specific Words and concrete words.

Business Correspondence
Memorandums: Types of memos: Status negative; Personal; Analysis of samples; Minutes of a meeting; E-mails: When and how to write an e-mail? Etiquettes of e-mailing; Resume and cover letter writing; Applications and follow-up letters; Business Letters: Format; Elements; Language: How to write? Language to avoid; Analysis of sample letters; Practice exercises on different types of official correspondence.

Interview Skills
Handling the interview; Investigating about the company; Making good appearance; Anticipating questions and preparing answers; Making oneself at ease – increasing confidence level ; Successful preparation of an interview: Knowing one's submitted resume well; Knowing the company applied to; Knowing the requirements of the available positions; Knowing the importance of non-verbal appearance; Knowing the importance of rehearsals.

Phonetics and Phonology
Phonetic symbols; Transcribing; Assimilation and elision; Use of dictionary; Stress patterns Intonation (practice in reading skills); First language interference in individual pronunciation.

Vocabulary Building
Techniques of building word power; Importance of reading as a voluntary habit and a vocabulary builder; Correct word usage; Synonyms; Ladder of accuracy; Words easily confused; Words with dual function.

Written Reports
Daily reports; Research methodology; Types of reports; Formal and informal reports; Executive summary; Scope; Purpose; Introduction; Writing the main report; Conclusion; Bibliography; APA and MLA styles; Plagiarism: What is plagiarism? How it can be avoided?

Presentations & Seminars

Lab Outline:
Lab work includes presentation practice.

Recommended Books:
1. Introduction to Business Communication by Zane K. Quible, Margaret H. Johnson & Dennis L. Mott, ISBN: 0134790723
2. Business Communication Today by Courtland L. Bovée, John V. Thill & Barbara E. Schatzman ISBN: 0130928585

3. Effective Business Communication by Herta A. Murphy, Herbert W. Hildebrandt & Jane P. Thomas, ISBN: 007044398X
4. Business Presentation by Lani Arredondo, ISBN: 0070028400

Journals/Periodicals:
World Wide Web:

SEMESTER-IV

PG-202 DRILLING ENGINEERING-I

Credit Hours: 3+1
Prerequisites: Fundamentals of Petroleum Engineering.

Specific Objectives of Course: To learn the basics of drilling operations.

Course Outline:
Introduction to drilling methods. Rotary drilling operations. Rig components and their functions. Bit type selection and evaluation. Drilling fluids: functions, types, and compositions. Mud properties and calculations. Mud pump ratings and horsepower requirements. Drilling hazards and their remedies. Pressure relationship in the formation and bore hole. The hydrostatic fluid head including mud and cement slurries.

Lab Outline:
1. Layout of drilling engineering laboratory.
2. Introduction of different models of rig components.
3. Density of mud determination using Mud Balance
4. To determine the properties of different clays.
5. Prepare a mud of known density.
6. To determine the gel strength of a drilling mud using Fann V. G. Meter.
7. To determine the plastic viscosity, apparent viscosity and Bingham yield point and true yield point using Fann V. G. Meter.
8. To determine the oil, water, solids and clay content of the drilling mud.
9. To determine API gravity and specific gravity of drilling mud.
10. To determine the gel strength of a drilling mud using Baroid Rheometer.
11. To determine the viscosity using Rotational Viscometer.
12. To prepare mud cake by Standard Filter Press and Mud Cell Assembly.
13. To study the filtration loss quality of a drilling mud by Baroid Miniature Filter Press.
14. To determine the clay/sand contents of the drilling mud using Sieve Analysis.

Recommended Books:
1. Applied Drilling Engineering by A. T Bourgoyne jr., K. K. Millehim, ISBN: 1555630014.

2. Drilling Fluids Optimization: A Practical Field Approach by J. L. Lummus, ISBN: 0878143068.
3. Formulas and Calculation for Drilling, Production and Workover, by Norton J. Lapeyrouse, ASIN: B001MT21K0.
4. Oil Well Drilling Engineering, Principles & Practice, by Hussain Rabia, ISBN: 0860107140.
5. Fundamentals of Casing Design, by Hussain Rabia, ISBN: 0860108635

Journals/Periodicals:

World Wide Web:

Ch-218 APPLIED THEMODYNAMICS

Credit Hours: 2+1
Prerequisites: Nil

Specific Objectives of Course: To learn principles of thermodynamics.

Course Outline:

Fundamental Quantities; Internal Energy, Enthalpy, Heat Capacity; Definition and Units of Basic System Parameters; First Law of Thermodynamics; PVT Behavior of Pure Substances; Thermodynamic Properties of Fluids; Equation of State and Correlation; Estimation of Thermodynamic Properties through Charts, Correlation and Diagrams; Heat Effect with and without Phase Change. Second Law of Thermodynamics; Concept of Entropy; Third Law of Thermodynamics; Thermodynamics analysis of Flow Processes;
The Concept of Equilibrium, Different Types of Equilibrium, Phase Equilibrium, Degrees of Freedom, Gibbs's Phase Rule. System of Variable Composition Ideal Behavior, The Chemical Potential as a Criterion of Phase Equilibrium, The Concept of Ideal Gas and Ideal Solution; Raoult's Law; P-X, Y And P-X, Y Diagrams For Ideal Solutions, Hubl-P, Bubl-T And Dew-T Calculation Methods; Flash Calculation, Heat Exchangers, Types, The Overall Heat Transfer Co-Efficient, Log Mean Temperature Difference, Parallel and Counter Flow Heat Exchanger, Multiphase and Cross Flow Heat Exchangers.

Lab Outline:

1. Measurement of following liquid properties
   Density
   Specific Weight
   Specific Volume
   Surface Tension
   Viscosity

Recommended Books:

1.Applied Thermodynamics for Engineering Technologists (5th Edition), A. Mcconkey, T. D, Eastop, ISBN: 0582091934.
2. Process Heat Transfer, D. Q. Kern, ISBN: 0070341907

Journals/Periodicals:
World Wide Web:

MA-219 APPLIED STATISTICS

Credit Hours: 3+0
Prerequisites: Applied Mathematics-II

Specific Objectives of Course: To learn different statistical methods to obtain the measure of central values of data and their interpretation.

Course Outline:

Basic probability, Random variables and probability distributions, Measures of central tendency. Measures of dispersion. Frequency distributions Binomial Normal, Poisson, Cauchy, Gamma, Beta, Chi-square, student's-t, and F-distributions, Bivariate Normal Distribution, Estimations and hypothesis testing, Analysis of variance. Curve fitting, Regression, and correlation, Auto and Cross correlation. Analysis of Time series.

Lab Outline: N/A

Recommended Books:

1. Introduction to Statistical Theory Part – I by Prof Sher Muhammad Ch. & Dr. Shahid Kamal Published by Illmi Kitab Khana, Urdu Bazar, Lahore
2. Schaum's Outline of Statistics (Schaum's Outline Series) , ISBN: 0071485848.
3. Schaum's Outline: Probability and Statistics, Second Edition [Paperback] , Schaum's Outline Series, ISBN: 0071350047

Journals/Periodicals:
World Wide Web:

PG-203 PETROLEUM GEOLOGY & GEOPHYSICAL EXPLORATION

Credit Hours: 3+1
Prerequisites: Applied Geology, Stratigraphy and Structural Geology

Specific Objectives of Course: To develop an understanding of hydrocarbon reservoir formations and methods of exploration.

Course Outline:

Geological history of petroleum. The origin, migration and accumulation of petroleum. Reservoirs with abnormal pressure and temperature. Geological distribution of petroleum in the world. Geological basins of Pakistan. Geology of existing oil and gas fields in Pakistan. Surface geological methods for petroleum exploration. Use of topography and

surface features for oil prospecting. Geophysical exploration methods with emphasis on seismic survey. History of exploration in Pakistan.

Lab Outline:

1. Presentations
2. Quiz
3. Assignments

Recommended Books:

1. Geology of Petroleum, by A. I. Levorsen, ASIN: B001F10TCW.
2. Basic Petroleum Geology, by Peter K. Link, ISBN: 0930972228.
3. Petroleum Geology of Pakistan, by Iqbal B. Kadri, ASIN: B007HFCE64.
4. Geophysical Prospecting, by Milton, B. Dobrin, ISBN: 0070171963.
5. Basic Exploration Geophysics, by E. S. Robinson, ISBN: 047187941X.

Journals/Periodicals:

World Wide Web:

CE-220 MECHANICS OF MATERIALS

Credit Hours: 2+1
Prerequisites: Fluid Mechanics

Specific Objectives of Course: To teach the students effect of forces on the dynamics of materials.

Course Outline:

Types of stresses and strains. Load extension diagrams. Hooke's Law. Temperature stresses. Geometrical properties of plane areas. (Centroid, Moment of Inertia & Product of Interia) Shearing Force and Bending Movements for simply supported beams, Cantilever and overhanging beams. Theory of simple Bending and Shearing Stresses in beams. Theory of Torsion in circular shafts (solid and hollow). Short Columns. Combined bending and direct stresses. Euler's Theory of buckling for long column-Empirical formula. Mechanical properties of metals and timber in tension and compression.. Principles of testing machine. Impact Loads. Hardness.

Lab Outline:

1. Layout Plan of Strength of Materials Laboratory.
2. Study of small instruments.
3. To perform direct shear test on plain mild steel bar.
4. To perform punching shear test on plain mild steel bar.
5. To perform tension test on plain mild steel bar.
6. To perform compression test on wooden cubes, when load is applied:-
   i) Perpendicular to grain.
   ii) Parallel to the grains.

7. To perform hardness test on mild steel and High Carbon steel specimen.
8. To perform bending test on wooden beam.
9. To verify the principal of super position by beam deflection.
10. To perform impact test on steel specimen:-
    i) In tension.
    ii) In bending.

Recommended Books:

1. Strength of Materials by A. Pytel, F. L. Singer, ISBN: 0060453133.
2. Mechanics of Materials by R.C. Hibbeler, ISBN: 0130164674.
3. Strength of Materials, By Schaum's Outline Series, ISBN-10: 0071635084.

Journals/Periodicals:

World Wide Web:

SEMESTER-V

PG-304 PETROPHYSICS

Credit Hours: 3+1

Prerequisites: Fundamentals of Petroleum Engineering, Petroleum Geology and Geophysical Exploration

Specific Objectives of Course: To study the physical properties of rocks.

Course Outline:

Introduction to formation evaluation. Fundamental properties of fluid permeated rocks; porosity, permeability, fluid saturations, compressibility and surface kinetics. Core-sampling and preservation. Measurement of basic rock properties. Interpretation and application of basic core analysis data. Special rock properties including electrical, acoustic and thermal. Use of correlations for the calculation of petrophysical properties with the help of computer.

Lab Outline:

1. To draw the layout plan of petrophysics & core laboratories.
2. To determine the grain density of given core sample.
3. To find the fluid saturation in the given core sample using modified ASTM Saturation Method.
4. To clean the given core sample using ASTM Extraction Methods.
5. To clean the given core sample using Soxhlet Extraction Methods.
6. To find the fluid saturation in the given core sample using Retort Oven.
7. To find the porosity of the given sample using Gravimetric Method.
8. To find the porosity of the given sample using Volumetric Method.
9. To calibrate Helium Porosimeter.

10. To measure the porosity of the given sample using Helium Porosimeter.
11. To measure the permeability of given core sample using Gas Permeameter.
12. To measure the permeability of given core sample using Liquid Permeameter.

Recommended Books:

1. Petrophysics, by Djebbar.Tiab, ISBN: 0123838487
2. Applied Petroleum Reservoir Engineering, by B. C. Craft & M. F. Hawkins, ISBN: 0130398845
3. Fundamental of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X
4. Petroleum Reservoir Engineering: Physical Properties, by James W. Amyx, ISBN: 0070016003.

Journals/ Periodicals:

World Wide Web:

PG-305 PROPERTIES OF RESERVOIR FLUIDS

Credit Hours: 3+1
Prerequisites: Applied Chemistry, Applied Thermodynamics

Specific Objectives of Course: To study the properties of reservoir fluids.

Course Outline:

Chemistry of petroleum and review of thermodynamic concepts. Basic concepts of phase behaviour; single, binary and multi-component systems. Equations of State for real fluids. Phase equilibria calculations for reservoir fluids. Sampling procedures: subsurface and surface sampling of reservoir fluids. Determination of reservoir fluid properties from: field data, laboratory analyses, correlations and equations of state. Application of fluid analysis data for use in reservoir and production engineering calculations. Properties of oil field waters. Gas hydrates. Use of existing/available software for phase behavior calculations.

Lab Outline:

1. Determination of flash point of crude oil.
2. Determination of cloud & pour point of crude oil.
3. Determination of density/specific gravity of crude oil.
4. Determination of kinematic viscosity of crude oil.
5. Determination of percentage of sulfur in crude oil.
6. Determination of surface tension of crude oil.
7. Gas Chromatography.
8. Determination of aniline point.
9. Determination of PVT properties.

Recommended Books:

1. The Properties of Petroleum Fluids, by William D. McCain, Jr, ISBN: 0878143351
2. Petroleum Engineering Handbook, Volume I General Engineering, by Larry Lake, ISBN: 1555631088
3. Handbook of Natural Gas Engineering, by Donald L. Katz, ISBN: 007033384X
4. Natural Gas Hydrates: A Guide for Engineers, by John J. Carroll, ISBN: 0123908299.

Journals/Periodicals:

World Wide Web:

PG-306 DRILLING ENGINEERING-II

Credit Hours: 3+1
Prerequisites: Drilling Engineering-I

Specific Objectives of Course: To study advanced drilling techniques, their problems and solutions.

Course Outline:

Formation pore pressures. Planning the well. Casing design and special design considerations. Overview of directional drilling and deviation control. Planning the directional well trajectory, kick off and trajectory change, deflection tools, deviation control and horizontal drilling. Coring methods and equipment. Formation damage: causes and prevention.

Drill Stem Testing: General procedure and considerations, test tool components and their arrangements. Drilling economics: equipment cost and methods of reducing drilling costs (e.g. slim-hole drilling). Introduction to managed pressure drilling. Blow out prevention and control. Introduction to offshore drilling technology.

Cementing: Primary well cementing. Techniques, types of cement and additives. Factors considered for the selection of cement type. Cementing volumes. Squeeze cementing. Stage cementing.

Lab Outline:

1. Studio work of Casing Design.
2. Presentations.
3. Quiz.
4. Assignments.

Recommended Books:

1. Applied Drilling Engineering by A. T Bourgoyne jr., K. K. Millehim, ISBN: 1555630014.
2. Oil Well Drilling Engineering, Principles & Practice, by Hussain Rabia, ISBN: 0860107140.

3. Petroleum Well Construction, by Michael J. Economides, Larry T. Watters ISBN: 0471969389
4. Casing Design; Theory and Practice, by S. S. Rahman, G. V. Chilingarian ISBN: 0444540628
5. Fundamentals of Casing Design, by Hussain Rabia, ISBN: 0860108635
6. Formulas and Calculation for Drilling, Production and Workover, by Norton J. Lapeyrouse, ASIN: B001MT21K0
7. Drill String Design Handbook by Willain C. Koger ASIN: B0006S40IE Horizontal Well Technology, by S. D. Joshi, ISBN: 0878143505.
8. Well Cementing, by Erik B. Nelson, ISBN: 0444555803
9. Advanced Well Control, by David Watson, Terry Brittenham, ISBN: 1555631010.

Journals/Periodicals:

World Wide Web:

CS-321 APPLIED NUMERICAL METHODS

Credit Hours: 2+1
Prerequisites: Applied Mathematics-III

Specific Objectives of Course: To teach numerical techniques for solving non-linear equations.

Course Outline:

Approximation and Errors: Accuracy, truncation, Taylor series and bracketing methods
Linear Equations: Gauss elimination, complex system and LU decomposition etc.
Non-Linear Equations: Bisection method, iteration, secant method, Newton-Raphson method, System of Nonlinear Equations and Convergence etc
Numerical Differentiation and Integration: Accuracy of derivatives, Newton-Cotes Integration Formulae, Integration for multiple and improper integrals.
Interpolation and Curve Fitting Methods: Binary Search, approximation, Larange polynomials, Inverse type, Least Squares and Orthogonal Polynomials including rational and spline function.

Lab Outline:

Numerous Programme.

Recommended Books:

1. Applied Numerical analysis, Curtis F. Gerald, ISBN: 0321133048.
2. Numerical methods for engineers, by Steven C. Chapra and R. P. Canale, ISBN: 0073401064
3. Applied numerical methods with MATLAB for engineers and scientists, by Steven C. Chapra, ISBN: 007313290X

Journals/Periodicals:
World Wide Web:

HU-322 SOCIAL SCIENCES

Credit Hours:3+0
Prerequisites: Nil

Specific Objectives of Course: To teach the students about social needs.

Course Outline:
As recommended by HEC/ Discretion of University/department.

Recommended Books:

Journals/Periodicals:
World Wide Web:

SEMESTER-VI

PG-307 WELL LOGGING

Credit Hours: 2+1
Prerequisites: Properties of Reservoir Fluids, Petrophysics.

Specific Objectives of Course: Learning log interpretation as diagnostic tool in formation evaluation.

Course Outline:
Introduction to well logging and its basic relationships. Principles, uses, tools and interpretation of spontaneous potential log, gamma ray log, porosity logs, resistivity logs and magnetic resonance imaging log, to identify the rock and calculate its fluid properties. CBL (cement bond log)/VDL (variable density log).

Lab Outline:
1. Interpretation of different resistivity profiles.
2. Determination of formation temperature using well log data.
3. Determination of variation in different resistivities with a change in temperature.
4. Determination of formation water resistivity from spontaneous potential log.
5. Determination of corrected resistivities of flushed zone and un-invaded rock using Tornado charts.
6. Determination of shale volume using SP/gamma ray log data.
7. Determination of shale corrected porosity of the rock by using sonic log data.

8. Determination of lithology and porosity of the rocks using various cross plots.

Recommended Books:

1. Basic Well Log Analysis, by George Asquith & Daniel Krygowski, ISBN: 0891816674
2. The Geological Interpretation of Well Logs by H. M. Rider, ISBN: 0954190688.
3. Fundamental of Well Log Interpretations:1 The acquisition of Logging data, by O. Serra, ISBN: 044455341X.
4. Theory, Measurement and Interpretation of Well Logs, by Zaki Bassiouni ISBN: 1555630561.

Journals/Periodicals:

World Wide Web:

PG-308 RESERVOIR ENGINEERING

Credit Hours: 3+1
Prerequisites: Petrophysics, Properties of Reservoir Fluids

Specific Objectives of Course: To introduce the principles of reservoir engineering.

Course Outline:

Fundamentals of reservoir engineering. Overview of PVT properties. Volumetric evaluation of hydrocarbons in place and empirical reserve estimation. Material balance equation. Reservoir drive mechanisms. Darcy's law of fluid flow through porous media. Radial steady state flow. Average permeability calculations for beds in series and in parallel for linear and radial reservoir geometry. Multiphase flow. Effective and relative permeabilities. Basic differential equations for radial flow in porous media and its solutions. Well inflow equations for stabilized flow conditions. Pressure distribution and pressure gradient for linear, radial, compressible, slightly compressible, and incompressible steady state flow conditions. Determination of average pressure in radial flow system. Productivity index, specific productivity index, and injectivity index. Relationship between well-bore radius and flow rate in radial flow system.

Lab Outline:

1. Determination of oil & gas in place by using graphical methods/Planimeter.
2. Demonstration of relative permeability from Steady State Test.
3. Determination of pressure gradient (gas, oil & water) from the field well data (such as MDT).
4. Determination of OIP with the help of GOC & WOC to find the value of oil thickness zone.
5. Determination of gas compressibility and pseudo-reduced compressibility of a gas reservoir.

Recommended Books:

1. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
2. Applied Petroleum Reservoir Engineering, by B. C. Craft and M. F. Hawkin, ISBN: 0130398845
3. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G.W. Tracy, ISBN: 0930972155.
4. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
5. Fundamental of Reservoir Engineering by Ben H. Caudle, ASIN: B0007GPIIQ.
6. Reservoir Engineering Manual, by Frank W. Cole, ASIN: B003AA4LKW.
7. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.

Journals/Periodicals:

World Wide Web:

PG-309 PETROLEUM PRODUCTION ENGINEERING-I

Credit Hours: 3+0
Prerequisites: Reservoir Engineering

Specific Objectives of Course: To familiarize the students with surface facilities and subsurface equipments for production optimization.

Course Outline:

Review of casing design concepts. Well completions: various completion designs, reservoir and mechanical considerations. Perforations, production packers, tubing strings, liners, subsurface completions, production control equipments and completion fluids. Wellhead and subsurface components installation. Surface production facilities. Piping systems, valves, chokes, fittings, separators, stock tanks, gathering systems and individual well flow rate allocation. Fluid Separators: separator components, types and factors influencing separator capacity. Production system analysis and design for single/multiphase fluid flow performance relationship. Tubing and flow line behavior: Tubing size, maximum possible flow rate and flow line size. Sand control procedures.

Lab Outline:

1. Design of production system.
2. Analyzing production system by Nodal Analysis.
3. Determination of pressure losses during production.
4. Production forecasting using different tools.
5. Separator designing.
6. Well completion design.

Recommended Books:

1. Petroleum Production Systems by Michael J. Economides, A. Daniel Hill, ISBN: 013658683X.
2. Production Optimization using Nodal™ Analysis by H. Dale Beggs, ASIN: B001QGWNOS.
3. Petroleum Production Engineering: A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
4. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
5. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
6. Principles of Oil Well Production by T.E.W Nind, ISBN: 0070465762.
7. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
8. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
9. Surface Operation in Petroleum Production, by G.V. Chillingarian, J. O. Robertson, ISBN: 0444424733.

Journals/Periodicals:

World Wide Web:

PG-310 NATURAL GAS ENGINEERING

Credit Hours: 3+1
Prerequisites: Mechanics of Materials, Properties of Reservoir Fluids

Specific Objectives of Course: To study gas measurement, processing, transmission and distribution.

Course Outline:

Introduction to natural gas industry, natural gas properties, flow and compression calculations, gas transmission, sweetening and dehydration of crude gases, distribution of gas in the city, gas stations, pipe line welding techniques, testing and welding defects and gas flow measurements.

Corrosion Principles: Corrosion mechanism, causes of corrosion cells, polarization and factors of polarization, high temperature corrosion, stress corrosion cracking; sulfide stress corrosion cracking, chloride stress corrosion cracking, caustic stress corrosion cracking, environmentally inducted cracking. Hydrogen damages and corrosion losses.

Corrosion Control: Corrosion detection methods; corrosion coupons, corrosion resistance probes, caliper measurements, ETT, sonic testing, casing potential profile tool. Corrosion control methods; material selection environment modification, inhibitor treatment. Evaluation of inhibitor treatment program, cathodic protection, properties of galvanic anodes, design of impressed current, G/B, criteria of cathodic protection, interference and anodic protection.

Lab Outline:

1. Ideal gas law.
2. Determination of Z-factor in different cases.
3. Determination of heating values & lower explosive limits.
4. Flowing calculations in high pressure piping with different formulas.
5. Equivalent lengths of complex pipeline systems.
6. Looping line problems.
7. High pressure pipeline wall thickness and pipe grades.
8. Define meter flow calculations by AGA Report 3 Formula.
9. Demonstration of positive displacement meters.

Recommended Books:

1. Handbook of Natural Gas Engineering by Donald & Katz, ISBN: 007033384X.
2. Petroleum Transportation Handbook by Harold Sill, ASIN: B0000CM32Q
3. Gas Conditioning and Processing by John M. Campbell, ASIN: B000UMK60W.
4. Petroleum Reservoir Engineering, Physical Properties by James W. Amyx, ISBN: 0070016003.
5. Corrosion Engineering, by Mars G. Fontana, Norbert D. Greene, ISBN: 0070214611.
6. Control of Pipeline Corrosion by A. W. Peabody, ISBN: 1575900920.
7. Pipeline Corrosion and Cathodic Protection, by Marshall Parker, Edward G. Peattie, ISBN: 0872011496.

Journals/Periodicals:

World Wide Web:

Man-323 ENVIRONMENT AND SAFETY MANAGEMENT

Credit Hours: 3+0

Prerequisites: Drilling Engineering-II, Petroleum Production Engineering-I

Specific Objectives of Course: To familiarize the students with environmental hazards, and safety management in petroleum industry.

Course Outline:

Environmental impact assessment of oil and gas field, risk securing techniques, concept of air and water pollution in petroleum industry, flaming impact, oil spill control, solid waste and sludge control, impact of drilling activity, emissions during drilling, production, storage and LPG plant operation, noise pollution in oil exploring and exploiting, prevention and control. Occupational health and safety administration. Design procedure for operation, maintenance, modification, and emergencies, safety by contractor, accident and incident reporting, investigation and follow-up, and reappraisal of the system. The principles of EIA. Legislation and regulatory aspects of EIA.

Lab Outline: N/A

Recommended Books:

1. Environmental Management in Petroleum Industry, S. K. Wahri, A.K. Agnihotri, ISBN: 8122403778.
2. Managing Drilling Operations, Ken Fraser, Jim Peden, ISBN: 1851666303.
3. Carbonate Depositional Environment, Peter A. Scholle, ISBN: 0891813101.
4. Safety for Industry: a manual for training and practice, by Creber, ASIN: B007SZBQI0
5. Environmental Health Engineering by Sandy Cairncross, ISBN: 0471938858.
6. OSHA Regulations and Guidelines: A Guide for Health Care Providers. ISBN: 9780766804784. http://www.osha.gov/pls/publications/publication.html
7. Environmental Impact Assessment by Larry W. Canter, ISBN: 0070097674.

Journals/Periodicals:

World Wide Web:

SEMESTER-VII

PG-411 WELL TESTING

Credit Hours: 3+1
Prerequisites: Properties of Reservoir Fluids, Reservoir Engineering.

Specific Objectives of Course: Acquisition of pressure and temperature data for reserves estimation and reservoir diagnostics.

Course Outline:

Fundamentals of fluid flow in porous media. Introduction to flow and buildup test analysis. Well test analysis by use of type curves. Analysis of pressure buildup tests distorted by phase redistribution. Well test interpretation in hydraulically fractured wells. Interpretation of well test data in naturally fractured reservoirs. Drillstem testing and analysis. Design and implementation of well tests.

Lab Outline:

Recommended Books:

1. Pressure Transient Testing by John Lee, ISBN: 1555630995.
2. Well Test Analysis by M. A. Sabet.
3. Advances in Well Test Analysis by Robert C. Earlougher Jr, ISBN: 0895202042.
4. Well Testing by John Lee, ISBN: 0895203170.

5. Oil Well Testing Handbook by Amanat Chaudhary, ISBN: 0750677066.
6. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731.

Journals/Periodicals:

World Wide Web:checked from here

PG-412 PETROLEUM PRODUCTION ENGINEERING-II

Credit Hours: 3+1

Prerequisites: Petroleum Production Engineering-I

Specific Objectives of Course: To Develop understanding of artificial lift methods and reservoir stimulation.

Course Outline:

Causes of low well productivity: Reservoir dominated factors, well bore dominated factors and mechanical failures. Well Diagnostics: Production test, deliverability tests, transient tests (PLT, PSP) and near wellbore damage characterization. Problem well analysis: Well Performance Prediction; Decline curve analysis, Material balance method and reservoir simulators and Remedies. Well services and work over jobs; squeeze jobs, re-perforation and well cleaning.

Stimulation Techniques: Hydraulic Fracturing; Introduction, inducing fractures, productivity ratio, fracture area, fracturing fluid coefficient, fracture efficiency, fracturing hydraulics, fracture design and calculations. Acidizing: Introduction, types of treatment, acid-fracturing design. Gas Lift: Introduction, application, valve mechanics, design of continuous-flow gas lift system, design of intermittent gas lift system and accumulation chambers.

Lab Outline:

1. Establishing different inflow performance relationships.
2. Determination of vertical lift performance of a well using choke and bottom-hole parameters.
3. Determination of reservoir/bottom-hole parameters using surface production data.
4. Interpretation of Production Logging Tool data for well diagnostics.
5. Determination of productivity ratio of a reservoir stimulation job.
6. Well hydraulics calculations for an anticipated stimulation job.
7. Complete hydraulic fracture design and its modeling.
8. Complete acid fracturing job and its modeling.
9. Graphical determination of the point of gas injection for a gas lift design.
10. Universal valve spacing design for a gas lift installation.

Recommended Books:

1. Petroleum Production Systems by Michael J. Economides, A. Daniel Hill, ISBN: 013658683X.
2. Production Optimization using Nodal^{TM} Analysis by H. Dale Beggs, ASIN: B001QGWNOS.

3. Petroleum Production Engineering**,** A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
4. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
5. Principles of Oil Well Production by T. E. W Nind, ISBN: 0070465762.
6. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
7. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
8. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
9. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733.

Journals/Periodicals:

World Wide Web:

PG-413 GAS RESERVOIR ENGINEERING

Credit Hours: 3+1
Prerequisites: Petrophysics, Reservoir Engineering

Specific Objectives of Course: Study of advanced concepts of gas reservoir engineering

Course Outline:

Basics of Gas Reservoir Engineering, reservoir gas volume factor, densities and gas gradient. Calculation of static bottom-hole pressure.
Gas Reservoirs: Estimation of gas reserves by volumetric method. Unit Recovery and recovery from volumetric and water drive gas reservoirs.
Material balance equation method: Assumptions, derivation and applications.
Reserve calculations and reservoir performance: Volumetric estimates, material balance estimates, pressure decline curve, P/Z method, material balance equation straight-line method, reservoir size, calculation of water influx. Gas equivalent of produced condensate and water.
Gas Condensate Reservoirs: Reservoir types defined with reference to phase diagrams, calculation of original gas and condensate in place for volumetric reservoirs. Reserves calculations with and without compositional data. Well Testing and sampling, material balance and performance of volumetric retrograde gas condensate reservoirs.
Gas Well Testing: Deliverability testing of gas wells: Fundamental equations in deliverability testing, flow after flow test, isochronal test and modified isochronal test. Use of pseudo pressure in deliverability testing and real gas pseudo pressure analysis. Transient testing: Pressure Build up and pressure draw down test. Guide lines for gas well testing. **Problems in gas well testing:** liquid loading. Use of computer in Gas Reserves estimation and well test analysis.

Lab Outline:

1. Class assignment.
2. Presentations.
3. Use of software

Recommended Books:

1. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
2. Gas Production Operations by Dale Beggs, ASIN: B001O78FVY.
3. Gaswell testing: theory, practice & regulation David A. T. Donohue, ISBN: 9780934634106
4. Oil Well Testing Handbook by Amanat Chaudhry, ISBN: 0750677066.
5. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731.

Journals/Periodicals:

World Wide Web:

Man-424 PROJECT PLANNING & MANAGEMENT

Credit Hours: 3+0

Pre-requisites: Technical writing and Presentation Skills

Specific Objectives of Course: To teach presentations and report writing skills

Course Outline:

Introduction, project management context; project management. Processes integration management; project plan development, project plan development, project plan execution, overall change control.

Scope management; initiation, scope planning, scope definition, scope verification, scope change control. Time management; activity definition, activity sequencing, activity duration estimation, schedule development, schedule control. Cost management; quality planning, staff acquisition, team development.

Communications management; communications planning, information distribution, performance reporting, administrative closure.

Risk management; risk identification, risk quantification, risk response development, risk response control.

Procurement management; procurement planning, solicitation planning, source selection, contract administration, contract close-out. Closing; administrative closure, contract close-out, lessons learnt.

Lab Outline:

Lab work include computing project management software, PERT, Gantt hart/Network, CPM, S Curves etc. CPM, Statistical techniques.

Recommended Books:

1. A guide to the Project Management Body of Knowledge, by Project Management Institute (PMI) standards committee, ISBN: 1880410133

2. Software Project Management, A Concise Study, by S. A. Kelkar, Prentice Hall of India, ISBN: 8120336720.

Journals/Periodicals:
World Wide Web:

Ch. E-425 INSTRUMENTATION AND PROCESS CONTROL

Credit Hours: 3+1
Prerequisites: Petrophysics, Properties of Reservoir fluids, Reservoir Engineering

Specific Objectives of Course: To study the instrumentation and controlling of different equipments to be used in Petroleum Industry.

Course Outline:

Instrumentation: Principles of measurement of temperature. Pressure level, flow, weight Power, speed, position; etc. Study of common sensors, transmitters, controllers, actuators, recorders, switches, etc. Methodology for calibration. Failsafe modes of operation, alarm, trip and interlock system. Emergency shut-down systems. Fire and gad detection. Pressure relief & venting systems.
Control Practice: Terminology signal types and standard ranges interpretation of P & I diagrams; Servo and regulator operation. Bias and offset auto/manual optimum settings. Ziegler and Nichols formulae. Control strategy: Formulation P & I diagrams. Control loop elements, Block diagrams. Control objectives. Industrial Applications. Use of feedback, cascade, ratio, fee forward. Use of analyzer and chromatographs, Modeling: Lumped parameter models to plant, e.g. jacked vessel.
Control Theory: Use of Laplace transforms. Mathematical modeling of simple lumped parameter systems and their Laplace transforms. Response of First & Second order systems. Study of a typical feedback control loop, open and closed loop response to simple inputs. Stability of a system, frequency response methods, various stability criteria. Tuning of PID controllers, criteria, methodologies. Introduction to advance control system, cascade & selective control system.

Lab Outline:

Study the K & J type thermocouples, Study of control loops, Process plant training

Recommended Books:

1. Principles and Practice of Automatic Process Control, Carlos A. Smith, Armando B. Corripio, ISBN: 0471431907.
2. Process Control: Designing Processes and Control Systems For Dynamic Performance T. E. Marlin, ISBN: 0070404917.
3. Process Dynamics, Modeling, and Control, Babatunde. A. Ogunnaike, ISBN: 0195091191.
4. Process system Analysis & Control, Donald R. Coughanowr, Steven LeBlanc, ISBN: 0072432500.

5. Process Control: Instrumentation Technology, Curtis D. Johnson, ISBN: 0555009629.
6. Chemical Process Control: An Introduction to Theory and Practice, George. Stephanopoulos, ISBN: 0131286293.

Journals/Periodicals: www.pdffactory.com
World Wide Web:

PG-414 PROJECT

Every student will be required to submit a comprehensive report on an assigned problem.

SEMESTER-VIII

Pet.E-415 PRINCIPLES OF ENHANCED OIL RECOVERY

Credit Hours: 3+1
Prerequisites: Reservoir Engineering, Petroleum Production Engineering-II.

Specific Objectives of Course: To enable the students to understand how to maximize recovery by applying external energy sources.

Course Outline:

Basic concepts of EOR: Linear, two- and three-dimensional displacements. The role of reservoir geology in the design and operations. Microscopic efficiency of linear immiscible displacement. Areal and vertical displacement efficiency in 2-D and 3-D systems.

Water Flooding: Selection criteria, displacement theories and performance calculations. Selection and efficiency of various flood patterns. Practical considerations for waterflood design.

Immiscible Displacement by Gas Injection: Surface installations; compression and treatment methods. Special applications of gas injection.

Thermal Recovery Methods: steam and hot water displacement. In-situ combustion.

Miscible Flooding: Thermodynamic miscibility, ternary diagram, first and multiple contact miscibilities. Carbon dioxide, nitrogen and water alternating gas flooding.

Chemical injection: polymers, misceller polymer, alkaline and surfactants.

Lab Outline:

1. Projects: Solution of EOR problems; development of computer algorithms and example calculations
2. Presentations

3. Assignments
4. Quiz

Recommended Books:

1. Enhanced oil Recovery by Marcel Latil, ISBN: 0872017753
2. Enhanced Oil Recovery by Don W. Green and G. Paul Willhite, ISBN: 1555630774.
3. Enhanced Oil Recovery by Larry W. Lake, ISBN: 1555633056.
4. Water Flooding by Don W. Green, G. Paul Willhite ISBN: 1555630057
5. Dynamics of Petroleum Reservoirs under Gas Injection, by Rafael Sandrea, Ralph Nielsen, ISBN: 0872012190

Journals/Periodicals:

World Wide Web:

PG-416 RESERVOIR SIMULATION

Credit Hours: 3+1
Prerequisites: Applied Numerical Methods, Reservoir Engineering,

Specific Objectives of Course: To develop a tool for predicting hydrocarbon-reservoir performance under various operating conditions using computer.

Course Outline:

Introduction to the concepts of reservoir simulation, its advantages and limitations. Revision of basic reservoir engineering concepts, reservoir fluid and rock properties and basic mathematical concepts.
Formulation of basic equations for single-phase flow in porous media, finite difference approximation to flow equations, stability and error analysis. Well representation in simulators, solution of linear difference equations applicable to the reservoir using direct and iterative methods.

Lab Outline:

Software Applications:
Use of a simulator (like **Eclipse)**, input data and data file preparation, fine tuning for history matching and performance prediction.
Class projects using software application.

Recommended Books:

1. Basic Applied Reservoir Simulation by T. Ertekin, ISBN: 1555630898.
2. Fundamentals of Numerical Reservoir Simulation by Donald W. Peaceman, ISBN: 0444552987
3. Reservoir Simulation by Calvin, C. Mattax, ISBN: 1555630286.
4. Modern Reservoir Engineering: A Simulation Approach by Henry B. Crichlow, ISBN: 0135974682.
5. Principles of Applied Reservoir Simulation by John R. Fanchi, ISBN: 0750679336

6. Principles of Hydrocarbon Reservoir Simulation by Gordon W. Thomas, ISBN: 0137111770

Journals/Periodicals:
World Wide Web:

PG-417 PETROLEUM ECONOMICS

Credit Hours: 2+0
Prerequisites: Applied Mathematics-III, Reservoir Engineering

Specific Objectives of Course: To study the feasibility and viability of petroleum projects.

Course Outline:

Introduction and definition of basic concepts, world supply and demand. Pakistan Petroleum Policies and laws, petroleum resource and reserves classification. Evaluation nomenclature, time value of money, basic interest equations, present and net present value, ABC transaction, payout, payback time and rate of return. Engineering economics, factors and their uses. Evaluation of alternatives. Depreciation, depletion and corporate taxes. Cash flow analysis. Risk analysis. EMV calculations. Application of the principles of engineering economics to exploration, drilling, and production operations.

Lab Outline: N/A

Recommended Books:

1. Petroleum Production Engineering: Petroleum Production Economics by Lester Charles Uren, ASIN: B0000CHPVU
2. Engineering Economy, by Anthony Tarquin, Leland Blank, ISBN: 0073376302
3. Economics of Worldwide Petroleum Production by Richard D. Seba, ISBN: 093097221X.
4. Decision Analysis For Petroleum Exploration by John R. Schuyler, ISBN: 0966440110.
5. Project Economics & Decision Analysis, by M. A. Mian, Mohammad A. Mian, ISBN: 0878148191.

Journals/Periodicals:
World Wide Web:

Ch. E-426 PETROLEUM REFINARY ENGINEERING

Credit Hours: 3+1
Prerequisites: Properties of Reservoir Fluids, Fluid Mechanics.

Specific Objectives of Course: To enable the students to understand refinery environment.

Course Outline:

Petroleum and Fuels: Petroleum Processing. Separation, Natural gas, composition, stripping at the well head, stripping at the gathering station and Natural gasoline.

Crude Oils: Composition, Types of crude oil, Types of Processing for crude oil, Separation and distillation.

Products of Primary Distillation: Separation by vacuum distillation, Indicative yield from primary distillation, separation by absorption, Petroleum Processing conversion processes, cracking and reforming, Products Treatments and Separation of olefins.

II. 1. Polymeric Materials from Petroleum.
2. Inorganic Chemicals from Petroleum.
3. Synthetic Fuels.
4. Synthetic Detergents.

Lab Outline:

Recommended Books:

1. Chemical Technology of Petroleum by William A. and Stevens, Donald Gruse, ASIN: B002FS0KVY.
2. Petroleum Refinery Engineering by W. L. Nelson, ASIN: B000VMMSY8.
3. Chemistry of Petrochemical Processes, by Lewis F. Hatch& Sami Matar, ISBN: 0884153150.

Journals/Periodicals:

World Wide Web:

PG-414 PROJECT

Credit Hours: 3

Prerequisites: Complete course work

Specific Objectives of Course: To create research abilities in student through research work.

Course Outline:

Experimental and/or theoretical approaches with possible application of computer techniques to integrate various components of the curriculum in a comprehensive engineering design experience. Design of a complete project including identification of a problem, formulation of design, preparation of specifications, and consideration of alternative feasible solutions both technically and economically

SCHEME OF STUDIES FOR
ME/M Sc. IN PETROLEUM/PETROLEUM & GAS ENGINEERING

CORE COURSES (GROUP-A)

Course No.	Courses Title	Marks		Contact Hours		Credit Hours		
		Theory	Practical	Theory	Practical	Theory	Practical	Total
PG-501	Enhanced Oil Recovery	100	100	2	2	2	1	3
PG-502	Advanced Well Testing	100	100	2	2	2	1	3
PG-503	Advanced Production Engineering	100	100	2	2	2	1	3
PG-504	Advanced Drilling Engineering	100	100	2	2	2	1	3
PG-505	Advanced Reservoir Engineering	100	100	2	2	2	1	3
PG-506	Advanced Reservoir Simulation	100	100	2	2	2	1	3
PG-507	Artificial Lift Methods	100	100	2	2	2	1	3
PG-508	Well Stimulation Design	100	100	2	2	2	1	3

ELECTIVE COURSES (GROUP-B)

Course No.	Courses Title	Marks		Contact Hours		Credit Hours		
		Theory	Practical	Theory	Practical	Theory	Practical	Total
PG-511	Geo-Physical Problems	100	100	2	2	2	1	3
PG-512	Flow Through Porous Media	100	100	2	2	2	1	3
PG-513	Well Log Interpretation	100	100	2	2	2	1	3
PG-514	Petroleum Economics	100	100	2	2	2	1	3
PG-515	Gas Processing	100	100	2	2	2	1	3
PG-516	Reservoir Engineering Management	100	100	2	2	2	1	3
PG-517	Naturally Fractured Reservoirs	100	100	2	2	2	1	3
PG-518	Horizontal Well Technology	100	100	2	2	2	1	3
PG-519	Petroleum Production Operations	100	100	2	2	2	1	3
PG-520	Drilling Fluids Hydraulics	100	100	2	2	2	1	3
PG-521	Production Optimization	100	100	2	2	2	1	3

RESEARCH THESIS

PG-500	Thesis			0	12	0	6

NOTE:

Every student has to pass four courses from each course group.

Practical marks comprise of 60% for Sessional work and 40% for Viva Voc.

DETAIL OF COURSES FOR
ME/M Sc. IN PETROLEUM/PETROLEUM & GAS ENGINEERING

PG-501 ENHANCED OIL RECOVERY

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Fluid and rock property data for different recovery process, water, oil, physical property correlations for crude oil, reservoir rocks, unconsolidated and consolidated oil sands. Methods and process, Fundamental of enhanced oil recovery methods and applications. Thermal recovery methods, Steam, stimulation, steam injection, estimation of oil recovery from steam drive mechanism, Insitu combustion process, Comparison of insitu and steam drive processes. Mobility control process, Polymer flooding, insitu permeability modification, slug integrity foam agents for enhanced oil recovery. Chemical flooding micellar/polymer process, surfactants, phase behavior of micro emulsions and ift and their variable affecti~Ephase behavior and ift. Viscosity and density micro emulsions and their displacement mechanism, modeling of chemical flood displacement with design procedures and criteria and alkaline flooding. Miscible and immiscible gas flooding Wag process, Ch4 flooding, Co2, Other gas injection methods.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Enhanced oil Recovery by Marcel Latil, ISBN: 0872017753
2. Enhanced Oil Recovery by Don W. Green and G. Paul Willhite, ISBN: 1555630774.
3. Enhanced Oil Recovery by Larry W. Lake, ISBN: 1555633056.
4. Water Flooding by Don W. Green, G. Paul Willhite ISBN: 1555630057
5. Dynamics of Petroleum Reservoirs under Gas Injection, by Rafael Sandrea, Ralph Nielsen, ISBN: 0872012190.

Journals/Periodicals:

World Wide Web:

PG-502 ADVANCED WELL TESTING

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Introduction to transient testing, basic concepts of well testing, Diffusivity Equation and its boundary conditions, Exponential integral (line source)

solution and its logarithmic approximation, Bounded circular reservoir solution, Depth of investigation, Drawdown testing and semilog analysis, Semilog plot of pwf versus Int., Determination of permeability, k, and skin factors, Early, middle and late time pressure behavior, Drawdown test in a developed reservoir, Buildup testing and the horner plot, Principle of superposition, Reservoir pressure response during buildup, Semilog plot of pws versus In [tp + t)/ t], Determination of permeability and reservoir pressure, Computation of skin factor form last flowing pressure, Analysis of buildup test using drawdown theory, Other semilog plots (mdh, slider, etc), Linear discontinuities (sealing faults), Drawdown Pressure draw Down, Pressure Build-up, Average Pressure determination, Two Rate Testing, Multirate Tests. Multiwell Testing – Interference Test Analysis, Pulse Testing of the Hydraulically Fractured Wells. Testing of the heterogeneous reservoir- Linear discontinuity, faults and barriers, permeability anisotropy, Composite systems, layered reservoirs (with cross flow). Naturally fractured reservoirs. Use of type curves in all types of well testing techniques. Pressure derivative approach.

Lab Outline:
Class Assignments, Presentations.

Recommended Books:

1. Pressure Transient Testing by John Lee, ISBN: 1555630995.
2. Well Test Analysis by M. A. Sabet. ISBN: 087201584X
3. Advances in Well Test Analysis by Robert C. Earlougher Jr, ISBN: 0895202042.
4. Well Testing by John Lee, ISBN: 0895203170.
5. Oil Well Testing Handbook by Amanat Chaudhary, ISBN: 0750677066.
6. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731.
7. Gas Well Testing Handbook by Amanat Chaudhry, ISBN: 0750677066

Journals/Periodicals:
World Wide Web:

PG-503 ADVANCED PRODUCTION ENGINEERING
Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:
Course Outline:
Inflow performance, multiphase flow correlations, tubing – flowline intake, and choke bean performance. Comprehensive study of well completion design, subsurface control equipment, perforation of oil and gas wells, completion and workover fluids, squeeze cementing, production logging, sand control, introduction to stimulation methods.

Lab Outline:
Class Assignments, Presentations.

Recommended Books:

1. Petroleum Production Systems by Michael J. Economides, A. Daniel Hill, ISBN: 013658683X.
2. Production Optimization using Nodal^{TM} Analysis by H. Dale Beggs, ASIN: B001QGWNOS.
3. Petroleum Production Engineering**,**A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
4. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
5. Principles of Oil Well Production by T. E. W Nind, ISBN: 0070465762.
6. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
7. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
8. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
9. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733.

Journals/Periodicals:

World Wide Web:

PG-504 ADVANCED DRILLING ENGINEERING

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Drilling assemblies, rotary drilling bits, the theory of elasticity in drilling operation. Fatigue and failure of drill pipes, directional drilling, hydraulics and casing design, optimization of drilling hydraulics and casing design, optimization of drilling parameters and related problems, well control, novel techniques in drilling.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Applied Drilling Engineering by A. T. Bourgoyne jr., K. K. Millehim, ISBN: 1555630014.
2. Oil Well Drilling Engineering, Principles & Practice, by Hussain Rabia, ISBN: 0860107140.
3. Petroleum Well Construction, by Michael J. Economides, Larry T. Watters ISBN: 0471969389
4. Casing Design; Theory and Practice, by S. S. Rahman, G. V. Chilingarian ISBN: 0444540628
5. Fundamentals of Casing Design, by Hussain Rabia, ISBN: 0860108635

6. Formulas and Calculation for Drilling, Production and Workover, by Norton J. Lapeyrouse, ASIN: B001MT21K0
7. Drill String Design Handbook by Willain C. Koger ASIN: B0006S40IE .
8. Horizontal Well Technology, by S. D. Joshi, ISBN: 0878143505.
9. Well Cementing, by Erik B. Nelson, ISBN: 0444555803
10. Advanced Well Control, by David Watson, Terry Brittenham, ISBN: 1555631010.

Journals/Periodicals:
World Wide Web:

PG-505 ADVANCED RESERVOIR ENGINEERING

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Introduction to reservoir engineering, reserve estimation, reservoir pressures, Abnormal pressure, Fluid pressures in hydrocarbon system?, Pressure gradients around the water oil contact, Techniques for pressure measurement, Reservoir temperatures; Averaging permeabilities for several layers black oil and compositional model, Properties of reservoir gases, Ideal gases, Behavior of real gases, Gas formation volume factor, Viscosity of gases, Equations of state, Properties of reservoir liquids, Black oil parameters, Oil formation volume factor, Calculation procedures for reservoir fluid density, Reservoir drive mechanisms, Types-depletion, water, compaction and gravity drainage, Reservoir performance of different drive systems, Rate sensitive systems re water drive, Gas condensates, Introduction, Development options, Appraisal methods, Material balance equations, A general material balance equation, Derivation of the material balance equation by equating pore volume to volume of fluids remaining therein, Derivation of the material balance equation by equating subsurface volume of produced fluid to expansion of original fluid plus more volume reduction, Significance and usage of the material balance equation, Sources of data to be used in the material balance, Effects not yet included in the material balance, Limitations of the material balance, Reservoir performance prediction, Material balance equation, Introduction, Instantaneous gas-oil ratio, Depletion drive reservoirs (solution gas drive), Performance prediction - tarner's method, Reservoir performance as a function of time, Reservoir prediction gas cap drive reservoirs, The material balance as an equation of a straight line, Reservoir performance prediction, Water influx, Water drive characteristics, Models for water encroachment, Hydraulic analogs of water influx, Unsteady - state (hurst van everdingen), Fetkovitch method for water influx determination, Water and gas coning.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
2. Applied Petroleum Reservoir Engineering, by B. C. Craft and M. F. Hawkin, ISBN: 0130398845
3. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G.W. Tracy, ISBN: 0930972155.
4. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
5. Fundamental of Reservoir Engineering by Ben H. Caudle, ASIN: B0007GPIIQ.
6. Reservoir Engineering Manual, by Frank W. Cole, ASIN: B003AA4LKW.
7. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.
8. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
9. Gas Production Operations by Dale Beggs, ASIN: B001O78FVY.
10. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731.

Journals/Periodicals:

World Wide Web:

PG-506: ADVANCED RESERVOIR SIMULATION

Credit Hours: 2+1

Prerequisites:

Specific Objectives of Course:

Course Outline:

A review of basic mathematics and reservoir engineering concepts in reservoir simulation. Formulation of reservoir simulation equations. Setting up the finite difference model. Solution of the finite difference model (explicit or implicit in pressure/saturation). Solving the matrix of simultaneous equations. Examples. Uses and misuses of reservoir simulation. Selection of a proper reservoir simulator. Application of finite element technique to reservoir simulation.

The principle objective of this course is the development of reservoir simulation theory to the level required for the construction of a three-phase, three-dimensional reservoir simulator. In addition to providing practice in developing a simulator, the course will also require the use of available reservoir simulators to do simulation study for a number of fields. A simulation project will include data preparation, selection of model, input file preparation, restart procedures, history matching, prediction and optimization. Field examples on well testing, coning problems and improved recovery techniques will be used.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Basic Applied Reservoir Simulation by T. Ertekin, ISBN: 1555630898.
2. Fundamentals of Numerical Reservoir Simulation by Donald W. Peaceman, ISBN: 0444552987.
3. Reservoir Simulation by Calvin, C. Mattax, ISBN: 1555630286.
4. Modern Reservoir Engineering: A Simulation Approach by Henry B. Crichlow, ISBN: 0135974682.
5. Principles of Applied Reservoir Simulation by John R. Fanchi, ISBN: 0750679336.
6. Principles of Hydrocarbon Reservoir Simulation by Gordon W. Thomas, ISBN: 0137111770.

Journals/Periodicals:

World Wide Web:

PG-507 ARTIFICIAL LIFT METHODS

Credit Hours: 2+1

Prerequisites:

Specific Objectives of Course:

Course Outline:

Theory and application of gas lift. Gas lift installation design and analysis. Compressor system, submersible sucker rod, and other type of pumping systems cost analysis of various installations, production optimization techniques including Nodal Analysis.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Technology of Artificial Lift Methods, by Kermit E. Brown, ISBN: 0878141197.
2. Petroleum Production Engineering**,**: A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701
3. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733.
4. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
5. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
6. Introduction to Petroleum Production; Volume I & II by D. R. Skinner ISBN: 0872017672

Journals/Periodicals:

World Wide Web:

PG-508 WELL STIMULATION DESIGN

Credit Hours: 2+1
Prerequisites:

Specific Objective of Course:

Course Outline:

Formation damage, Damage mechanisms associated with plugging, c1~ys, Emulsions and wet ability changes, Damage identification and prevention, Well servicing fluids, Function of packer, completion, perforating and work over fluids, Perforating, Principles of jet perforating, AdClization, Concepts of acid stimulation in sandstone and carbonate reservoir, Fracturing, Introduction, Principles and mechanics of hydraulic fracturing, theory and data sheet, Fracture initiation and propagation pressures, Fracture fluid option and additives, Fracture proppants, Sand production and control, Mechanisms for sand production, Prediction of sanding tendency and sand failure analysis, Sand control by critical production rate prediction, Gravel packing of open and caused holes, Sand consolidation, Well diagnosis, Well bore and reservoir problems affecting well performance, Investigative/evaluation techniques, Measurement of hydraulic fracture conductivity, Statement of objectives, summary of progress and conclusions, Theoretical basis to project, Equipment manufacture and experimental techniques.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
2. Principles of Oil Well Production by T. E. W Nind, ISBN: 0070465762.
3. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
4. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
5. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
6. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733

Journals/Periodicals:

World Wide Web:

PG-511 GEO-PHYSICAL PROBLEMS

Credit Hours: 2+1
Prerequisites:

Specific Objective of Course:

Course Outline:

Students have to undertake and complete limited investigation and involve himself to field practice. Interpretation of field oriented problems (1-12) and

get familiarity with geo-physical practice related to different surveying methods

Lab Outline:
Class Assignments, Presentations.

Recommended Books:

Journals/Periodicals:
World Wide Web:

PG-512 FLOW THROUGH POROUS MEDIA
Credit Hours: 2+1
Prerequisites:

Specific Objective of Course:
Course Outline:
Physical properties of porous media with emphasis on transport phenomena in porous media, geometrical and mechanical properties, single-phase flow and (miscible and immiscible) multiphase fluid flow through porous media, and heat transfer in porous media. Reserve calculations for volumetric, water drive, and geopressured gas reservoirs. Decline curve analysis, Gas wells deliverability tests. Static and flowing buttonhole pressure. The goal of this course is to develop the techniques for the solution of a wide variety of single-phase flow problems in porous media for compressible and incompressible and incompressible flow. Two-dimensional flow will be considered for the greater part. Selection mathematical techniques will be developed for specific problems.

Lab Outline:
Class Assignments, Presentations.

Recommended Books:
1. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
2. Applied Petroleum Reservoir Engineering, by B. C. Craft and M. F. Hawkin, ISBN: 0130398845
3. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G.W. Tracy, ISBN: 0930972155.
4. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
5. Fundamental of Reservoir Engineering by Ben H. Caudle, ASIN: B0007GPIIQ.
6. Reservoir Engineering Manual, by Frank W. Cole, ASIN: B003AA4LKW.
7. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.

8. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
9. Gas Production Operations by Dale Beggs, ASIN: B001O78FVY.
10. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731

Journals/Periodicals:
World Wide Web:

PG-513 WELL LOG INTERPRETATION

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Open hole logging: review of petrophysical parameters, rapid initial interpretation, log interpretation in complex lithology computer processed interpretation, cased hole logging: review of porosity tool principles, thermal decay time log, cement bond logging, production logs, Cross plotting techniques.

Interpretation guideline for sand stone carbonate, Volumetric determination of hydrocarbons from the well logging, Resistivity measurement devices, Electrical spontaneous potential, Static sp, And other resistivity logs (normal, lateral, sonic, acoustic, gamma ray, density log and neutron log), Quantitative analysis, Quantitative analysis-I, Density logs, neutron logs, combine porosity logs and resistivity logs, Quantitative analysis-ii, Shaly sand interpretation, computer processing of well logs, abnormal pressure detection with well logs, fracture detection with well logs.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Basic Well Log Analysis, by George Asquith & Daniel Krygowski, ISBN: 0891816674
2. The Geological Interpretation of Well Logs by H. M. Rider, ISBN: 0954190688.
3. Fundamental of Well Log Interpretations: 1 The acquisition of Logging data, by O. Serra, ISBN: 044455341X.
4. Theory, Measurement and Interpretation of Well Logs, by Zaki Bassiouni, ISBN: 1555630561

Journals/Periodicals:

World Wide Web:

PG-514 ADVANCED PETROLEUM ECONOMICS

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Principles or economics, estimation of costs, evaluation of costs, evaluation of oil and gas reservoir, oil operations, optimization, cost and risk analysis, study of various scenarios, profitability analysis and pay out time, Monte Carlo simulation, linear programming theory of forecasts, pipelines, tankers, decision tree methods. OPEC cartel, review of annual forecasts from various multinational companies. Oil prices policy. Gas pricing policy. Petroleum concession agreement for Pakistan, its uses and limitations. Petroleum policy 1994.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Petroleum Production Engineering: Petroleum Production Economics by Lester Charles Uren, ASIN: B0000CHPVU
2. Engineering Economy, by Anthony Tarquin, Leland Blank, ISBN: 0073376302
3. Economics of Worldwide Petroleum Production by Richard D. Seba, ISBN: 093097221X.
4. Decision Analysis for Petroleum Exploration by John R. Schuyler, ISBN: 0966440110.
5. Project Economics & Decision Analysis, by M. A. Mian, Mohammad A. Mian, ISBN: 0878148191.

Journals/Periodicals:

World Wide Web:

PG-515 GAS PROCESSING

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Planning the system, System concepts, consideration of alternative and optimization, Thermodynamic concept, units, properties, derived properties, law of thermodynamics, applied processing, basic equations and specific heat. Phase behavior, P-v-t plots and meaning, vapor pressure, criticals and pseudocriticals, vapor liquid behavior, compressibility, prediction of critical, physical constants, molecular refraction, density, and viscosity gas liquid contracts, reid vapor pressure, liquid specification. Two phase hydrocarbon system, ideal system, fugacity, "k" values, convergence pressure, dew points bubble points, flash calculations, properties of hydrocarbons, storage of liquids. Process vessel design and specification, Separation, mist extraction, liquid-liquid separation, dust scrubbers, absorbers and fractionators, packed towers,

relief and venting equipment, design and specification with their pressure and temperature effects, reflux and theoretical pates and overall efficiency and heat balances and typical process performances of above units. Fundamentals of mass and heat transfer, Fluid flow basic pump design, single, multiple and loop system, complex system, effect of compressibility, pressure surges, pressure testing, blow-down two phase flow, metering and heating values. Heat transfer overall and film coefficients, log mean temperature difference, mtd correction for shell and tube exchangers, thermal conductivity, practical choice of exchangers, direct fired and waste heat exchangers radiation, heat loss to ground, cooling towers, wet bulb and dry bulb air cooling. Mass transfer, type of diffusion, rate of diffusion, Mass transfer coefficients, review of processes depending on ideal stages. Compression and expansion of fluids, Use of enthalpy energy diagram, calculation of temperature, compressibility effects, volumetric efficiency, axial compressors gas and expansion turbines and control gas ejectors, refrigeration system, ammonia absorption system, application of refrigeration, use of expansion turbines and centrifugal compressors, liquefactions processes, helium, natural gas, cascade cycle, arc cycle, metallurgy, heat exchange, compression of Ing processes, storage, tankers, Ing utilization, peak shaving. Water hydrocarbon system, Water content of natural gas, Water content of liquid hydrocarbons. The measuring of water content, Hydrates, Conditions for hydrates to form, Calculation of the possibility of hydrates forming, The prevention of hydrates and problems, Other types of impingement separators and problems.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Handbook of Natural Gas Engineering by Donald & Katz, ISBN: 007033384X.
2. Petroleum Transportation Handbook by Harold Sill, ASIN: B0000CM32Q
3. Gas Conditioning and Processing by John M. Campbell, ASIN: B000UMK60W.
4. Petroleum Reservoir Engineering, Physical Properties by James W. Amyx, ISBN: 0070016003.
5. Corrosion Engineering, by Mars G. Fontana, Norbert D. Greene, ISBN: 0070214611.
6. Petroleum & Gas Field Processing by H. K. Abdel-Aal, ISBN: 0824709624.

Journals/Periodicals:

World Wide Web:

PG-516 RESERVOIR ENGINEERING MANAGEMENT

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

This course develops strategies for optimization of recovery from oil and gas fields, applicable to the development stage as well as the production stage of field. Initially, a review of physical properties, geology, technology, economical limitations, etc. is made. Next criteria for various optimization strategies applicable to the development stage are discussed and developed. Particular emphasis is put on the inherent uncertainty in available data, and on the subsequent flexibility requirements in the development plans. Examples from the North Sea are used to illustrate this important aspect. Then optimization strategies for the production stage are discussed, based on practical experience from the North Sea and other regions of the world. Finally, field development plans for fields in the North Sea are compared to observed behavior during production for the purpose of developing insight into the uncertainties associated with reservoir data and to learn from faulty decisions made in the development plans.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
2. Applied Petroleum Reservoir Engineering, by B. C. Craft and M. F. Hawkin, ISBN: 0130398845
3. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G.W. Tracy, ISBN: 0930972155.
4. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
5. Fundamental of Reservoir Engineering by Ben H. Caudle, ASIN: B0007GPIIQ.
6. Reservoir Engineering Manual, by Frank W. Cole, ASIN: B003AA4LKW.
7. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.
8. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.
9. Gas Production Operations by Dale Beggs, ASIN: B001O78FVY.
10. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731

Journals/Periodicals:

World Wide Web:

PG-517 NATURALLY FRACTURED RESERVOIRS

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Specific features of carbonate fractured reservoirs, geological condition of fracturing, fracture evaluation, characterization of fractures, fracture parameters, simplified correlations, quantitative fracture evaluation, physical properties of fractures & matrix, relative permeability curves, capillary pressure curves, drainage and imbibition displacement process, schematization of drive mechanism by capillary and gravity forces, fracture evaluation through well tests, coning in fracture reservoirs, duel continuum approach.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Naturally Fractured Reservoir Characterization, by Wayne Narr, ISBN: 1555631126.
2. Fundamentals of Fractured Reservoir Engineering, by T. D. Van Golf-Racht, ISBN: 0444420460.
3. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
4. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G. W. Tracy, ISBN: 0930972155.
5. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
6. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.
7. Gas Reservoir Engineering by W. John Lee, ISBN: 1555630731

Journals/Periodicals:

World Wide Web:

PG-518 HORIZONTAL WELL TECHNOLOGY

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

An overview of horizontal well technology, drilling and completion techniques. Reservoir engineering concepts – skin factor, P. I., flow regimes. Steady – State solution of flow equations. Comparison of Horizontal Wells and fractured vertical wells. Horizontal wells in fractured reservoirs, Pseudo steady – state solution and unsteady – state solutions, Transient well testing. Water and gas conning, Pressure drop through horizontal wells.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Horizontal Well Technology by S. D. Joshi, ISBN: 0878143505
2. Fundamentals of Reservoir Engineering, by L. P. Dake, ISBN: 044441830X.
3. Applied Petroleum Reservoir Engineering, by B. C. Craft and M. F. Hawkin, ISBN: 0130398845
4. Applied Reservoir Engineering Vol. I & II, by Charles Robert Smith, G.W. Tracy, ISBN: 0930972155.
5. Oil Reservoir Engineering, by Sylvain Joseph Pirson, ISBN: 0882755005.
6. Fundamental of Reservoir Engineering by Ben H. Caudle, ASIN: B0007GPIIQ.
7. Reservoir Engineering Manual, by Frank W. Cole, ASIN: B003AA4LKW.
8. A Generalized Approach to Primary Hydrocarbon Recovery of Petroleum Exploration & Production, by M. Walsh and L. W. Lake, ISBN: 0444506837.

Journals/Periodicals:

World Wide Web:

PG-519 PETROLEUM PRODUCTION OPERATIONS

Credit Hours: 2+1

Prerequisites:

Specific Objectives of Course:

Course Outline:

Introduction; Production Operations and Geologic Considerations; Reservoir Considerations in Well Completions; Fluid and Rock Properties, Formation Pressure Regimes, Reservoir Fluid Flow, Use of Well Test Analysis in Determining Reservoir Fluid and Rock Properties. Reservoir Drive Mechanisms.

Field Operations; Wire line Operations, Production Logging, Coiled Tubing – scale clean outs, Problem Wells e.g. Formation Damage – Minimization and Stimulation. Primary Cementing, Well Completion Design, Tubing Strings, Packers, Subsurface Control Equipment, Perforating Oil and Gas Wells, Completion and Work over Fluids, Work over Systems; Through-Tubing Production Logging, Work over and Completion Rigs; Squeeze Cementing - Remedial Cementing, Sand Control, Formation Damage, Surfactants for Well Treatments, Acidizing; Hydraulic Fracturing, Scale Deposition, Removal, and Prevention, Corrosion Control

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Petroleum Production Engineering: A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
2. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
3. Natural Gas Production Engineering by Chi U. Ikoku, ISBN: 0894646397.

4. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
5. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
6. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733.

Journals/Periodicals:
World Wide Web:

PG-520 DRILLING FLUIDS HYDRAULICS

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Introduction, Development of drilling fluid technology, Drilling fluid materials and equipment, Drilling fluid properties, Drilling fluid components, Evaluation of drilling fluid performance. Clay mineralogy and Colloid Chemistry of Drilling Fluids, Hole stability, Drilling Problems related to drilling fluids and their solutions.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Composition and Properties of Drilling and Completion Fluids, by George R. Gray, HCH. Darley, ISBN: 087201147X.
2. Composition and properties of Drilling and completion Fluids. By George R. Gray, HCH. Darley, ISBN: 0123838584
3. Applied Drilling Circulation Systems, by Boyun Guo, Gefei Liu, ISBN-10: 0123819571
4. Composition and properties of oil well Drilling Fluids, by Walter F. Rogers, ASIN: B0000EG0UI
5. Advanced Well Control, by David Watson, Terry Brittenham, ISBN: 1555631010
6. Applied Drilling Engineering by A. T Bourgoyne, jr., K. K. Millehim, ISBN: 1555630014
7. Formulas and Calculation for Drilling, Production and Workover, by Norton J. Lapeyrouse, ASIN: B001MT21K0
8. Well Cementing, by Erik B. Nelson, ISBN: 0444555803

Journals/Periodicals:
World Wide Web:

PG-521 PRODUCTION OPTIMIZATION

Credit Hours: 2+1
Prerequisites:

Specific Objectives of Course:

Course Outline:

Well completions, Bottom hole completion techniques, Completion string configuration and functional requirements, Wireline servicing techniques

and tools, Selection of completion equipment, Well productivity, Effect on pi of both real and pseudo skin factors, Multiphase flow in both vertical and inclined tubing, Flow correlations and pressure drop prediction, Gradient curves and generation of vertical lift performance curves, Use of ipr/vlp matching to predict production rate, rate sensitivity and tubing diameter requirements, Concepts of choke utilization, Design, operation and selection of chokes, Production logging, Principles of production logging, Production logging tool functions, Gas lift, Principles of gas lift, Design of continuous flow gas lift string, Design of intermittent flow gas lift string, Submersible pumping, Electrical submerged pumps, esp, Design and operation of esp, Surface facilities, General overview of oil production system, Gas/oil separation, Dew point conditioning, Gas dehydration, Separation of oil and gas, Introduction and types of classification of separators, Components of a separator, Operating problems, Design basis for liquids, Gas capacity, Field processing of gas, Need for field processing, Gas dehydration, Hydrates, Dehydration/treating methods, Crude oil dehydration, Introduction, RE;rr10val of free water, Water in oil emulsions, Demulsification methods, Chemical demulsifying.

Lab Outline:

Class Assignments, Presentations.

Recommended Books:

1. Production Optimization using Nodal™ Analysis by H. Dale Beggs, ASIN: B001QGWNOS.
2. Petroleum Production Engineering : A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
3. Production Operations, by Thomas O. Allen and Alan P. Roberts, ASIN: B007OAP64O.
4. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
5. Well Performance by Michael Golan and Curtis Whitson, ISBN: 9027722838.
6. Surface Operation in Petroleum Production, by G. V. Chillingarian, J. O. Robertson, ISBN: 0444424733.

Journals/Periodicals:

World Wide Web:

PG-500 THESIS

Credit Hours: 6

Prerequisites: Complete course work

Specific Objectives of Course: To create research abilities in student through research work.

RECOMMENDATIONS

The Committee emphasized that in order to take full advantage of the new curriculum, efforts should be made to increase the effectiveness of teaching – learning process. For that purpose, the following recommendations are made:

1. Faculty training in teaching methodology, increase academia – industry interaction and regular participation of faculty in relevant conferences/workshops/seminars must be ensured. Universities should take necessary steps and provide financial resources for this purpose.

2. The improvement in examination system to ensure that students understand concepts and are able to apply these concepts independently.

3. For the postgraduate studies, the minimum requirements are as follows:
   a) At least two qualified instructors having PhD Degree in Petroleum Engineering to be included in the faculty.
   b) At least 30 credit hours that include 6 credit hours of thesis or 30 credit hours of course work without thesis.
   c) The student has to maintain a minimum GPA of 3.0 out of 4

4. The coding system for the courses should be standardized in all universities/ Degree awarding institutes.

5. Curriculum contents are being provided as guidelines to meet the requirement of uniformity. However the universities are at liberty to formulate their respective curriculum plans.