CURRICULUM (2020 – 2023)

Vision:

To become a Professional School of Choice in Petroleum & Gas Engineering Education and Research.

Mission:

To transform young brains into brilliant Petroleum Engineers, through modern teaching and research, to achieve professional excellence in oil and gas industry.

Program Educational Objectives

1. To equip graduates with updated engineering knowledge and research skills for examining and solving complex industry problems.
2. To enhance graduates' interpersonal, teamwork and management skills while focusing on socio-economic development in an eco-friendly manner.
3. To develop an aptitude for lasting personal capacity-building through continued professional development, along with integrity and a sense of ethical norms and values.

Mapping of PEOs to PLOs / Graduate Attributes

Graduating Attributes	PEO-1	PEO-2	PEO-3
Engineering Knowledge	■		
Problem Analysis	■		
Design/Development of Solutions	■		
Investigations	■		
Modern Tool Usage	■		
The Engineer and Society		■	
Environment and Sustainability		■	
Ethics			■
Individual and Teamwork		■	
Communication		■	
Project Management		■	
Lifelong Learning			■

Program Learning Outcomes (PLOs)/ Graduate Attributes:

GA1 Engineering Knowledge: An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.

GA2 Problem Analysis: An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

GA3 Design/Development of Solutions: An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.

GA4 Investigation: An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.

GA5 Modern Tool Usage: An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.

GA6 The Engineer and Society: An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.

GA7 Environment and Sustainability: An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of, and need for, sustainable development.

GA8 Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.

GA9 Individual and Team Work: An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.

GA10 Communication: An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

GA11 Project Management: An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

GA12 Lifelong Learning: An ability to recognize the need for, and have the preparation and ability to engage in, independent and life-long learning in the broadest context of technological change.

Knowledge Profile

WK1 Natural Sciences: A systematic theory-based understanding of natural sciences applicable to the discipline.

WK2 Mathematics and Computing: The concept-based mathematical thinking, numerical analysis, statistics and formal aspects of computer and information science to support analysis and modelling applicable to the discipline.

WK3 Engineering Fundamentals: A systematic, theory-based formulation of engineering fundamentals required in an engineering discipline.

WK4 Engineering Specialization: The knowledge of Engineering specialization that provides theoretical frameworks and bodies of knowledge for the accepted practice areas that are at the forefront in a discipline.

WK5 Engineering Design: The Design Thinking Knowledge that supports engineering design in a practice area of an engineering discipline.

WK6 Engineering Practice: The Knowledge of engineering practices (technology) in different practice areas of an engineering discipline.

WK7 Engineering in Society: A systematic, comprehension-based knowledge of the role of engineers in a society and the professional issues related to practicing engineering profession in a discipline: ethics and the professional responsibility of an engineer to public safety including the impact of an engineering activity i.e., economic, social, cultural, environmental and sustainability

WK8 Research Literature: Engagement with selected knowledge in the research literature of the discipline.

Course Scheme for Session-2020 to Session-2023

Course No.	Title	Contact Hours	Credit Hours	Pre-requisite
1.	**Knowledge Area-Humanities**	**(14 Credit Hours)**		
HU-111L	Communication Skills	3(0, 3)	1(0, 1)	None
HU-221	Technical Writing & Presentation Skills	3(3, 0)	3(3, 0)	None
IS-101	Islamic & Pakistan Studies-I	3(3, 0)	3(3, 0)	None
IS-201	Islamic & Pakistan Studies-II	3(3, 0)	3(3, 0)	None
QT-101	Translation of Holy Quran-I	1(1, 0)	1(1, 0)	None
QT-201	Translation of Holy Quran-II	1(1, 0)	1(1, 0)	None
QT-301	Translation of Holy Quran-III	1(1, 0)	1(1, 0)	None
QT-401	Translation of Holy Quran-IV	1(1, 0)	1(1, 0)	None
2.	**Knowledge Area-Management**	**(06 Credit Hours)**		
MGT-413	Entrepreneurship	3(3, 0)	3(3, 0)	None
Ch. E-453	Environment & Safety	5(2, 3)	3(2, 1)	None
3.	**Knowledge Area-Natural Sciences**	**(18 Credit Hours)**		
Phy-115	Applied Physics	5(2, 3)	3(2, 1)	None
CY-171	Petroleum Chemistry	5(2, 3)	3(2, 1)	None
MA-123	Calculus	3(3, 0)	3(3, 0)	None
MA-129	Vector and Complex Analysis	3(3, 0)	3(3, 0)	None
MA-225	Differential Equations and Transforms	3(3, 0)	3(3, 0)	None
MA-343	Applied Probability and Statistics	3(3, 0)	3(3, 0)	None
4.	**Knowledge Area-Natural Sciences/Math Elective**	**(03 Credit Hours) ***		
Pet. E-305	Principles of Corrosion Control	3(3, 0)	3(3, 0)	None
Pet. E-302	Unconventional Reservoirs	3(3, 0)	3(3, 0)	None
Pet. E-328	Reservoir Geomechanics	3(3, 0)	3(3, 0)	None
Ch. E-361	Instrumentation and Control	5(2, 3)	3(2, 1)	None
Min-E-359	Surveying & Levelling	5(2, 3)	3(2, 1)	None
5.	**Knowledge Area-Computing**	**(06 Credit Hours)**		
CS-103	Introduction to Computer Programming for Data Science	5(2, 3)	3(2, 1)	None
MA-346	Numerical Methods	3(3, 0)	3(3, 0)	None
6.	**Knowledge Area-Engineering Foundation**	**(24 Credit Hours)**		
Pet. E-101	Fundamentals of Petroleum Engineering	3(3, 0)	3(3, 0)	None
Pet. E-102	Petroleum Geology & Geophysics	3(3, 0)	3(3, 0)	None
Pet. E-317	Petroleum Economics & Risk Analysis	3(3, 0)	3(3, 0)	None
CE-216	Strength of Materials	5(2, 3)	3(2, 1)	None

CE-233	Fluid Mechanics	5(2, 3)	3(2, 1)	None
EE-201	Electrical Engineering & Electronics	5(2, 3)	3(2, 1)	None
ME-120L	Engineering Drawing & Graphics	3(0, 3)	1(0, 1)	None
ME-100L	Workshop Practice	3(0, 3)	1(0, 1)	None
Min-E-110	Applied Geology	6(3, 3)	4(3, 1)	None

7. Knowledge Area-Major Based Core (Breadth) (23 Credit Hours)

Pet. E-203	Petrophysics	5(2, 3)	3(2, 1)	Pet. E-101
Pet. E-204	Drilling Engineering - I	6(3, 3)	4(3, 1)	Pet. E-101
Pet. E-205	Properties of Reservoir Fluids	6(3, 3)	4(3, 1)	Pet. E-101
Pet. E-314	Reservoir Engineering	6(3, 3)	4(3, 1)	Pet. E-203
Pet. E-315	Petroleum Production Engineering-I	6(3, 3)	4(3, 1)	Pet. E-205
Pet. E-322	Natural Gas Processing and Pipeline Management	6(3, 3)	4(3, 1)	None

8. Knowledge Area-Major Based Core (Depth) (24 Credit Hours)

Pet. E-306	Drilling Engineering - II	6(3, 3)	4(3, 1)	Pet. E-204
Pet. E-313	Well Logging	5(2, 3)	3(2, 1)	Pet. E-203
Pet. E-422	Principles of Reservoir Simulation	5(2, 3)	3(2, 1)	Pet. E-314
Pet. E-423	Reservoir Management	5(2, 3)	3(2, 1)	Pet. E-314
Pet. E-424	Well Testing	5(2, 3)	3(2, 1)	Pet. E-203
Pet. E-425	Petroleum Production Engineering-II	6(3, 3)	4(3, 1)	Pet. E-315
Pet. E-429	Principles of Enhanced Oil Recovery	6(3, 3)	4(3, 1)	Pet. E-313

9. Knowledge Area-Inter-Disciplinary Engineering Breadth (12 Credit Hours)

Ch. E-251	Applied Thermodynamics	6(3, 3)	4(3, 1)	None
Ch. E-351	Chemical Technology of Petroleum	6(3, 3)	4(3, 1)	None
Pet. E-103	Occupational Health and Safety	1(1, 0)	1(1, 0)	None
Pet. E-421	Field Operations in Petroleum Engineering	3(3, 0)	3(3, 0)	None

10. Knowledge Area-Senior Design Project (06 Credit Hours)

Pet. E-491	Project (Phase-I)	9(0, 9)	3(0, 3**)	None
Pet. E-492	Project (Phase-II)	9(0, 9)	3(0, 3)	Pet. E-491

* One subject will be offered as per faculty availability.

** Will be evaluated at the end of 8th Semester.

Semester-wise Scheme of Study

SEMESTER I						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet. E-101	Fundamentals of Petroleum Engineering	3	0	3	0	None
CS-103	Introduction to Computer Programming for Data Science	2	3	2	1	None
HU-111L	Communication Skills	0	3	0	1	None
MA-123	Calculus	3	0	3	0	None
Min-E-110	Applied Geology	3	3	3	1	None
ME-120L	Engineering Drawing & Graphics	0	3	0	1	None
	TOTAL	**11**	**12**	**11**	**4**	
	GRAND TOTAL	**23**		**15**		

SEMESTER II						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
QT-101	Translation of Holy Quran-I	1	0	1	0	None
Pet. E-102	Petroleum Geology & Geophysics	3	0	3	0	None
Pet. E-103	Occupational Health and Safety	1	0	1	0	None
CY-171	Petroleum Chemistry	2	3	2	1	None
IS-101	Islamic/Ethics & Pakistan Studies-I	3	0	3	0	None
MA-129	Vector and Complex Analysis	3	0	3	0	None
ME-100L	Workshop Practice	0	3	0	1	None
Phy-115	Applied Physics	2	3	2	1	None
	TOTAL	**15**	**9**	**15**	**3**	
	GRAND TOTAL	**24**		**18**		

SEMESTER III						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
QT-201	Translation of Holy Quran-II	1	0	1	0	None
Pet. E-203	Petrophysics	2	3	2	1	Pet. E-101
Pet. E-204	Drilling Engineering-I	3	3	3	1	Pet. E-101
CE-216	Strength of Materials	2	3	2	1	None
EE-201	Electrical Engineering & Electronics	2	3	2	1	None
IS-201	Islamic/Ethics & Pakistan Studies-II	3	0	3	0	None
	TOTAL	**13**	**12**	**13**	**4**	
	GRAND TOTAL	**25**		**17**		

SEMESTER IV						
Course No.	Course Title	Contact Hours		Credit Hours		Pre-requisite
		Theory	Practical	Theory	Practical	
Pet. E-205	Properties of Reservoir Fluids	3	3	3	1	Pet. E-101
C.E-233	Fluid Mechanics	2	3	2	1	None
Ch. E-251	Applied Thermodynamics	3	3	3	1	None
HU-221	Technical Writing & Presentation Skills	3	0	3	0	None
MA-225	Differential Equations and Transforms	3	0	3	0	None
	TOTAL	**14**	**9**	**14**	**3**	
	GRAND TOTAL	**23**		**17**		

SEMESTER V						
Course No.	Course Title	Contact Hours		Credit Hours		Pre-requisite
		Theory	Practical	Theory	Practical	
QT-301	Translation of Holy Quran-III	1	0	1	0	None
Pet. E-313	Well Logging	2	3	3	1	Pet. E-203
Pet. E-314	Reservoir Engineering	3	3	3	1	Pet. E-203
Pet. E-322	Natural Gas Processing and Pipeline Management	3	3	3	1	None
MA-343	Applied Probability and Statistics	3	0	3	0	None
MA-346	Numerical Methods	3	0	3	0	None
	TOTAL	**15**	**9**	**15**	**3**	
	GRAND TOTAL	**24**		**18**		

SEMESTER VI						
Course No.	Course Title	Contact Hours		Credit Hours		Pre-requisite
		Theory	Practical	Theory	Practical	
Pet. E-306	Drilling Engineering-II	3	3	3	1	Pet. E-204
Pet. E-315	Petroleum Production Engineering-I	3	3	3	1	Pet. E-205
Pet. E-317	Petroleum Economics & Risk Analysis	3	0	3	0	None
Ch. E-351	Chemical Technology of Petroleum	3	3	3	1	None
	Natural Sciences/ Math Elective	2/ 3	3/ 0	2/ 3	1/ 0	None
	TOTAL	**14/ 15**	**12/ 9**	**14/ 15**	**4/ 3**	
	GRAND TOTAL	**26/ 24**		**18**		

SEMESTER VII						
Course No.	Course Title	Contact Hours		Credit Hours		Pre-requisite
		Theory	Practical	Theory	Practical	
Pet. E-422	Principles of Reservoir Simulation	2	3	2	1	Pet. E-314
Pet. E-424	Well Testing	2	3	2	1	Pet. E-203
Pet. E-425	Petroleum Production Engineering-II	3	3	3	1	Pet. E-315
Ch. E-453	Environment & Safety	2	3	3	1	None
Pet. E-491	Project (Phase-I)	0	9	0	3*	None
	TOTAL	**9**	**21**	**9**	**7**	
	GRAND TOTAL	**30**		**16**		

SEMESTER VIII						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
QT-401	Translation of Holy Quran-IV	1	0	1	0	None
Pet. E-421	Field Operations in Petroleum Engineering	3	0	3	0	None
Pet. E-423	Reservoir Management	2	3	2	1	Pet. E-314
Pet. E-429	Principles of Enhanced Oil Recovery	3	3	3	1	Pet. E-313
MGT-413	Entrepreneurship	3	0	3	0	None
Pet. E-492	Project (Phase-II)	0	9	0	3	Pet. E-491
TOTAL		**12**	**15**	**12**	**5**	
GRAND TOTAL		**27**		**17**		

TOTAL DEGREE	**103/ 104**	**99/ 96**	**103/**	**33/ 32**
GRAND TOTAL DEGREE	**202/ 200**		**136**	

Courses Details

FIRST SEMESTER

Pet.E-101 FUNDAMENTALS OF PETROLEUM ENGINEERING

National and International energy requirements. Sources of energy. Role of Petroleum as an energy source. Brief history of International Petroleum industry. Influence of Petroleum on International politics. Highlights of local Petroleum industry. Job Scope of Petroleum engineering graduates.

Overview of Petroleum Engineering including geological, geophysical prospecting. Drilling mechanisms, formation evaluation, reservoir, and production engineering.

RECOMMENDED BOOKS:

1. Introduction to Petroleum Engineering, John R. Fanchi, Richard L. Christainsen, John Wiley, ISBN: 978-1119193449.
2. Debby Denehy, Fundamentals of Petroleum, 5th Edition, PETEX, ISBN: 978-0886982317.
3. Petroleum Engineering: Drilling and Well Completions, Carl Gatlin, Prentice Hall, ISBN: 978-0136621553.
4. Properties of Petroleum Fluids, 3rd Edition, William D. McCain Jr., PennWell Books, ISBN: 978-1593703738.

CS-103 INTRODUCTION TO COMPUTER PROGRAMMING FOR DATA SCIENCE

Introduction to Hardware, Software Engineering, Networking, Operating Systems and Database Concepts.

Business Applications: Data acquisition, storage and presentation using MS Office.

Pseudo Code: Problem solving techniques, and Flow Charts.

Introduction to Visual Basic

Class Project: Solving specific engineering problems.

Good understanding of the worldwide and internet applications.

LAB OUTLINES

Various Programming codes

RECOMMENDED BOOKS:

1. Computer Science an Overview, by J. Glenn Brook Shear
2. Simple Program Design, by Lesley Anne Robertson
3. Visual Basic and tutorials by Schaum Series
4. Discovering Computers by Shelly Vermaat

HU-111L COMMUNICATION SKILLS

Week	Main Topics	Lecture contents
1	Introduction to Communication Skills	A. Communication Principles B. Process of communication. C. Importance of good communication skills in business environments
2	Introduction to Communication Skills	A. Communication in business organizations I. Internal-operational II. External-operational III. Personal B. Challenge of communication in the global market.
3	Study Skills	A. Brain storming B. Time-management C. Effective reading strategies D. Note-taking E. Organization F. Summarizing
4	Components of Communication	A. Context B. Sender-Encoder C. Message D. Medium E. Receiver-decoder F. Feedback
5+6	Non-Verbal Communication	A. Appearance and dress codes B. Body language C. Silence, time and space D. Importance of listening in communication
7	Functional English	Role-play/Speaking activities
8	Public Speaking	A. Difference between speaking and writing. B. Reading texts of good public speeches and analysis of their components.
9	Public Speaking	C. Listening to famous public speeches. D. Exercise in public speaking.
10	Formal Presentations	A. Difference between informal and formal presentations B. Modes of formal presentation I. Extemporaneous II. Prepared III. Reading out form a written text IV. Combination of the above mentioned methods.

11	Formal Presentations	C. Purpose of oral presentations I. Entertain II. Persuade III. Inform IV. Sell D. Mechanics of Presentations I. Organization II. Preparation (including A V As) III. Rehearsals IV. Presentations E. Teacher shall mode presentations both, with and without A V As
12	Resume/CV Writing	Cover Letters, Resumes, CVs
13	Interview Skills	Practice/Viva
14+15	Formal Presentations	Students Presentation

RECOMMENDED BOOKS:

1. Introduction to Business Communication by Zane K. Quible, Margaret H. Johson & Dennis L. Mott.
2. Business Communication Today by Courtland L. Bovee, John V. Thill& Barbara E. Schatzman.
3. Effective Business Communication by Herta A. Murphy, Herbert W. Hildebrandt & Jane P. Thomas.
4. Business Presentation by Lani Arrendondo.

MA-123 CALCULUS

A review of differentiation: Geometrical interpretation of a derivative; Infinitesimal; Differential coefficient; Derivatives of higher order; Indeterminate forms and L. Hopital's; Asymptotes; Curvature; Approximation and error estimates.

Further techniques of integration; Integration by reduction formula; Fundamental Theorem of integral Calculus; Definite integral and its properties; Area enclosed between curves; Arc length; Volume of a solid; Volume of a solid revolution; Area of surface of revolution; Moments; Centroids. Improper Integrals; Infinite series

RECOMMENDED BOOKS:

1. Thomas' Calculus, Joel R. Hass, Christopher E. Heil, 14th edition, Pearson, 2017, **ISBN**: 978-0134438986

2. Calculus, Howard Anton, Irl C. Bivens, 10th Edition, 2012, John Wiley **ISBN**: 978-8126556403.
3. Calculus, E. Swokowski.

Min-E-110 APPLIED GEOLOGY

Introduction to various branches of geology, Origin of the earth and its place in universe, interior of the earth and chemical composition of the earth's crust, Mountain building and valley formation, drainage patterns and their types, agents of weathering and erosion, Deformational structural features of rocks, dip, strike, faults, folds, joints and fissures, unconformities etc. Introduction to continental drift and plate tectonics, earth quakes and volcanism with special reference to Pakistan, Formation of rocks and minerals, classification of rocks, Occurrence of economic minerals and dimension stones of Pakistan.

LAB OUTLINES:

1. International geological symbols for rocks, structures and minerals
2. Measurement of dip and strike
3. Geological map reading
4. Moh's Scale Hardness
5. Identification of rock forming minerals
6. Study of wooden models of faults and folds etc.

RECOMMENDED BOOKS:

1. K. M. Banger, Text book of Geology
2. H. H. Read, Rutley's Mineralogy
3. Dana, Dana's Manual of Mineralogy
4. Santosh Kumar Grag, Text book of Geology
5. Raymond, L. A., The Study of Igneous, Sedimentary and Metamorphic Rocks, McGraw Hill.
6. Arthur Holmes and Dorris Holmes, Physical Geology
7. F. G. H. Blyth, Geology for Engineers

ME-120L ENGINEERING DRAWING & GRAPHICS

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

RECOMMENDED BOOKS:

1. Fundamentals of Engineering Drawing by Warrem J. Luzjader.
2. Elementary Engineering by N.D. butt.
3. Elementary of Solid Geometry by M.K. Guna.
4. A first year Engineering Drawing by A.C. Parkinson.

SECOND SEMESTER

QT-101 Translation of the Holy *Qur'ān* -I

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to faith (*Imaniyāt*) & ethics (ایمانیات واخلاقیات).
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1- Explain and understand the meanings of the Holy *Qur'ān* through its translation.

2- Identify the teachings and the guidance of the Holy *Qur'ān* regarding faith (*Imaniyāt*) & ethics (ایمانیات واخلاقیات).

3- Evaluate the call of the Holy *Qur'ān* on faith (*Imaniyāt*) & ethics (ایمانیات واخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Week wise Course Contents:

Week	Details
Week 1	Translation of Part (*Parah*) 1, first ½ portion
Week 2	Translation of Part (*Parah*) 1, second ½ portion
Week 3	Translation of Part (*Parah*) 2, first ½ portion
Week 4	Translation of Part (*Parah*) 2, second ½ portion
Week 5	Translation of Part (*Parah*) 3, first ½ portion
Week 6	Translation of Part (*Parah*) 3, second ½ portion
Week 7	Translation of Part (*Parah*) 4, first ½ portion
Week 8	Translation of Part (*Parah*) 4, second ½ portion
Week 9	**Mid semester exam**
Week 10	Translation of Part (*Parah*) 5, first ½ portion
Week 11	Translation of Part (*Parah*) 5, second ½ portion
Week 12	Translation of Part (*Parah*) 6, first ½ portion
Week 13	Translation of Part (*Parah*) 6, second ½ portion
Week 14	Translation of Part (*Parah*) 7, first ½ portion
Week 15	Translation of Part (*Parah*) 7, second ½ portion
Week 16	Translation of Part (*Parah*) 8, first ½ portion
Week 17	Translation of Part (*Parah*) 8, second ½ portion
Week 18	**End semester exam**

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن — شاہ عبدالقادر دہلوی
2. فتح القرآن — فتح محمد جالندھری
3. ترجمہ قرآن مجید — حافظ نذر احمد
4. آسان ترجمہ قرآن — سید شبیر حسین
5. احسن البیان — مولانا محمد جوناگڑھی
6. ترجمہ ضیاالقرآن — پیر کرم شاہ الازہری
7. آسان ترجمہ قرآن — مولانا محمد تقی عثمانی
8. ترجمہ قرآن — مولانا اشرف تھانوی
9. کشف الرحمٰن — مولانا احمد سعید دہلوی
10. ترجمہ تبیان القرآن — مولانا غلام رسول سعیدی
11. مصباح القرآن — ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن — دارالسلام
13. ترجمہ قرآن — سید ابوالاعلیٰ مودودی
14. قرآن مجید، لفظی ترجمہ — ڈاکٹر فرحت ہاشمی
15. مقبول القرآن — سید مقبول احمد دہلوی
16. آسان ترجمہ قرآن — محمد ظفر
17. The meaning of Glorious *Qur'ān* — Marmaduke Pickthal
18. *Qur'ān* Translation English — Abdullah Yousaf Ali
19. *Qur'ān* Translation English — Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English — Muhammad Asad

Pet. E-102 PETROLEUM GEOLOGY & GEOPHYSICS

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.

Modes of deformation of rocks, parts, varieties and classification of folds, faults, joints and unconformities, expression of the above features on geological field maps, Geological mapping and the application of photogrammetry

Geophysical exploration methods with emphasis on seismic methods and History of exploration in Pakistan.

Rock deformation and formation of different types of structures like faults, folds, etc. and interpreting subsurface formations through various maps.

RECOMMENDED BOOKS:

1. Basic Exploration Geophysics, by E. S. Robinson, ISBN: 978-0-471-87941-1.
2. Geophysical Prospecting, by Milton, B. Dobrin, ASIN: B010WFNR98, 4th Edition.
3. Geology of petroleum, A.I. Levorsen. ASIN: B000H4RFY8.
4. Basic Petroleum Geology, Peter K. Link., ISBN-13: 978-0930972226, 3rd Edition.
5. Petroleum Geology of Pakistan, Iqbal B. Kadri. ASIN: B0006F6X1Y

Pet. E-103 OCCUPATIONAL HEALTH AND SAFETY.

- Introduction to Occupational Health & Safety (OHS)
- OHS as a Behaviour
- Health & Safety Standards
- Risks, Hazards & Their Classification
- Health & Safety Hazards in Upstream Petroleum Industry
    - Risks & Hazards During Drilling
    - Risks & Hazards During Production
- OHS Communication
    - Signs & Safety Symbols
    - Accident Reporting
- OHS Management: Proactive vs. Reactive
- Impacts Associated with Accidents
- Risk Assessment and Minimization
- Pakistan's OHS Regulatory Framework
- International Best Practices

RECOMMENDED BOOKS:

1. Jeremy Stranks, The A-Z of Health and Safety, Thorogood, **ISBN**: 978-1854183873.
2. Charles D. Reese, Occupational Health and Safety Management 3rd Edition, Routledge, **ISBN:** 978-1138749573.
3. Phil Hughes MBE, Ed Ferrett, Introduction to Health and Safety at Work: for the NEBOSH National General Certificate in Occupational Health and Safety 6th Edition, Routledge, **ISBN:** 978-0415723084

CY-171 PETROLEUM CHEMISTRY

Petroleum chemistry: Basic introduction, General characteristics, Nature, composition and chemical constitution of crude oil and natural gases

Instrumental and Spectroscopic Analytical Techniques:

Principles of spectroscopy, Electromagnetic spectrum, UV-Visible, IR, AAS spectroscopy, Mass Spectrometry, proton NMR

Physico-Chemical methods of Separation and Analysis

Chromatography, Basic principles and classification, column chromatography, paper and thin layer, ion exchange, gel permeation, gas and high performance liquid chromatographic methods, electrophoresis,

Statistical Data Treatment

Introduction, Types of Errors, Accuracy and Precision, Determinate and Indeterminate Errors, Mean, Median, Range, Variance, Coefficient of Variance, Q-Test, t-Test, F-Test, Standard Deviation, Relative Standard Deviation, Mean Standard Deviation, Confidence limit, Significant and Insignificant Figures, Numericals

LAB OULINES:

1. Determination of Heat of Solution of a given salt solution.
2. Determination of 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 of a given liquid by using Ostwald's viscometer
5. Determination of the strength of Acid/Base by conductometric titration
6. Determination of the strength of Acid/Base by potentiometric titration
7. Separation of provided black ink by Thin Layer Chromatography

8. Separation of Food Dyes by Paper Chromatography
9. Separation of Metal Cations by Paper Chromatography
10. Determination of Errors
11. Determination of the strength of provided ion using complexometric titration
12. Determination of the strength of provided analyte using gravimetric analysis
13. Preparation of buffers solutions
14. Determination of percentage composition of provided analyte solution using spectrophotometric analysis.

RECOMMENDED BOOKS

1. Standard Handbook of Petroleum and Natural Gas Engineering, Volume I, William C. Lyons, Gulf Publishing Company, Texas.
2. Modern Fourier Transform Infra-red Spectroscopy, by Chiristy, A. A, Y. Ozaki, and V. G. Gregorou, Elsevier.
3. Inorganic Mass Spectrometry: Fundamentals and Applications 1st Edition by Barshick, Christopher M., Douglas C, Duckworth, and David H, Smith Marcel Dekker,
4. Organic Spectroscopy 3rd edition by William Kemp, MACMILLAN.
5. X-Ray Fluoriscence Spectrometry, 2nd Edition by Jenkins, Ron, John Wiley & Sons.
6. Analytical Chemistry 5th edition by Gary D. Christian, John Wiley & Sons.
7. Fundamentals of Analytical Chemistry 5th edition by Skoog, West and Holler, Saunders Collage Publishing.

IS-101 ISLAMIC & PAKISTAN STUDIES-I

PART- I ISLAMIC STUDIES Marks: 60

QUR'ĀN AND SUNNAH

1) Al-Qur'ān Al Karim

1. Significance of The Holy Qur'ān

II) Compilation of The Holy Qur'ān

1. Textual Study of **Sura Al-Hujurat** (Complete)

(Meanings of Arabic text, translation & explanation)

Sura Al-Hujurat

Focus: Impact of the teachings and commands mentioned in Sura Al-Hujurat on human life.

Main Points of discussion

1. Commands of Allah regarding meeting with the Holy Prophet peace be upon him.
2. Reports from wicked person to be tested.
3. Brotherhood, equality, effort to compose the quarrels of groups and reconciliate between them.
4. Elimination of social evils such as to laugh at people in contempt, calling others by offensive nick names, suspicion and back-biting.
5. All people (mankind) are one and the most righteous gets most honour before Allah.
6. Qualities of believers.
7. Knowledge of Allah about the secrets of the heavens and the earth and our actions.

Sura Al-Maida

Textual study of Surah Al-Maida (Verses:1 to 26)

(Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in sura Al-Maida on human life.

Main Points of discussion:

1. Stress on fulfillment of uqud (obligations)
2. Concept of Halal (lawful) and haram (forbidden) in Islam
3. Halal and haram animals and food
4. Symbols of Allah
5. Emphasis on helping one another in righteousness and piety
6. Rules of hunting the animals for food
7. Social relationship with non Muslims
8. Relationship between Muslims and Ah'l Al-Kitab (people of the Book)
9. Rules of purity and cleanliness
10. Allah's command to do justice and act righteously
11. The Covenant of Bani-Israel (The children of Isreal) with Allah and breach of their covenant
12. Allah's address to Ah'l Al-Kitab (people of the Book)
13. Address of prophet Moses (peace be upon him) to his people.
14. Textual Study of Sura **Al-Fur'qan:** verses: 63 to 77

(Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in Sura Al-Fur'qan on human life.

Main Points of discussion:

Characteristics of Ibad-ur-Rehman (Slaves of Allah)

2) Al-Hadith Al-Sharif

1. The need & Importance of Hadith
2. Textual study of Hadith: Arbaeen-e-Navavi by Imam Nawawi, Hadith: 1 to 21
   (Meanings of Arabic text, translations and explanation.)

Focus: Impact of teaching and commands mentioned in Ahadith on human life.

Main points of discussion:

1. Importance of intention (Niyya) in human actions
2. Islam, Iman (belief), Ihsan (excellence) and the Hour.
3. Rejection of Innovation (Al-Bid'ah) in religion (Din)
4. Lawful, unlawful and doubtful matters
5. Sincerity to Allah, His Books, His Messengers, leaders of the Muslims and common people
6. Protection of lives and property of people
7. Obedience of the Holy Prophet peace be upon him
8. Importance of lawful food, drink, clothing and nourishing
9. True believer is who likes for his brother what he likes for himself
10. Honour of the blood of Muslim and others
11. Respect of neighbours and guests
12. Importance of good talk and silence
13. Prohibition to become angry and furious
14. Ihsan (excellence) with regards to everything
15. Good behavior towards people
16. All kinds of expectation, help and benefit from Allah
17. Importance of modesty (Al-Hiya)
18. To stand firm on Islam

3) Den-e-Islam, The study of basic articles of faith

Focus: Impact of basic articles of faith on human life.

Main points of discussion:

1. Tawheed: Fundamentals and types of Tawheed,
2. Prophet-hood and Finality of Prophet-hood,
3. The Day of Judgment

4) Seera-tun-Nabi

Life of The Holy Prophet (Peace be upon him) from prophet-hood to Hijra

Focus: Impact of the study of life of the Holy Prophet peace to upon him, on human life.

Main points of discussion:

4. First revelation
5. Message of the Holy Prophet peace be upon him to the people
6. Difficulties in preaching Islam in Makka and opposition of Quresh.
7. Reasons of hijra (migration) to Madina and impact of this migration

5) Islam and Modern Science

Focus: Impact of the teaching regarding Modern Science on human life.

Main points of discussion:

1. The Holy Qur'ān as s guide for the modern scientific development, Surah Al-Baqra: verse164, Aal-e-Imran: verses 190-191
2. Importance of science education in the modern age
3. Introduction of Muslim scientists, contribution of Muslim Scholars towards science

6) Ethics

Focus: Impact of the ethics on human life.

Definition, importance and significance of Ethics

Concept of Ethics in the light of Holy Qur'ān

Al-Baqra : 83, 169	Al-Ana'am : 151,152,153	Al-Tauba : 7
Yunus : 36	Hood : 18	Al-Nah'l : 112
Al-Mutaffefeen: 1,2,3		

Main points of discussion:

1. Kindness with parents, kindred, orphans and needy people.
2. Fair speaking to the people.
3. Refrain from evil and shameful deeds
4. Abstain from killing any person except by way of law
5. Security of the orphan's property
6. Full justice in measure and weight

7. Prevention from inventing a lie
8. Fraud and its bad effects.

Moral values in the light of Hadith

Bulugh-ul-Maram, Kitab-ul-Jamae, Babul Tarheeb Min Msavi-al-Akhlaq

Ahadith No.3, 4,7,14,17

Main points of discussion:

1. To control anger
2. Oppression is darkness
3. Telling a lie is sign of hypocracy
4. Backbiting
5. **Ethics and character building in the light of Seerah**

   Ethical behaviour of the Holy Prophet (PBUH)

   Significance of moral values

   i) Truth (ii) Honesty (iii) Taqwa

   (iv) Brotherhood (v) Patience
6. **Comparative Religious Morals**

1. (i)Hinduism (ii) Buddhism (iii) Judaism

   (iv) Christianity (v) Islam
2. Philosophy of Ethics in revealed and non revealed religions: an analysis

PART-II PAKISTAN STUDIES Marks: 40

1. **Ideology of Pakistan**.
   i) Definition & Explanation.
   ii) Aims & objectives of Formation of Pakistan.
   iii) Ideology of Pakistan in the light of the sayings and speeches of Allama Iqbal and Quaid-e-Azam
2. **A Brief History of Muslim Society in Subcontinent**
3. The arrival of Muhammad Bin Qasim.
4. Muslim rule in Subcontinent.
5. The down fall of Muslim Rules and renaissance of Muslim rule in Sub-Continent.
6. **Historical background of the Ideology of Pakistan, National & Reformative Movements.**
   a. Sheikh Mujaddad Alf-I-Sani.
   b. ShahWali Ullah.

c. Syed Ahmad Shaeed

Sheikh Mujaddad Alf-I-Sani

7. Biography, Social & Religious Services,
8. Efforts against non Islamic Fundamentals.
9. Effects of the Movement.

Shah Wali Ullah

1. Biography
2. Efforts Against non-Islamic fundamentals.
3. Reforms, social and religious services.

Sayyed Ahmad Shaheed

1. Biography
2. Jihad against Sikhs,
3. Opposition from Afghan tribes
4. Martyrdom at Balakot.

10. **Educational Efforts.**

1. Services of Sir Syed Ahmad Khan (Aligarh movement)
2. Political aspects of Alighar Movement
3. Educational services of Alighar Movement
4. Impact of Alighar Movement

11. **Pakistan Movement**

1. Muslim Nationalism:
2. Evolution of Two-Nation Theory.
3. Independence of India & Muslims
4. Khilafat Movement and Non-Cooperation Movement
5. Role of Ali Brothers and Mr. Gandhi
6. Presidential Address of Allama Iqbal at Allah Abad in 1930
7. 1937 Elections. Congress behavior.
8. Pakistan Resolution 1940.
9. To safeguard the ideological state in present era

MA-129 VECTOR AND COMPLEX ANALYSIS

A review of vector algebra, scalar and vector products; Scalar triple product; Vector triple product; Scalar and vector point functions; Differentiation and integration of vector point functions; Gradient of a function; Divergence, curl and their physical interpretations; Green's theorem in the plane; Gauss' divergence theorem and Stock's theorem; Cartesian tensors.

Polar and exponential forms of complex numbers; Product and quotient of complex numbers in polar form; Properties of complex numbers; Lograthim of a complex number; De Moivres Theorem, The *n*th roots of a number; Solution of equations; Circular and hyperbolic functions; Inverse hyperbolic functions; Limit, continuity and differentiability of complex functions; Analytic functions, Harmonic functions; Cauchy fundamental theorem and its consequences; Cauchy Integral formula; Derivatives of an analytic function; Singularities and calculus of residues; Contour integration.

RECOMMENDED BOOKS:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch, published by Allied Book Centre, Urdu Bazar Lahore.
2. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,
3. "Vector Analysis" by M.R. Spiegel, McGraw – Hill Book Company.
4. "Elements of Complex Variables" by Pennisi, L. L. Holt, Rinehart and Winston, U.S.A.
5. "Vector and Tensor Analysis" by N.A. Shah, A–One Publishers, Urdu Bazar, Lahore.

ME-100L WORKSHOP PRACTICE

1. Machine Shop: Detailed study of centre lathe and accessories. Plain and Taper turning. Basic lath operations including turning, facing, simple screw cutting/treading, knurling, Grooving (Drilling and Boring), cutting tools and their grinding. Brief Introduction of shaper, milling Sharing and Surface Grinding Machine. Assigning of Practical Jobs.

2. Fitting and Fabrication Shop: The use and care of fitter's tools. Marking out of job. Practice in Metal filing. Sawing, Drilling, dieing, Tapping and reaming. Brief introduction and use of power Hack Saw, Arbor Press, Sheet Sharing Machine, Sheet Rolling Machine, Punching Machine and Drilling Machine. Assigning of practical Jobs.

3. Carpentry Shop: The use and care of tools. Type of Timber, its defects and preservation methods practice in planning and sawing. Different types of wood joints. Study of sawing, planning, turning mortise and tenon machines. Assigning of Practical Jobs.

4. Electrical Shop: Electric shocks and treatment. The use and care of tools used by Electrician. Types and uses of cable and electrical accessories for house wiring, practice in simple house wiring, testing methods. Switch gear used on domestic installation and DB system. Earthing System. Assigning of Wiring arrangements practical.

RECOMMENDED BOOKS:

1. Workshop Technology Part-1 by W.A.J Chapman.
2. Electrical Wring by Richter and Schwan
3. Wiring Manual by Pak Cables Limited.

Phy-115 APPLIED PHYSICS

Electrodynamics: Electric field & its measurement, Gauss's Law, Applications of Gauss's Law, Magnetic field, Ampere's Law, Faraday's law, Lenz's Law, Eddy currents, Maxwell's equations, electromagnetic wave, Electromagnetic spectrum.

Waves & Oscillations: Sound Waves, Interference, Diffraction, Snell's Law, Doppler's Effect for sound and light. Ultrasonic waves, X-ray Diffraction (XRD.

Atomic and Nuclear Physics: Structure of atom, Types of Atomic Spectra, the laser, X-ray production and scattering, nuclear properties of atom, Radiations from nucleus, Laws of Radioactive disintegration, Nuclear reactors, neutron thermalization, radiation detectors, Interaction of rays and matter.

LAB OUTLINES

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

RECOMMENDED BOOKS:

1. Fundamentals of Physics, 10th edition by David Halliday, Robert Resnick, and Jearl Walker
2. University Physics. 7th edition by Zears, Zemansky and Young.
3. Physics for Scientists and Engineers with Modern Physics, 4th edition by Dougles C. Giancol.

THIRD SEMESTER

QT-201 Translation of the Holy *Qur'ān* - II

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the worship (*Ibadāt*) & ethics (عبادات واخلاقیات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1- Explain and understand the meanings of the Holy *Qur'ān* through its translation.

2- Identify the teachings and the guidance of the Holy *Qur'ān* regarding worship (*Ibadāt*) & ethics (عبادات واخلاقیات).

3- Evaluate the call of the Holy *Qur'ān* on worship (*Ibadāt*) & ethics (عبادات واخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Week wise Course Contents

Week	Details
Week 1	Translation of Part (*Parah*) 9, first ½ portion
Week 2	Translation of Part (*Parah*) 9, second ½ portion
Week 3	Translation of Part (*Parah*) 10, first ½ portion
Week 4	Translation of Part (*Parah*) 10, second ½ portion
Week 5	Translation of Part (*Parah*) 11, first ½ portion
Week 6	Translation of Part (*Parah*) 11, second ½ portion
Week 7	Translation of Part (*Parah*) 12, first ½ portion
Week 8	Translation of Part (*Parah*) 12, second ½ portion
Week 9	**Mid Semester Exam**
Week 10	Translation of Part (*Parah*) 13, first ½ portion
Week 11	Translation of Part (*Parah*) 13, second ½ portion
Week 12	Translation of Part (*Parah*) 14, first ½ portion
Week 13	Translation of Part (*Parah*) 14, second ½ portion
Week 14	Translation of Part (*Parah*) 15, first ½ portion
Week 15	Translation of Part (*Parah*) 15, second ½ portion
Week 16	Translation of Part (*Parah*) 16, first ½ portion
Week 17	Translation of Part (*Parah*) 16, second ½ portion
Week 18	**End Semester Exam**

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن — شاہ عبدالقادر دہلوی
2. فتح القرآن — فتح محمد جالندھری
3. ترجمہ قرآن مجید — حافظ نذر احمد
4. آسان ترجمہ قرآن — سید شبیر حسین
5. احسن البیان — مولانا محمد جوناگڑھی
6. ترجمہ ضیاالقرآن — پیر کرم شاہ الازہری
7. آسان ترجمہ قرآن — مولانا محمد تقی عثمانی
8. ترجمہ قرآن — مولانا اشرف تھانوی
9. کشف الرحمٰن — مولانا احمد سعید دہلوی
10. ترجمہ تبیان القرآن — مولانا غلام رسول سعیدی
11. مصباح القرآن — ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن — دارالسلام
13. ترجمہ قرآن — سید ابوالاعلیٰ مودودی
14. قرآن مجید، لفظی ترجمہ — ڈاکٹر فرحت ہاشمی
15. مقبول القرآن — سید مقبول احمد دہلوی
16. آسان ترجمہ قرآن — محمد ظفر
17. The meaning of Glorious *Qur'ān* — Marmaduke Pickthal
18. *Qur'ān* Translation English — Abdullah Yousaf Ali
19. *Qur'ān* Translation English — Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English — Muhammad Asad

Pet. E-203 PETROPHYSICS

Introduction to formation evaluation, core analysis. Fundamental properties of fluid permeated rocks; porosity, Permeability, fluid saturations, compressibility, surface kinetics. Core sampling and preservation. Measurement of basic rock properties. Interpretation of basic core analysis data. Special rock properties; electrical, acoustic, thermal.

Application of core analysis data. Example calculations of petrophysical properties.

LAB OUTLINES:

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.
11. To measure the permeability of given Core sample using Gas Permeameter

RECOMMENDED BOOKS:

1. Petrophysics, Djebbar Tayyab, 4th Edition, Gulf Professional Publishing ISBN: 978-0128031889
2. Applied Petroleum Reservoir Engineering, B.C. Craft & M.F. Hawkins, Ronald E Terry, ISBN: 978-0130398840.
3. Fundamental of Reservoir Engineering, L.P. Dake, ISBN: 978-0444418302.
4. Petroleum Reservoir Engineering Physical Properties, James W. Amyx, ISBN: 0070016003.

Pet.E-204 DRILLING ENGINEERING-I

Purpose of drilling, Planning the well, Rotary drilling-its introduction and basic operations, Basic rig components and brief introduction to their function mud pumps rating and capacities. Development in drilling system, Rotary drilling bits, Bits types, standard classification of bits, Bit selection and

evaluation, Introductions to drilling fluids, their function general nature and composition. Different types of drilling mud, Drilling mud additives, Drilling mud calculations, Air, natural gas, and aerated mud used as drilling fluids, Calculation of air and horsepower requirements. Pressure relations in the earth and bore hale. The hydrostatic heads of liquids, the hydrostatic heads of mud and cement slurries, Formation pressures and its types, Total overburden pressure, Drilling hazards and their remedies. Types of Different Wells, Typical Drilling Rig Organization, Dull Bit Grading, Formation Pressure Measurement using Different Techniques, Underbalanced Drilling (UBD).

LAB OUTLINES

1. Layout of Drilling Engineering Laboratory.
2. Introduction of different models of Rig components.
3. Density of Mud Determination using Mud Balance
4. Prepare a mud of known density
5. To determine the Gel strength of a drilling mud using Fann V. G. meter
6. To determine the Plastic viscosity, Apparent viscosity and Bigham Yield point and true yield point using Fann V.G meter.
7. To determine the Gel strength of a drilling mud using Baroid Rheometer
8. To determine the viscosity using Rotational Viscometer
9. To prepare mud cake by standard filter press and mud cell assembly
10. To study the filtration loss quality of a drilling mud by Baroid Miniature filter press
11. To determine the clay/ sand contents of the drilling mud using sieve analysis
12. To determine the oil, water, solids and clay content of the drilling mud
13. To determine API gravity, specific gravity of drilling mud

RECOMMENDED BOOKS:

1. Oil well Drilling Engineering by Don W. Dareing, ISBN: 978-0791861875, ASME Press
2. Applied Drilling Engineering by Adam. T. Bourgoyne Jr., Keith. K. Millheim, SPE Textbook Series, Vol 2, ISBN: 978-1555630010, Society of Petroleum Engineers
3. Well Engineering and Construction by Hussain Rabia,, ISBN: 978-0954108700, Entrac Consulting
4. Petroleum Well Construction by Michael J. Economides, Larry T. Watters, Shari Dunn-Norman, ISBN: 978-0471969389, John Wiley; 1st edition

5. Formulas and Calculations for Drilling, Production, and Workover: All the Formulas You Need to Solve Drilling and Production Problems by William C. Lyons, Thomas Carter, Norton J. Lapeyrouse, ISBN: 978-0128034170, Gulf Professional Publishing; 4th edition.

CE-216 STRENGTH OF MATERIALS

Important geometrical properties of plane areas, Introduction to forces, load transfer mechanism, resultant and reaction calculations, Bending moment and shear force diagrams for determinate beams for general loading. Principle of superposition, relationship between load, shear force and bending moment.

Types of stresses and strains, stress-strain behavior of ductile and brittle materials. Statically determinate and indeterminate problems, compound bars. Temperature stresses. Torsion of solid and hollow circular sections. Strain energy due to torsion and impact loads. Concept of bending and axial stresses in pipes.

LAB OUTLINES

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. Mechanics of Materials by Andrew Pytel 2nd Edition, 2011.

2. Mechanics of Materials by R.C. Hibbeler.
3. Mechanics of Engineering Materials by F.V. Warnock, P.P. Benham

EE-201 ELECTRICAL ENGINEERING & ELECTRONICS

Basics Concepts, Electrical And Units, Basic Circuits Laws and Measurements, Circuit Components, Multiple-Load Circuits, Complex-Circuit Analysis, Magnetism and Electromagnetism, Alternate Current And Voltage Power in AC Circuits, Capacitance, Inductance Transformers, R, C, and L Circuits, Electric Motors, Instruments and Measurements, Residential Wiring Concepts.

LAB OUTLINES

1.	Resistance Measurement by Color Code and its comparison with the Ohm-Meter Reading.
2.	Study of Ohm's Law
3.	Study and Proof of KCL
4.	Study and Proof of KVL
5.	Voltage Division Rule
6.	Current Division Rule
7.	Superposition Principle
8.	Study and Use of Oscilloscope
9.	RC Time Constants (Plot charging and discharging curves)
10.	RL Time Constants (Plot charging and discharging curves)
11.	To study resonance in an RLC circuit and find resonant frequency.
12.	To find power in a single phase AC circuit by one voltmeter ammeter method.
13.	To find power in a three phase AC circuit by two wattmeter method.
14.	Demo (Speed Control of DC Motor using Armature Voltage Control)
15.	Demo (Speed Control of DC Motor using Field Excitation Control)

RECOMMENDED BOOKS:

1. Electricity: Principles & Applications, By Richard Fowler, 8th Edition, Mc-Graw Hill.

IS-201 ISLAMIC & PAKISTAN STUDIES-II

PART- I ISLAMIC STUDIES Marks: 60

1. **Al-Qur'ān Al-Karim**

1. Miracles (Ijaz) of the Holy Qur'ān
2. Principle of interpretation (Tafseer)
3. Textual Study of the Holy Qur'ān.

Surah Luqman (Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in Surah Luqman on human life.

Main points of discussion:

1. Characteristics of the righteous people (Al-Mohsineen) and their reward
2. Explanation of Lah wal Hadith and torment for its buyer
3. Universal logical arguments on Allah as the Creator
4. Conquering the Universe
5. Advices of Luqman to his son: not to associate anyone with Allah, to establish Salat, (prayer) enjoin good, forbid evil, bear the difficulties, not to speak to others with your face turned away, not to walk proudly and lower your voice
6. Orders of Allah to recognize the rights of parents
7. Amr-Bill Maruf and Nahi Anil Munkar, Need, importance and methods of Preaching Characteristics of a Preacher
8. Allah has subjected to man everything in the earth and the heavens and bestowed on him all His favour
9. Punishments for a disbeliever
10. Stress on fear of Allah the Lord and the Judgment Day
11. Knowledge of Allah

Surah Al-Noor

with Al-Baqra: 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 (Subjective study of the Sura)

Focus: Impact of the teachings and commands mentioned in surah Al-Noor on human life.

Main Points of discussion:

1. Introduction to the criminal law of Islam, concept of crime and punishment.
2. Classification of crimes in Islamic Criminal Law: Hudood and Tazirat.

3. Hudood: Zina (adultery, fornication),
4. Qad'f (false accusation),
5. Li'ān (accusation of a wife of zina),
6. Drinking intoxicating liquors, narcotics.
7. theft, Dacoity, Robbery, Murder, Apostasy and Rebellion.
8. If'k story (slander)
9. Privacy, Hijab (woman's veil)

2- Al-Hadith Al-Sharif

1- Compilation of Hadith.

2- A Brief Introduction of Sihah Settah and its compilers.

3- Textual study of Hadith:

Bulugh-ul-Maram. Kitab-ul-Jami (Bab-ul-Adab, Bab-ul-Bir Wa Sela

(Meanings of Arabic text, translation and explanation)

Focus: Impact of teachings and commands mentioned in Ahadith on human life.

Main points of discussion:

1-Bab-ul-Adab: (Good Behavior)

1. Obligations on a Muslim for a Muslim
2. Golden principal to and lead a satisfied life and to control one's greed
3. What is righteousness? What is sin?
4. Emphasis on the respect of human sentiments
5. Social manners
6. Awareness of a meal blessed with auspiciousness
7. Manners of salam and greeting Muslims and non-Muslims
8. Manners regarding sneeze, eating, drinking, wearing cloths, putting on and off shoes and walking with shoes
9. Restriction of trailing garments arrogantly
10. Restriction of overspending

2-Bab-ul-Bir Wa Sila: (Kindness and joining the ties of relationship)

1. Golden principal for expansion of one's provision and an increase in life span
2. Prohibition to sever ties of relationship
3. Unlawful to be undutiful to mothers, to bury daughters alive, to refuse others and to demand from others.
4. Hatred actions

5. Pleasure and displeasure of Allah result form pleasure and displeasure of parents
6. Rights of neighbours
7. Most serious sins
8. Prohibition of reviling parents
9. Prohibition for a Muslim to avoid his brother
10. Importance of any miner act of goodness
11. Importance of help provided for others
12. Reward of concealing the faults of others
13. Re-compensation of kindness from others

3- Deen-e-Islam

Pillars of Islam; Shahada, Salat, Saum, Zakat, Hajj and Jihad

Focus: Impact of Shahada, Salat, Saum, Zakat, Hajj and Jihad on human life.

Main points of discussion:

1. **Shahada** (Witness) Importance and philosophy of witness that no God but Allah and Muhammad (peace be upon him) is His Messenger.
2. **Salat** (Prayer) Imposition of prayer, orders and significance.
3. **Saum** (Fasting) Meaning of Fasting obligation of Fasting, significance, disbursement, physical and spiritual advantages.
4. **Zakāt:** The Economic system of Islam, Importance of Zakāt, Prohibition of Riba (Interest). Comparison between Islamic Economic system and socialism, Capitalism & Communism,
5. **Hajj:** Imposition of Hajj, commands and rites of Hajj, financial social and spiritual advantages of Hajj.
6. **Jihad** (Striving in the cause of Allah)**:** Importance, significance and its kinds:
    a. Against one's soul: to control its ego and desires (The greatest Jihad)
    b. Against ignorance
    c. Against Satan,
    d. Against the enemy
    e. Against disbelievers by the Holy Qur'an etc.

4- Seerah-Tun-Nabi

Focus: Impact of the life of the Holy Prophet peace be upon him on human life.

Main points of discussion:

1. Life of the Holy Prophet (Peace be upon him) at Madina, Madina Pact
2. The Holy Prophet (Peace be upon him) as a Perfect Man.

3. Mohammedan Revolution.

5- Ethics

Focus: Impact of ethics on human life.

Main points of discussion:

(a) **1. Ethics and Religion**

i. **Ethical behavior of the Prophets**

ii. Impact of belief on Ethics.

iii. Concept of worship and manners/ social relations in religion and their

1. impact on ethics

(b) **2. Ethics and character building, significance of moral values**

iv. Charity, Tolerance, Simplicity, Respect of mankind

v. Social Etiquettes of meetings, eating & drinking and conversation, Right of people.

Verses of the Holy Qur'ān about Ethics

Aal-e-Imran: 112	Al-Nisa: 43, 90, 91	Al-Aa'raf: 35	Al-Ra'd: 30
	Al-Nah'l: 90, 91	Bani IsrailI: 29-37	Al-Fat'h: 26

Main points of discussion:

Purity and cleanliness Nourishing of peace liberality to kith and kin fulfillment of contracts condemnation of misery negligence from the signs of Allah, trust in Allah

Moral values in the light of Hadith:

vi. Bulugh-ul-Maram, Babul Zoh'd wal Wara', Ahadith 2,6

vii. Babul Tarheeb Min Msavi Al-Akhlaq: Ahadith No.1,6,9

Main points of discussion:

Misery Worldly desires Avoid envy Showing of good deeds Insulting and abusing others

PART-II PAKISTAN STUDIES Marks: 40

Formation of Pakistan

1. Role of Scholars & Mashaikh, Students and Women, Journalists in the formation of Pakistan
2. Contribution of Non-Muslim leaders in the struggle of Pakistan

3. Initial Difficulties after Formation of Pakistan
4. Anti-Muslim riots in India:
5. Canal Water and distribution of Assets
6. Accession of States: Junagarh & Kashmir, its background and danger for the peace of South Asia.

The Land of Pakistan

1. Geographical importance
2. Pak-China economic corridor
3. Agricultural and industrial resources
4. Man Power & Education.

Efforts for implementation of Islamic System in Pakistan

1. Objectives Resolution 1949
2. Islamic provisions of the Constitutions of 1956,1962 &1973.
3. Process of Islamization during Zia era.

Foreign Policy of Pakistan

1. Determinants and principles of Pakistan foreign policy
2. Importance of Pakistan in Muslim World.
3. Pakistan and international organizations: UN, OIC, SAARC, ECO & SCO
4. Economic and defensive planning (Nuclear Policy)

FOURTH SEMESTER

Pet.E-205 PROPERTIES OF RESERVOIR FLUIDS

Basic concept of phase behavior; single, binary, and multi-component systems. The five reservoir fluids, properties of gases. Properties of dry gases, wet gases, Gas condensates.

Properties of Black oils, Determination of reservoir fluid properties by

1. Field data
2. Laboratory Analysis
3. Correlation's
4. Equations of state

Properties of oil field waters and Hydrates.

Use of existing/available software for phase behavior calculations.

LAB OUTLINES:

Determination of different oil properties including

1. Flash Point of Crude Oil.
2. Cloud & Pour Point of Crude Oil.
3. Density/ Specific Gravity of Crude Oil.
4. Kinematic Viscosity of Crude Oil.
5. Sulfur percentage in Crude Oil.

RECOMMENDED BOOKS:

1. Properties of Petroleum Fluids by William D. McCain Jr. 3rd Edition, PennWell Books, 2017, ISBN: 978-1593703738.
2. Phase Behavior of Petroleum Reservoir Fluids, Karen Schou Pedersen, Peter L. Christensen, Jawad Azeem Shaikh, 2nd Edition, CRC Press, 2014, ISBN: 978-1439852231

CE-233 FLUID MECHANICS

Introduction to fluid mechanics, hydrostatics, kinematics, hydrodynamics, hydraulics, solids and fluids, liquids and gases. Units and dimensions, physical properties of fluids, specific weight,

specific volume, specific gravity, surface tension, compressibility, viscosity, newton's equation of viscosity.

Fluid Statics: pressure intensity and pressure head, pressure specific weight relationship, absolute and gage pressure, measurement of pressure, piezometer, Manometer, pressure transducer, differential manometer and bourdon gage. Forces on submerged plane and curved surfaces and their applications. Buoyancy and floatation, equilibrium of floating and submerged surfaces.

Fluid Kinematics: steady and unsteady flow, laminar and turbulent flow, uniform and non-uniform flow, path lines, stream lines and stream tubes, velocity and discharge, equation of continuity for compressible and incompressible fluids.

Hydro dynamics/Fluid dynamics: different forms of energy in a flowing liquid, head, Bernoulli's equation and its application, energy lines and hydraulic grade lines, free and forced vortex.

Flow Measurement: orifice meter, pitot tube and pitot static tube, venturimeter.

Steady flow through pipes: Darcy's Weisbach equation for flow in pipes, energy losses in pipelines, hydraulic grade lines and energy lines, pipes in series and parallel, transmission of energy through pipes, introduction to computer aided analysis of pipe network.

LAB OUTLINES:

Sr. No	Topics
1	To study the layout of Fluid Mechanics and Hydraulics lab.
2	Determination of various properties of fluid.
3	To measure head loss in a pipe of uniform diameter.
4	To determine the hydrostatic forces on a submerged plane and locate the position of center of pressure i.e. depth of center of pressure.
5	To investigate the validity of Bernoulli's equation when applied to a steady flow of water in a tapered duct.
6	To determine the coefficient of discharge for the horizontal venturimeter or for the calibration of venturimeter.
7	To determine coefficient of contraction (Cc), coefficient of velocity (Cv) and coefficient of discharge (Cd) of an orifice
8	To determine coefficient of discharge (Cd) of an orifice and hence to calibrate it.

RECOMMENDED BOOKS:

1. Fluid mechanics with Engineering Applications by Robert L. Daugherty, SI Edition
2. A textbook of fluid mechanics and hydraulic machines by Dr. R. K. Bansal
3. A textbook of Hydraulics, Fluid Mechanics and hydraulic machinery by R. S. Khurmi
4. Fluid Mechanics by J. F. Douglas

Ch. E-251 APPLIED THERMODYNAMICS

1. Fundamental quantities — Internal energy; Enthalpy; Heat capacity
2. First law of thermodynamics
3. Thermodynamic properties of fluids — PVT behavior of pure substances; Equations of state and correlations; Estimation of thermodynamic properties using charts, correlations, and diagrams
4. Heat effects with and without phase change
5. Second law of thermodynamics — Entropy
6. Third law of thermodynamics
7. Phase equilibrium — Degrees of freedom; Gibbs phase rule; Ideal gas; Ideal solution; Chemical potential as criterion for phase equilibrium; Raoult's law; P-x,y and T-x,y diagrams; Bubble- and dew-point calculations
8. Heat transfer — Overall heat transfer coefficient; Log-mean temperature difference; Types of heat exchangers

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

RECOMMENDED BOOKS:

1. Applied Thermodynamics for Engineering Technologists, by A. Mc Conkey, T. D. Eastop, Pearson.
2. Process Heat Transfer, D.Q. Kern.

3. Surface Production Operation Volume-I, Design of Oil Handling Systems and Facilities by Ken Arnold & Manrice Stewart.

HU-221 TECHNICAL WRITING AND PRESENTATION SKILLS

Week	Main Topic	Lecture Contents
01.	Introduction Technical Communication	A. What is technical communication? B. Factors to consider in technical communication. C. Examining your purpose. D. Determining how to provide content.
02+03.	The Writing Process	A. Writing effective paragraphs for technology. B. Developing a clear pattern of organization.
04+05.	Getting started with technical writing	A. Recognizing different audiences. B. Involving the audience.
06.	Making writing effective	A. Achieving parallelism in writing. B. Constructing effective sentences.
07.	Memos	
08.	Assessment Week	
09.	Letter writing	E-Mails
10.	Parts of a Formal/Technical Report	• Title • Abstract • Outline/contents • Introduction • Body/procedures • Conclusion • Appendices • Use of illustrations (Tables and Figures)
11+12.	Parts of a Research Report	• Title • Abstract • Contents • Introduction • Literature review • Methodology • Analysis/Results • Discussions/interpretation • Conclusion • Recommendations • References
13+14.	Report Defense	Presentation of Reports.

MA- 225 DIFFERENTIAL EQUATIONS AND TRANSFORMS

1. Formation of differential equations; Solution of various types of first order differential equations; Orthogonal trajectories, Application in physical problems. Linear differential equations of second order, Complementary function and particular integral. Solution of non-homogeneous linear differential equations of second order and higher by (i) the method of undetermined coefficients (ii) the method of variation of parameters Application of second order differential equations; System of differential equations.
2. Formation of partial differential equations; Equations reducible to ordinary differential equations. Equations of the form Pp + Qq = R; Solution by the method of separation of variables. Wave, heat and Laplace equations.
3. Introduction to Laplace transform: Laplace transform of elementary functions, Laplace transform theorems, Inverse Laplace transform, applications to the solutions of initial value problems, Convolution theorem and applications.
4. Periodic functions, Even and odd functions. Fourier series of functions of period 2π and arbitrary period; Half range series. Complex Fourier series, Fourier transform and applications.

RECOMMENDED BOOKS:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch., published by Allied Book Centre, Urdu Bazar Lahore.
2. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons.
3. Elementary Differential Equations and Boundary Value Problems, by Boyce and Diprima, 10th Edition, Wiley, 2012
4. "Advanced Engineering Mathematics" by H.K. Dass, published by S. Chand & Company, New Delhi.
5. "Ordinary Differential Equations" by N.A. Shah, A-one publishers, Urdu Bazar, Lahore.

FIFTH SEMESTER

QT-301 Translation of the Holy *Qur'ān* - III

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the Commands (*Ahkamāt*) & ethics (احکامات واخلاقیات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1. Explain and understand the meanings of the Holy *Qur'ān* through its translation.
2. Identify the teachings and the guidance of the Holy *Qur'ān* regarding the Commands (*Ahkamāt*) & ethics (احکامات واخلاقیات).
3. Evaluate the call of the Holy *Qur'ān* on the Commands (*Ahkamāt*) & ethics (احکامات واخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Week wise Course Contents

Week	Details
Week 1	Translation of Part (*Parah*) 17, first ½ portion
Week 2	Translation of Part (*Parah*) 17, second ½ portion
Week 3	Translation of Part (*Parah*) 18, first ½ portion
Week 4	Translation of Part (*Parah*) 18, second ½ portion
Week 5	Translation of Part (*Parah*) 19, first ½ portion
Week 6	Translation of Part (*Parah*) 19, second ½ portion
Week 7	Translation of Part (*Parah*) 20, first ½ portion
Week 8	Translation of Part (*Parah*) 20,
Week 9	Mid Semester Exam
Week 10	Translation of Part (*Parah*) 21, first ½ portion
Week 11	Translation of Part (*Parah*) 21, second ½ portion
Week 12	Translation of Part (*Parah*) 22, first ½ portion
Week 13	Translation of Part (*Parah*) 22, second ½ portion
Week 14	Translation of Part (*Parah*) 23, first ½ portion
Week 15	Translation of Part (*Parah*) 23, second ½ portion
Week 16	Translation of Part (*Parah*) 24, first ½ portion
Week 17	Translation of Part (*Parah*) 24, second ½ portion
Week 18	End Semester Exam

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن — شاہ عبدالقادر دہلوی
2. فتح القرآن — فتح محمد جالندھری
3. ترجمہ قرآن مجید — حافظ نذر احمد
4. آسان ترجمہ قرآن — سید شبیر حسین
5. احسن البیان — مولانا محمد جوناگڑھی
6. ترجمہ ضیاالقرآن — پیر کرم شاہ الازہری
7. آسان ترجمہ قرآن — مولانا محمد تقی عثمانی
8. ترجمہ قرآن — مولانا اشرف تھانوی
9. کشف الرحمٰن — مولانا احمد سعید دہلوی
10. ترجمہ تبیان القرآن — مولانا غلام رسول سعیدی
11. مصباح القرآن — ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن — دارالسلام
13. ترجمہ قرآن — سید ابوالاعلیٰ مودودی
14. فہم القرآن، لفظی ترجمہ — ڈاکٹر فرحت ہاشمی
15. مقبول القرآن — سید مقبول احمد دہلوی
16. آسان ترجمہ قرآن — محمد ظفر
17. The meaning of Glorious *Qur'ān* — Marmaduke Pickthal
18. *Qur'ān* Translation English — Abdullah Yousaf Ali
19. *Qur'ān* Translation English — Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English — Muhammad Asad

Pet.E-313 WELL LOGGING

Basic Concepts: Logging environment, porosity, permeability, fluid saturations, formation density, resistivity, invasion process and resistivity profiles.

Electrical Logs: SP logs, conventional, normal, lateral and micro devices.

Nuclear Logs: Gamma ray, neutron and formation density logs Sonic or acoustic log.

Cross plots of various logs.

Quantitative Analysis: Formation water resistivity and saturation determination. Lithology and porosity determination. 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 OUTLINES:

1. Interpretation of different resistivity profiles.
2. Determination of formation temperature using well log data.
3. Determination of variation in different resistivity with a change in temperature.
4. Determination of formation water resistivity from spontaneous potential log.
5. Determination of corrected resistivity 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. Theory, Measurement & Interpretation of Well Logs by Zaki Bassiouni, SPE Textbook Series Vol.4, ISBN: 978-1555630560.
2. Open hole Log Analysis and Formation Evaluation by Richard M. Bateman, SPE Textbook Series, Second Edition, ISBN: 978-1613991565.
3. Cased Hole Log Interpretation, Principles/ Applications by Schlumberger.

Pet.E-314 RESERVOIR ENGINEERING

Fundamental reservoirs engineering, classification of reservoir flows system, geometry of the reservoir steady state and unsteady state flow, Darcy's law of fluid flow through porous media, Dimensional analysis of Darcy's law, Basic flow equations, Pressure distribution and pressure gradient for linear, radial, compressible, slightly compressible and incompressible steady state flow conditions. Average permeability calculations for beds in series and beds in parallel for linear and radial reservoir geometry. Determination of average pressure in radial flow system, Readjustment time, Productivity index, Specific productivity index and injectivity index, Relationship between well-bore radius and flow rate in radial flow system. Continuity equation and its derivation. Diffusivity equation and its different forms. Volumetric evaluation of oil in place and empirical reserve estimates. Different type of oil drives of reservoir.

RECOMMENDED BOOKS:

1. Applied Petroleum Reservoir Engineering, Ronald E. Terry, J. Brandon Rogers. ISBN: 978-0133155587
2. Reservoir Engineering Handbook, Tarek Ahmed PhD, ISBN: 978-1856178037
3. Fundamental Principles of Reservoir Engineering by Brian F. Towler, ISBN: 978-1555630928
4. Oil Reservoir Engineering, Sylvain Joseph Pirson, ISBN: 0882755005.
5. Fundamental of Reservoir Engineering, Ben H. Caudle, ASIN: B0007GPIIQ.
6. Reservoir Engineering Manual, Frank W. Cole, ASIN: B003AA4LKW.

Pet.E-322 NATURAL GAS PROCESSING & PIPELINE MANAGEMENT

Introduction to natural gas industry, natural gas properties, flow and compression calculation, gas transmission, sweetening and dehydration of crude gases, distribution of gas in the city, gas stations, pipeline welding techniques, testing and welding defects, gas appliances and their design, gas flow measurements.

LAB OUTLINES

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 + ve Displacement Meters.
10. Quizzes.

RECOMMENDED BOOKS:

1. Donald & Katz, Handbook of Natural Gas Engineering, ISBN: 007033384X.
2. Harold Sill, Petroleum Transportation Handbook, ASIN: B007KPZ8JG.
3. John M. Campbell, Gas Conditioning and Processing, ASIN: B000UMK60W.
4. James W. Amyx, Petroleum Reservoir Engineering, Physical Properties, ISBN: 0070016003

MA-343 APPLIED PROBABILITY AND STATISTICS

1. Frequency distribution.
2. Mean, Median, Mode and other measures of central tendency.
3. Standard deviation and other measures of dispersion, Coefficient of dispersion.
4. Random experiments; Sample space; Definition of probability; Addition and product rules of probability; Bayer's theorem; Discrete and continuous random variables; Discrete and continuous probability distributions. Simple random processes and their probability distributions. Approximation and application of normal distribution in Engineering.
5. Central limit theorem; Simulation of random variables; Markov processes.
6. Methods of least squares, Curve fitting, Linear Regression.

RECOMMENDED BOOKS:

1. Applied Statistics for Engineers & Scientists by Devore/Farnum, 3rd Ed. Thomas.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, 8th Ed. Pearson Educational International, 2007.
3. Probability and Statistics for Engineering and Sciences, 8th Ed. CENGAGE Learning.
4. Applied Statistics and Probability for Engineers by Montgomery, Runger, 3rd Ed. John and Wiley and Sons.

5. Probability and Random Variables and Stochastic Processes, Papoulis Athanasios, 3rd Ed. McGraw-Hill Inc.
6. Introduction to Statistical Theory by Muhammad Shehzad and Sher Muhammad, Ilmi Kitab Khana Urdu Bazar Lahore.

MA-346 NUMERICAL METHODS

1. Solution of non-linear equations: Open methods, bracketing methods for locating roots, initial approximation and convergence criteria, Newton Raphson and Secant methods.
2. Solution of linear simultaneous equations: Jacobi's method; Gauss-Seidle method;
3. Finite differences: Difference operators and tables; Differences of polynomials;
4. Interpolation and polynomial approximation: Taylor series approximation, introduction to interpolation, Newton's polynomials, Newton's divided difference table and interpolation, Lagrange's interpolation, Chebyshev polynomials.
5. Numerical differentiation: approximating the derivative.
6. Numerical integration: Introduction to quadrature, trapezoidal, composite trapezoidal and Simpson's rules.
7. Solution of partial differential equations: Hyperbolic Equations, Parabolic Equations, Elliptic equations.
8. Computations: Numerical techniques in context of engineering applications and solutions of problems by using Matlab.

RECOMMENDED BOOKS:

1. "Numerical Methods for Engineers" by S. C Chapra & R. P Canale, McGraw-Hill.
2. "Numerical Methods using MATLAB" by John H. Mathews, Pearson Education.
3. "Applied Numerical Methods for Engineers using MATLAB" by Robert J. Schilling & Sandra L. Harris, Brooks/Cole.
4. "Numerical Methods for Engineers and Scientists" by D. Joe Hoffman.

SIXTH SEMESTER

Pet.E-306 DRILLING ENGINEERING-II

Directional drilling and deviation control, Definitions and reasons for directional drilling, planning the directional well trajectory, planning the kick-off and trajectory change, Deflection tools. Factors affecting rate of penetration (ROP), overview of horizontal drilling.

Drill stem testing (DST), test procedure and common considerations, Test tool components and their arrangement, Analysis of test data, formation damage causes and prevention of formation damage. Oil well cementing. Primary oil well cementing techniques, types of cement, cement additives and factors considered for the preparation of cement recipe, cement volumes calculation, Squeeze cementing and Stage cementing techniques.

Drilling economics, Equipment cost, slim hole drilling, Air gas drilling, methods of reducing drilling cost. Well Control procedures and kill sheet calculations, Managed Pressure Drilling (MPD), HTHP Drilling Challenges, Drilling Optimization Considering Different Cost Factors, and Fishing Operations. Offshore Drilling Operations, offshore rig selection criteria, designing for offshore well construction

LAB OUTLINES:

1. Studio work of Casing Design
2. Presentations

RECOMMENDED BOOKS:

1. Oil well Drilling Engineering by Don W. Dareing, ISBN: 978-0791861875, ASME Press
2. Applied Drilling Engineering by Adam. T. Bourgoyne Jr., Keith. K. Millheim, SPE Textbook Series, Vol 2, ISBN: 978-1555630010, Society of Petroleum Engineers
3. Well Engineering and Construction by Hussain Rabia,, ISBN: 978-0954108700, Entrac Consulting
4. Horizontal Well Technology, by S.D. Joshi, ISBN: 978-0878143504, PennWell Corp. 1st Edition
5. Well Cementing by Erik B. Nelson, ISBN: 978-0444555809, Elsevier Scienc
6. Petroleum Well Construction by Michael J. Economides, Larry T. Watters, Shari Dunn-Norman, ISBN: 978-0471969389, John Wiley; 1st edition

7. Formulas and Calculations for Drilling, Production, and Workover: All the Formulas You Need to Solve Drilling and Production Problems by William C. Lyons, Thomas Carter, Norton J. Lapeyrouse, ISBN: 978-0128034170, Gulf Professional Publishing, 4th edition
8. Offshore Petroleum Drilling and Production by Sukumar Laik, ISBN: 978-1498706124, CRC Press; 1st edition

Pet.E-315 PETROLEUM PRODUCTION ENGINEERING-I

Introduction to Petroleum Production system; components and working principles, deliverability of oil and gas reservoir; various estimation models and their selection on the basis of flow regimes and pressure and pressure levels, Inflow performance Relationship (IPR) models; straight line and curve IPR , time dependency of the IPR models, Wellbore/ Tubing performance of oil and gas wells; single phase and multi-phase well flow models, homogeneous and separated flow models, mechanistic and empirical models, pressure traverse and pressure drop estimation, Estimating the choke performance; single phase, multiphase, critical and sub critical flow models, Deliverability of oil and gas wells; principle of system analysis (NODAL™ Analysis) with simplified well configuration, use of IPR and TPR (Tubing Performance Relationship), forecast of Well production; forecasting the behavior of and oil or gas well using the principle of Nodal analysis and material balance.

LAB OUTLINES:

1. Different production softwares utilization
2. Studio work
3. Presentations

RECOMMENDED BOOKS:

1. Petroleum Production Systems: A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor Elsevier Science & Technology Books, ISBN: 0750682701.
2. Petroleum Production Systems, 2nd Edition, Michael J. Economides, A. Daniel Hill, Christine Ehlig- Economides, Ding Zhu, Prentice Hall ISBN: 013658683X
3. Production Optimization using NODAL™ Analysis, by H. Dale Beggs, OGCI, ISBN: 978-0930972141.

Pet.E-317 PETROLEUM ECONOMICS & RISK ANALYSIS

Definition and some of basic concepts. Profit Planning. Typical oil company objectives. The role of management in planning. Planning of capital expenditures. Some Basic Principles of Economics. Demand, supply, and equilibrium price. Crude oil price volatility. Energy independence. Inflation. Consumer price index. Uncertainty and Risk.

The Time Value of Money: The Concept of Interest. Simple and compound interest. Nominal and effective interest rate. Cash Flow Diagram. The Time Value of Money. Present value of future sum. Future value of present sum

Before-Tax Cash Flow Models: Cash Flow Model. Data Required for Project Evaluation. Forecasting Product Stream. Product Pricing. Capital Expenditures (CAPEX). Geological and geophysical (G&G) costs. Estimating drilling costs. Facility costs. Operating Expenditure (OPEX). Abandonment costs and sunk costs. Opportunity costs.

After Tax Cash Flow Models

International Petroleum Economics: Types of Contract Arrangements. The concessionary system. Sample concessionary system cash flow spreadsheet. The production sharing system. Sample PSC cash flow spreadsheet. Basic elements of production sharing and royalty tax systems

Capital Budgeting Techniques: Accounting Approaches. Payback period. Average return on investment (AROI). Discounted Cash Flow Approaches. Discounted payback period. Net present value (NPV). Internal rate of return (IRR). Profitability index (PI).

Project Decision & Risk Analysis: Handling of Uncertainty in Capital Investment. The Decision Analysis Cycle. Application of Decision Analysis. Typical Industry Risks. Descriptive Statistics. Mean, Median and Mode. Measures of Variability. Range, Variance and Standard Deviation. Mean Absolute Deviation. Understanding Probability Concept. Classical Approach and Empirical Approach. Rule of Probability

RECOMMENDED BOOKS:

1. Project Economics & Decision Analysis,Volume I ISBN: 978-0878148191 & II ISBN: 978-0878148558, M. A. Mian, Pennwell Books
2. Economics of Worldwide Petroleum Production, Richard D. Seba ISBN: 978-0930972219
3. Engineering Economy, William G. Sullivan, Elin M. Wicks, C. Patrick Koelling, 16th Edition, Pearson Education Ltd. ISBN:978-0133439274

Ch. E-351 CHEMICAL TECHNOLOGY OF PETROLEUM

1. History, occurrence, and recovery of petroleum — Classification; Origin and occurrence; Reservoirs and reservoir fluids; Exploration, recovery, and transportation
2. Composition and properties of petroleum — Chemical composition; Fractional composition; Petroleum analysis methods
3. Refining of petroleum — Atmospheric distillation; Vacuum distillation; Thermal and catalytic cracking; Hydrotreating and desulfurization; Hydrocracking; Reforming; Petrochemicals
4. Petroleum-derived products — Solvents; Polymeric materials; Synthetic fuels
5. Environmental aspects of petroleum processing — Refinery wastes

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

RECOMMENDED BOOKS:

1. Speight, J. G., The Chemistry and Technology of Petroleum. 5th ed.; CRC Press.
2. The Chemical Technology of Petroleum by William A Gruse and D. R. Stevens.
3. Petroleum Refinery Engineering by W.L. Nelson.

NATURAL SCIENCES/ MATH ELECTIVE

Pet.E-311 PRINCIPLES OF CORROSION CONTROL

1. Corrosion Principles
    a. Corrosion Mechanism causes of corrosion cells.
    b. Polarization and factors of polarization.
    c. High temperature corrosion.
    d. Stress corrosion cracking (sulfide stress corrosion cracking, chloride stress corrosion cracking, caustic stress corrosion cracking, environmentally inducted cracking).
    e. Hydrogen damages.
    f. Corrosion losses.
2. Corrosion Control

a. Corrosion detection methods (corrosion coupons, corrosion casing potential profile tool).
b. Corrosion control methods (material selection environment modification, inhibitor treatment).
c. Evaluation of inhibitor treatment program.
d. Cathodic protection, properties of galvanic anodes, design of impressed current, G/B, Criteria of CP, interference, anodic protection.

RECOMMENDED BOOKS:

1. A.W. Peabody, "Control of Pipeline Corrosion", National Association of Corrosion Engineers, ISBN: 1575900920
2. Pierre R. Roberge, "Handbook of Corrosion Engineering", McGraw-Hill, **ASIN:** B0092J33H2
3. Mars Fontana, "Corrosion Engineering (Materials Science & Engineering)", 3rd Edition, McGraw-Hill Companies, ISBN: 0070214611.

Pet. E-312 UNCONVENTIONAL RESERVOIRS

1. Introduction to Unconventional Energy Resources
   a. Economic Significance, technical, economic, political, and environmental constraints on development of unconventional resources.
2. Occurrences, resources and reservoir characteristics
   a. Low-permeability (Tight) sands.
   b. Shale reservoirs (gas and oil).
   c. Coal Bed Methane (CBM).
   d. Gas Hydrates.
   e. Heavy oil.
3. Drilling and completion methods for unconventional reservoirs
4. Other unconventional energy resources
   a. Geothermal energy.
   b. Coal conversion to Gas.
   c. Coal-to-gas and In-situ gasification.
   d. Water and environmental issues.
   e. Natural fractures and its importance in unconventional resources..
5. Basic measurements for characterization of unconventional resources.

RECOMMENDED BOOKS:

1. Reza Rezaee, Fundamentals of Gas Shale Reservoirs, ISBN: 978-1118645796.
2. Usman Ahmed and Nathan Meehan; Unconventional Oil and Gas Resources-Exploitation and Development, CRC Press, ISBN: 978-1498759403.
3. Y Ma, Holditch, "Unconventional Oil and Gas Resources Handbook: Evaluation and Development", 1st Edition, Elsevier, ISBN: 978-0128022382.
4. A Guide to Coal-bed Methane Operation, Gas Research Institute, ISBN: 978-9993152064.

Pet.E-318 RESERVOIR GEOMECHANICS

1. Fundamentals and experimental rock mechanics
    a. Stress and strain analysis, mechanical deformation, strength and failure analysis.
2. Subsurface Stresses
    a. Principal earth stresses: principal and effective, regional and local stresses, overburden stress, horizontal stress orientation, borehole breakouts, drilling-induced tensile fractures, classification of faults.
    b. Concept and construction of the Mechanical Earth Model, data requirements and types of input data.
3. Wellbore geo-mechanics and wellbore stability
    a. State of stresses around the wellbore
    b. Modes of rock deformation around the wellbore
    c. Optimization of horizontal well trajectory on the basis of stress regime.

4. Introduction to reservoir compaction. Geo-mechanical changes in the petrophysical properties. Introduction to geo-mechanical modeling

RECOMMENDED BOOKS:

1. Erling. Fjar et al, Petroleum Related Rock Mechanics, Elsevier, ISBN: 978-0444502605.
2. Mark D. Zoback, "Reservoir Geo-mechanics" 1st Edition, ISBN: 978-0521146197.
3. Tarek Ahmed, "Reservoir Engineering Handbook" (fourth Edition) Elsevier ISBN: 978-1856178037.
4. Curtis D. Johnson, "Process Control Instrumentation Technology", ISBN: 978-0555009629.

5. George Stephanopoulos, “Chemical Process Control: An introduction to Theory and Practice”, ISBN: 978-0131286293.

Ch. E-361 INSTRUMENTATION AND CONTROL

1. Fundamentals of electrical technology and digital logic employed in measurement
2. Review of scientific principles employed in instruments — Parts of instruments; Dynamics and static properties of instruments; Selection and calibration of instruments; Instrument identification and line symbols
3. Available technology of instrumentation — Temperature; Flow; Level; Weight; Load; Pressure; Composition
4. Introduction and significance of process control
5. Design and hardware elements of a control system
6. Feed-forward and feed-back control structures
7. Dynamics of first- and second-order systems
8. P, PI, and PID controllers
9. Routh’s criterion and Bode plots

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

RECOMMENDED BOOKS

1. Stephanopoulos, G., Chemical Process Control: An Introduction to Theory and Practice. Prentice Hall.

Min. E-359 SURVEYING AND LEVELLING

1. **Fundamental Concepts:** Definitions, Uses & types of surveys, Units of Measurement., Main instruments and their accessories Accuracy and Precision, Errors and Mistakes, adjustments of errors.
2. **Measurement of Horizontal Distances:** Different Methods and instruments for distance measurement. Errors and mistakes in taping and their adjustments. Field notes for Taping, Conventional and Electronic Field Books.

3. **Leveling:** Different methods and instruments used for leveling. Effects of Curvature of earth and Refraction of atmosphere, Types of Levels, Errors in leveling and their adjustment. Differential, profile and Reciprocal Leveling.
4. **Angles and Directions:** Angles and Directions, Meridians and Azimuths, Bearing and their computation. Adjustments of Bearings, Types of Compasses.
5. **Surveying Operation**: Types of Theodolites, Measurement of Horizontal and Vertical Angles, Temporary and Permanent Adjustments. Plane Table Surveying. Transit Tape Traverse. Adjustment of Traverse. Computation of Rectangular Co-ordinates., Computation of Omitted Measurements, Area Computation of Closed Traverse. Topographic map, Contours and their characteristics. Different methods of Contouring.
6. **An Introduction to Geomatics and Global Positioning System:** Geomatics defined, Branches of Geomatics, GPS Surveying techniques

LAB OUTLINES:

1. To establish vertical control using differential leveling.
2. Distance measurement with taping
3. Traversing
    a. Plane table traverse
    b. Transit tape traverse
4. Basic operations of Hand-Held GPS receiver.
5. To locate the coordinates of Different building around Campus using Hand Held GPS.

RECOMMENDED BOOKS:

1. Elementary Surveying: An Introduction to Geomatics / Charles D. Ghilani, Paul R.Wolf. 13th Ed. (2012)
2. Surveying and Leveling by T. P. Kanetker, Published by: Pune Vidyarthi Griha Prakashan, 24th Ed. (2010).
3. Surveying Theory and Practice by Raymond Earl Davis, Francis Seeley Foote and William Horace Rayner. Publisheed by: McGraw Hil 3rd Ed. (1981)

SEVENTH SEMESTER

Pet. E-422 PRINCIPLES OF RESERVOIR SIMULATION

Introduction: Concept of reservoir simulation, its advantage, and limitations,

Formulation: Developing a model for single phase, incompressible, slightly compressible, and compressible fluids at different reservoir conditions, formulation of partial differential equations governing single phase and multiphase flow in porous media,

Solution: Direct and iterative methods for solving real life problems, and Performance prediction.

RECOMMENDED BOOKS:

1. Turgay Ertekin, Jamal H. Abou-Kassem, Gregory R. King, Basic Applied Reservoir Simulation, SPE Textbook Series Vol. 7, Richardson Texas. **ISBN:** 978-155563089-8
2. Donald W. Peaceman, Fundamentals of Numerical Reservoir Simulation, Elsevier Science, **ISBN:** 978-044455298-3.
3. Calvin C. Mattax, Robert L. Dalton, Reservoir Simulation, SPE Monograph Series Vol. 13, **ISBN:** 978-155563028-7.
4. M. R. Islam, S. M. Farouq Ali, Jamal H. Abou-kassem, Petroleum Reservoir Simulation: A basic Approach, Gulf Publishing company, **ISBN:** 978-097651136-6

LAB OUTLINES

Introduction: Developing a model for single phase, incompressible, slightly compressible, and compressible fluids at different reservoir conditions

Solution: Selection of Reservoir simulator and computer aided design. Use of Black oil Simulator. Input data keywords and data file preparation. Fine tuning for history matching and Performance prediction through Class Projects. Quizzes/ viva voces. / Surprise tests etc.

Pet.E-424 WELL TESTING

Analytical solution of the diffusivity equation for constant rate and constant pressure under transient and pseudo-steady state flow regimes; skin effect due to well-bore damage and storage; Analytical / numerical solution of diffusivity equation including damage and storage presented in the graphical form and its use as a diagnostic plot; Principle of superposition and Horner's approximation of pseudo-time.

Pseudo build-up analysis; Ideal build-up test and actual build-up test; Determination of reservoir permeability, skin factor, flow efficiency etc.; Pseudo-skin; Analysis of hydraulically fractured wells; Determination of static drainage area by P* and Muscat method; Distance to fault and areal extent determination; Modification of liquid equation for multiphase flow; Transient equation for gases including well-bore damage, storage and turbulence factor 'D'; Pseudo-pressure and pseudo-time determination and calculation of 'k'. 's' and 'D' by conventional and modern methods; 2-phase flow testing using pseudo pressure function; Drawdown analysis oil and gas well; Multi rate testing; Deliverability Testing for gas wells; Multi – Well testing; use of type curves and derivative curves; Specialized plotting for different flow regimes; Discussion of Ramey's, Gringarten's and Bourdet's type curves.

LAB OUTLINES:

This course will cover concepts of Well Testing and its operational aspects. Analytical solution of the diffusivity solutions along with flow regimes will be taught with practical examples. Pressure transient testing will be covered in terms of pressure build up test and drawdown tests including multiphase flow and multiwell testing; use of type curves and derivative curves. The course will be concluded with the application of deliverability testing of gas wells. Tools like Ecrin will be considered to cover complex engineering problems

RECOMMENDED BOOKS:

1. Lee, Rollins & Spivey., Pressure Transient Testing, SPE, ISBN: 978-1555630997
2. John Lee., Well Testing, SPE Textbook Series, ISBN: 978-0895203175.
3. M A Sabet., Well Test Analysis, Gulf Publishing Company, ISBN: 9780872015845
4. George Stewart., Well Test Design & Analysis, PennWell Corporation, ISBN: 978-1593702311

Pet.E-425 PETROLEUM PRODUCTION ENGINEERING-II

Causes of low well productivity: Reservoir dominated factors, well bore dominated factors, mechanical failures.

Well Diagnostics: Bottomhole static and flowing pressure calculations for single-phase and multiphase flow in wellbores. Single-phase and multiphase Production Test, deliverability tests, Transient tests (PLT), near well bore damage characterization and Problem well analysis.

Well Performance Prediction: Decline curve analysis, Material balance method, and reservoir simulation.

Well services and work over jobs: Squeeze jobs, re-perforation, well cleaning

Stimulation Techniques:

Hydraulic Fracturing: Introduction, inducing, productivity ratio, fracture area, fracturing fluid coefficients, fractures efficiency, fracturing hydraulics, fracture design and calculation.

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 OUTLINES:

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. Graphically determining 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: A computer Assisted Approach by Boyun Gue, William C. Lyons and Ali Ghalambor ISBN: 0750682701.
2. Introduction to Petroleum Production; Volume I & II by D. R. Skinner, ISBN: 0872017672.
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, ISBN: 978-0930972196.
5. Petroleum Production Systems by Michael J. Economides, A. Daniel Hill, ISBN: 013658683X.

Ch. E-453 ENVIRONMENT & SAFETY

1. Introduction to safety, health, and environment management — Basic terminology in HSE; Objectives and scope of HSE guidelines; Safety equipment; Safety inspection checklist
2. Risk and risk assessment — Hazard classification; Hazard identification; HAZOP; Hazards associated with petroleum exploration, production, refining, and transportation
3. Environmental management in petroleum engineering — Environmental implication of petroleum exploration, production, refining, and transportation; Drilling accidents; Impact on marine pollution; Oil spills; Atmospheric pollution
4. Environmental impact assessment — Principles; Legislation and regulatory aspects; Impact prediction and significance assessment

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

RECOMMENDED BOOKS:

1. Chandrasekaran, S., Health, Safety, and Environmental Management in Offshore and Petroleum Engineering. John Wiley & Sons, Inc.: 2016
2. Environmental management in Petroleum Industry, S.K. Wahri, Tech, A.K. Agnihotri, and J.S. Sharma.

Pet.E-491 PROJECT (Phase-I)

Every student/group will be required to submit a comprehensive report on an assigned problem. It will be evaluated at the end of 8th Semester.

EIGHTH SEMESTER

QT-401 Translation of the Holy *Qur'ān* - IV

Aims and objectives:

1. To teach the students the Holy *Qur'ān* with translation only.
2. To teach the students translation of the Holy *Qur'ān* relevant to the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات)
3. To make the students understand the call of the Holy *Qur'ān*, so that they may be able to practise accordingly and be successful in this world and the world hereafter consequently.

Course Learning Objectives (CLOs)

1. Explain and understand the meanings of the Holy *Qur'ān* through its translation.
2. Identify the teachings and the guidance of the Holy *Qur'ān* regarding the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات).
3. Evaluate the call of the Holy *Qur'ān* on the dealings and affairs (*Muamalāt*) & ethics (معاملات واخلاقیات) and recognize them by trying to practise on them accordingly to become a dutiful Muslim.

Week wise Course Contents

Week	Details
Week 1	Translation of Part (*Parah*) 25, first ½ portion
Week 2	Translation of Part (*Parah*) 25, second ½ portion
Week 3	Translation of Part (*Parah*) 26, first ½ portion
Week 4	Translation of Part (*Parah*) 26, second ½ portion
Week 5	Translation of Part (*Parah*) 27, first ½ portion
Week 6	Translation of Part (*Parah*) 27, second ½ portion
Week 7	Translation of Part (*Parah*) 28, first ½ portion
Week 8	Translation of Part (*Parah*) 28, second ½ portion
Week 9	**Mid Semester Exam**
Week 10	Translation of Part (*Parah*) 29, first ¼ portion
Week 11	Translation of Part (*Parah*) 29, second ¼ portion
Week 12	Translation of Part (*Parah*) 29, third ¼ portion
Week 13	Translation of Part (*Parah*) 29, fourth ¼ portion
Week 14	Translation of Part (*Parah*) 30, first ¼ portion
Week 15	Translation of Part (*Parah*) 30, second ¼ portion
Week 16	Translation of Part (*Parah*) 30, third ¼ portion
Week 17	Translation of Part (*Parah*) 30, fourth ¼ portion
Week 18	**End Semester Exam**

List of recommended translations of the Holy *Qur'ān:*

1. موضح القرآن — شاہ عبدالقادر دہلوی
2. فتح القرآن — فتح محمد جالندھری
3. ترجمہ قرآن مجید — حافظ نذر احمد
4. آسان ترجمہ قرآن — سید شبیر حسین
5. احسن البیان — مولانا محمد جوناگڑھی
6. ترجمہ ضیاالقرآن — پیر کرم شاہ الازہری
7. آسان ترجمہ قرآن — مولانا محمد تقی عثمانی
8. ترجمہ قرآن — مولانا اشرف تھانوی
9. کشف الرحمٰن — مولانا احمد سعید دہلوی
10. ترجمہ تبیان القرآن — مولانا غلام رسول سعیدی
11. مصباح القرآن — ڈاکٹر عبدالرحمٰن طاہر
12. معانی القرآن — دارالسلام
13. ترجمہ قرآن — سید ابوالاعلیٰ مودودی
14. فہم القرآن، لفظی ترجمہ — ڈاکٹر فرحت ہاشمی
15. مقبول القرآن — سید مقبول احمد دہلوی
16. آسان ترجمہ قرآن — محمد ظفر
17. The meaning of Glorious *Qur'ān* — Marmaduke Pickthal
18. *Qur'ān* Translation English — Abdullah Yousaf Ali
19. *Qur'ān* Translation English — Dr. Mohammad Mahmood Ghali
20. *Qur'ān* Translation English — Muhammad Asad

Pet.E-421 FIELD OPERATIONS IN PETROLEUM ENGINEERING

Drilling Operations: Executing Fishing, Cementing and Coring operations

Well Completion: Performing perforation job; Liner placement; Executing Sand control procedures; Conducting Well Testing operations

Production Operations: Procedures related to Scale Removal, Nitrogen Shooting, Coiled Tubing operations, Acidizing, Hydraulic Fracturing, Snubbing

RECOMMENDED BOOKS:

1. Advanced Well Control, David Watson, Terry Brittenham, ISBN: 978-1555631017.
2. Petroleum Well Construction, Michael J. Economides, Larry T. Watters, ISBN: 978-0471969389.
3. Applied Drilling Engineering, A. T. Bourgoye Jr., K. K. Millheim, ASIN: B01L0PRBX2.
4. Petroleum Production Systems, Michael J. Economides, A. Daniel Hill Christine Ehlig-Economides, ISBN: 978-0137031580, 2nd Edition.
5. Production Operations (Volume 1, 4th Edition), Thomas O. Allen, Alan P.Roberts, ISBN: 978-0930972196.
6. Natural Gas Production Engineering, Chi U. Ikoku, ISBN: 978-0471894834.

Pet.E-423 RESERVOIR MANAGEMENT

Material balance equation and its different forms for oil and gas reservoirs, K_{rg}/K_{ro} (relative permeability ratio) determination from field data and its applications. Performance calculation for depletion drive reservoirs and empirical prediction techniques for miscible and immiscible processes. Decline Curve Analysis. Performance of water-drive reservoirs using Frontal Advance Rate theory of Buckley and Leveret. Field development planning. Water and gas fingering and coning in reservoirs. Remedial treatments for coning.

LAB OUTLINES

1. Class Project.
2. Software Applications and Presentations.

RECOMMENDED BOOKS:

1. Oil reservoir Engineering by S.J. Pirson, ISBN-13:978-0070500747, 2nd Rev Edition

2. Advanced Reservoir Engineering by Tarek Ahmed, ISBN 9780750677332.
3. Applied Petroleum Reservoir Engineering, B.C. Craft & M.F. Hawkins, ISBN: 978-0133155587.

Pet.E-429 PRINCIPLES OF ENHANCED OIL RECOVERY

Factors Common to all Enhanced Recovery Methods: Principle influence on the efficiency of enhanced recovery. Linear displacement. Two and three-dimensional displacement. Injection well location. Arial sweep efficiency for pattern floods.

Water Flooding: Selection of water injection as an EOR method. Displacement mechanics and performance calculations. Practical considerations in water injection projects.

Immiscible Displacement by Gas Injection: Preliminary studies and field evaluation of injection efficiency. Injection and production well completions. Surface installations; compression and treatment methods. Special applications of gas injection.

Miscible Drive: Miscible slug flooding, thermodynamic miscibility, ternary diagram. Basic methods of miscible drive. Improved methods of miscible drive.

Gas Recycling in Gas-Condensate Reservoirs: Thermodynamics of gas recycling. Sweep efficiency, well locations, production control, production equipment, and determination of operating conditions.

Thermal Recovery Methods: Data required for the study of thermal recovery methods. Hot fluid displacement. In-situ combustion.

Other Methods of Enhanced Recovery: Use of polymers. Foam injection. Use of surfactant solutions and Micro-emulsions. Carbon dioxide flooding.

Calculations: Solution of EOR problems; development of computer algorithms and example calculations.

LAB OUTLINES:

This course will cover concepts of EOR and its technologies including EOR role in current and future oil production. Typical recovery mechanisms and factors common to all EOR methods will be taught to students in detail. Thereafter, secondary recovery in terms of water flooding and immiscible gas injection will be demonstrated. In last, the focus will be on the principles of miscible flooding, chemical flooding (polymer, foam, and surfactant), and thermal injection. The main aim of this course is to explain the different aspects of EOR by teaching the motives of the EOR including key constraints of the successful EOR operations

RECOMMENDED BOOKS:

1. Deryck Bond and Samuel Krevor., The Imperial college lectures in petroleum engineering: topics in reservoir management, Volume 3 World Scientific, ISBN 978-1786342843.
2. Chemical Enhanced Oil Recovery (cEOR) - a Practical Overview Edited by Laura Romero-Zeron, ISBN: 978-9535127000, In Tech.
3. Sheng, J.J., Enhanced Oil Recovery Field Case Studies, Gulf Professional publishing, Elsevier, ISBN: 978-0123865458

MGT-413 ENTREPRENEURSHIP

The course aims at providing necessary theoretical and practical knowledge for establishing and managing small business. This includes various functions that an entrepreneur performs to ensure growth of small business.

The Foundations of Entrepreneurship, The Driving Forces behind Small Business, Starting from Scratch or Joining an Existing Business, Choosing a Form of Ownership, The Business Plan: Visualizing the Dream, The business model, A Firm's Sources of Financing, Franchising and Buyouts, E-Commerce and the Entrepreneur, Building a New Venture Team and Planning for the Next Generation, Global Aspects of Entrepreneurship.

RECOMMENDED BOOKS:

1. Thomas W. Zimmer, Norman M. Scarborough and Doug Wilson, Essentials of Entrepreneurship and Small Business Management 5th Edition, Pearson
2. Robert D. Hisrich, Michael P. Peters and Dean A. Shepherd, Entrepreneurship, 5th Edition

Pet.E-492 PROJECT (Phase – II)

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

Note:

Freshly admitted students, especially foreign students, may have to take additional subjects as prerequisites, over and above the credits required towards completion of the degree. These subjects will not be counted towards completion of their degree requirement.

CURRICULUM (2015 – 2019)

University of Engineering and Technology
DEPARTMENT OF PETROLEUM & GAS ENGINEERING
Lahore – 54890. Pakistan Tel:+92-42-99029471 Fax: +92-42-99250202
chairmanpetroleum@uet.edu.pk, www.uet.edu.pk

Vision Statement:

"To generate knowledge for global competitive advantage and become a leading world class research university".

Mission Statement:

"To transform young brains into brilliant Petroleum Engineers, through modern teaching and research, to achieve professional excellence in oil and gas industry."

Program Education Objectives (PEOs):

The Petroleum & Gas Engineering program education objectives are as follows:

1. To enable the graduates to solve **complex engineering problems**, through the acquired **engineering knowledge**, **design practices** and skills pertinent to petroleum engineering.
2. To develop **effective communication**, **teamwork,** and **management skills** among graduates.
3. To inculcate comprehension of the fundamentals of economic, **environmental sustainability** and **society development**.
4. To develop professionalism, **ethical values** and determination among graduates to continue **lifelong learning**.

<u>Mapping of PEOs to PLOs / Graduate Attributes</u>

Graduating Attributes	PEO-1	PEO-2	PEO-3	PEO-4

Engineering Knowledge	■	■		■
Problem Analysis	■	■		
Design/Development of Solutions	■	■		
Investigations	■	■		■
Modern Tool Usage	■	■		
The Engineer and Society			■	■
Environment and Sustainability			■	■
Ethics			■	■
Individual and Teamwork	■	■		
Communication	■	■		
Project Management	■	■		
Lifelong Learning	■	■	■	■

Program Learning Outcomes (PLOs):

The following PLOs have been adopted by B. Sc. Petroleum & Gas Engineering Program.

1. **Engineering Knowledge:** An ability to apply knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
2. **Problem Analysis:** An ability to identify, formulate, research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
3. **Design/Development of Solutions:** An ability to design solutions for complex engineering problems and design systems, components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal, and environmental considerations.
4. **Investigation:** An ability to investigate complex engineering problems in a methodical way including literature survey, design and conduct of experiments, analysis and interpretation of experimental data, and synthesis of information to derive valid conclusions.
5. **Modern Tool Usage:** An ability to create, select and apply appropriate techniques, resources, and modern engineering and IT tools, including prediction and modeling, to complex engineering activities, with an understanding of the limitations.
6. **The Engineer and Society:** An ability to apply reasoning informed by contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice and solution to complex engineering problems.
7. **Environment and Sustainability:** An ability to understand the impact of professional engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of engineering practice.
9. **Individual and Teamwork:** An ability to work effectively, as an individual or in a team, on multifaceted and /or multidisciplinary settings.
10. **Communication:** An ability to communicate effectively, orally as well as in writing, on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project Management:** An ability to demonstrate management skills and apply engineering principles to one's own work, as a member and/or leader in a team, to manage projects in a multidisciplinary environment.

12. **Lifelong Learning:** An ability to recognize importance of, and pursuing life-long learning in the broader context.

CURRICULUM FOR B. SC. in PETROLEUM & GAS ENGINEERING

Entry 2015 -2019 (Knowledge Areas)

Course No.	Title	Contact Hours	Credit Hours	Pre-requisite
1.	**Knowledge Area-Humanities (10 Credit Hours)**			
HU-111	Communication Skills	3(0, 3)	1(0, 1)	None
HU-221	Technical Writing & Presentation Skills	3(3, 0)	3(3, 0)	None
IS-101	Islamic & Pakistan Studies-I	3(3, 0)	3(3, 0)	None
IS-201	Islamic & Pakistan Studies-II	3(3, 0)	3(3, 0)	None
2.	**Knowledge Area-Management (04 Credit Hours)**			
ChE-451	Environment & Safety	6(3, 3)	4(3, 1)	None
3.	**Knowledge Area-Natural Sciences (29 Credit Hours)**			
Phy-115	Applied Physics	5(2, 3)	3(2, 1)	None
CY-171	Petroleum Chemistry	5(2, 3)	3(2, 1)	None
MA-113	Calculus and Analytic Geometry	3(3, 0)	3(3, 0)	None
MA-129	Vector and Complex Analysis	3(3, 0)	3(3, 0)	None
MA-224	Multivariate Calculus	3(3, 0)	3(3, 0)	None
MA-225	Differential Equations and Transforms	3(3, 0)	3(3, 0)	None
MA-343	Applied Probability and Statistics	3(3, 0)	3(3, 0)	None
MA-345	Numerical Methods in Computing	6(3, 3)	4(3, 1)	None
Min-E-110	Applied Geology	6(3, 3)	4(3, 1)	None
4.	**Knowledge Area-Computing (03 Credit Hours)**			
CS-101	Computing Fundamentals	5(2, 3)	3(2, 1)	None
5.	**Knowledge Area-Engineering Foundation (22 Credit Hours)**			
Pet.E-101	Fundamentals of Petroleum Engineering	3(3, 0)	3(3, 0)	None
EE-199	Applied Electricity	5(3, 2)	4(3, 1)	None
ME-120	Engineering Drawing & Graphics	4(1, 3)	2(1, 1)	None
ME-100L	Workshop Practice	3(0, 3)	1(0, 1)	None
C.E-210	Strength of Materials	6(3, 3)	4(3, 1)	None
C.E-240	Fluid Mechanics	6(3, 3)	4(3, 1)	None
ChE-251	Applied Thermodynamics	6(3, 3)	4(3, 1)	None
6.	**Knowledge Area-Major Based Core (Breadth & Depth) (58 Credit Hours)**			
Pet.E-202	Petroleum Geology & Geophysical Exploration	3(3, 0)	3(3, 0)	Min-E-110
Pet.E-203	Petrophysics	5(2, 3)	3(2, 1)	None
Pet.E-211	Drilling Engineering - I	5(2, 3)	3(2, 1)	Pet.E-101
Pet.E-212	Properties of Reservoir Fluids	5(2, 3)	3(2, 1)	None
Pet.E-313	Well Logging	5(2, 3)	3(2, 1)	Pet.E-203
Pet.E-314	Reservoir Engineering	3(3, 0)	3(3, 0)	None

Pet.E-315	Petroleum Production Engineering-I	3(3, 0)	3(3, 0)	None
Pet.E-316	Field Operations in Petroleum Engineering	3(3, 0)	3(3, 0)	None
Pet.E-317	Petroleum Economics & Risk Analysis	3(3, 0)	3(3, 0)	None
Pet.E-322	Natural Gas Processing & Pipeline Management	6(3, 3)	4(3, 1)	None
Pet.E-323	Drilling Engineering - II	6(3, 3)	4(3, 1)	Pet.E-211
Pet.E-424	Well Testing	5(2, 3)	3(2, 1)	Pet.E-203
Pet.E-425	Petroleum Production Engineering-II	6(3, 3)	4(3, 1)	Pet.E-315
Pet.E-426	Principles of Reservoir Simulation	6(3, 3)	4(3, 1)	Pet.E-314
Pet.E-427	Reservoir Management	6(3, 3)	4(3, 1)	Pet.E-314
Pet.E-428	Gas Reservoir Engineering	6(3, 3)	4(3, 1)	None
Pet.E-429	Principles of Enhanced Oil Recovery	6(3, 3)	4(3, 1)	None

7. Knowledge Area-Inter-Disciplinary Engineering Breadth (04 Credit Hours)

Ch.E-351	Chemical Technology of Petroleum	6(3, 3)	4(3, 1)	

8. Knowledge Area-Senior Design Project (06 Credit Hours)

Pet.E-491	Project (Phase-I)	9(0, 9)	3(0, 3*)	None
			* (Will be evaluated at the end of 8th Semester)	
Pet.E-492	Project (Phase-II)	9(0, 9)	3(0, 3)	Pet.E-491

Course Scheme for B. Sc. in Petroleum & Gas Engineering
Entry 2015 – 2019 (Semester-wise sample)

SEMESTER I						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-101	Fundamentals of Petroleum Engineering	3	0	3	0	None
EE-199	Applied Electricity	3	2	3	1	None
MA-113	Calculus and Analytic Geometry	3	0	3	0	None
Min-E-110	Applied Geology	3	3	3	1	None
HU-111	Communication Skills	0	3	0	1	None
ME-120	Engineering Drawing & Graphics	1	3	1	1	None
	TOTAL	**13**	**11**	**13**	**4**	
	GRAND TOTAL	**24**		**17**		

SEMESTER II						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
MA-129	Vector and Complex Analysis	3	0	3	0	None
Phy-115	Applied Physics	2	3	2	1	None
CS-101	Computing Fundamentals	2	3	2	1	None
ME-100L	Workshop Practice	0	3	0	1	None
IS-101	Islamic & Pakistan Studies-I	3	0	3	0	None
CY-171	Petroleum Chemistry	2	3	2	1	None
	TOTAL	**12**	**12**	**12**	**4**	
	GRAND TOTAL	**24**		**16**		

SEMESTER III						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-202	Petroleum Geology & Geophysical Exploration	3	0	3	0	Min-E-110
Pet.E-203	Petrophysics	2	3	2	1	None
Pet.E-211	Drilling Engineering-I	2	3	2	1	Pet.E-101
MA-224	Multivariate Calculus	3	0	3	0	None
C.E-210	Strength of Materials	3	3	3	1	None
	TOTAL	**16**	**9**	**16**	**3**	
	GRAND TOTAL	**25**		**19**		

SEMESTER IV						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-212	Properties of Reservoir Fluids	2	3	2	1	None
ChE-251	Applied Thermodynamics	3	3	3	1	None
HU-221	Technical Writing & Presentation Skills	3	0	3	0	None
C.E-240	Fluid Mechanics	3	3	3	1	None
MA-225	Differential Equations and Transforms	3	0	3	0	None
TOTAL		**14**	**9**	**14**	**3**	
GRAND TOTAL		**23**		**17**		

SEMESTER V						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-313	Well Logging	2	3	2	1	Pet.E-203
Pet.E-314	Reservoir Engineering	3	0	3	0	None
Pet.E-322	Natural Gas Processing & Pipeline Management	3	3	3	1	None
MA-343	Applied Probability and Statistics	3	0	3	0	None
IS-201	Islamic & Pakistan Studies-II	3	0	3	0	None
MA-345	Numerical Methods in Computing	3	3	3	1	None
TOTAL		**17**	**9**	**17**	**3**	
GRAND TOTAL		**23**		**20**		

SEMESTER VI						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-315	Petroleum Production Engineering-I	3	0	3	0	None
Pet.E-316	Field Operations in Petroleum Engineering	3	0	3	0	None
Pet.E-317	Petroleum Economics & Risk Analysis	3	0	3	0	None
Pet.E-323	Drilling Engineering-II	3	3	3	1	Pet.E-211
ChE-351	Chemical Technology of Petroleum	3	3	3	1	None
TOTAL		**15**	**6**	**15**	**2**	
GRAND TOTAL		**21**		**17**		

SEMESTER VII						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-424	Well Testing	2	3	2	1	Pet.E-203
Pet.E-425	Petroleum Production Engineering-II	3	3	3	1	Pet.E-315
Pet.E-426	Principles of Reservoir Simulation	3	3	3	1	Pet.E-314
ChE-451	Environment & Safety	3	3	3	1	None
Pet.E-491	Project (Phase-I)	0	9	0	3*	None
TOTAL		**11**	**21**	**11**	**7**	
GRAND TOTAL		**32**		**18**		

* Will be evaluated at the end of 8th Semester

SEMESTER VIII						
Course No.	**Course Title**	**Contact Hours**		**Credit Hours**		**Pre-requisite**
		Theory	**Practical**	**Theory**	**Practical**	
Pet.E-427	Reservoir Management	3	3	3	1	Pet.E-314
Pet.E-428	Gas Reservoir Engineering	3	3	3	1	None
Pet.E-429	Principles of Enhanced Oil Recovery	3	3	3	1	None
Pet.E-492	Project (Phase-II)	0	9	0	3	Pet.E-491
TOTAL		**9**	**18**	**9**	**6**	
GRAND TOTAL		**27**		**15**		

TOTAL DEGREE	**104**	**96**	**104**	**32**	
GRAND TOTAL DEGREE	**200**		**136**		

DETAILS OF COURSE CONTENTS

FIRST SEMESTER

Pet.E-101 FUNDAMENTALS OF PETROLEUM ENGINEERING

National and International energy requirements. Sources of energy. Role of Petroleum as an energy source. Brief history of International Petroleum industry. Influence of Petroleum on International politics.
Overview of Petroleum Engineering including geological, geochemical and geophysical prospecting. Drilling mechanisms, formation evaluation, reservoir engineering, production engineering, processing, transportation, refining and petrochemicals. Utilization of products Highlights of local Petroleum industry. Job Scope of Petroleum engineering graduates.

RECOMMENDED BOOKS:

1. Fundamentals of Petroleum, by Debby Denehy, PETEX
2. Petroleum Engineering Drilling & Well completion by Carel Gatlin.
3. A first Course in Petroleum Technology by David A.T. Donobue, Karl R. Lang.

EE-199 APPLIED ELECTRICITY

Basics Concepts, Electrical And Units, Basic Circuits Laws and Measurements, Circuit Components, Multiple-Load Circuits, Complex-Circuit Analysis, Magnetism and Electromagnetism, Alternate Current And Voltage Power in AC Circuits, Capacitance, Inductance Transformers, R, C, and L Circuits, Electric Motors, Instruments and Measurements, Residential Wiring Concepts.

RECOMMENDED BOOKS:

1. Electricity: Principles & Applications, By Richard Fowler, 8th Edition, Mc-Graw Hill, 2012.

LAB OUTLINES

As defined by the concerned department (who owns the subject).

MA-113 CALCULUS AND ANALYTIC GEOMETRY

1. A review of differentiation: Geometrical interpretation of a derivative; Infinitesimal; Differential coefficient; Derivatives of higher order; Indeterminate forms and L. Hopital's rule; Asymptotes; Curvature; Approximation and error estimates.
2. Further techniques of Integration: Integration by reduction formula; Fundamental Theorem of Integral Calculus; Definite integral and its properties; Area enclosed between curves; Arc length; Volume of a solid; Volume of a solid of revolution; Area of surface of revolution; Moments; Centroids.
3. Cartesian, cylindrical and spherical coordinates: The ratio formula; Equations of a straight line in R^3; Direction ratios and direction cosines; Angle between two straight lines, Distance of a point from a line; Equations of a plane; Angle between two planes; The sphere; Directional derivatives.
4. The concept of limit, continuity and differentiation in functions of several variables; Geometric interpretation of partial derivatives; Total differential; Chain rule; Implicit differentiation; Maxima and minima of functions of two independent variables. Taylor's and Maclaurin's series for functions of two variables.
5. Double Integration; Fubini's Theorems; Change of order; Geometrical Interpretation of double integral; Applications to find volumes and areas.

RECOMMENDED BOOKS:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch., published by Allied Book Centre, Urdu Bazar Lahore.
2. "Calculus" by Thomas & Finny published by Addison Wesley
3. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,
4. "Calculus" by Howard Anton.
5. "Calculus" by Swokowski.

Min-E-110 APPLIED GEOLOGY

Introduction to various branches of geology, Origin of the earth and its place in universe, interior of the earth and chemical composition of the earth's crust, Mountain building and valley formation, drainage patterns and their types, agents of weathering and erosion, Deformational structural features of rocks, dip, strike, faults, folds, joints and fissures, unconformities etc. Introduction to continental drift and plate tectonics, earth quakes and volcanism with special reference to Pakistan, Formation of rocks and minerals, classification of rocks, Occurrence of economic minerals and dimension stones of Pakistan.

RECOMMENDED BOOKS:

1. K. M. Banger, Text book of Geology
2. H. H. Read, Rutley's Mineralogy

3. Dana, Dana's Manual of Mineralogy
4. Santosh Kumar Grag, Text book of Geology
5. Raymond, L. A., The Study of Igneous, Sedimentary and Metamorphic Rocks, McGraw Hill.
6. Arthur Holmes and Dorris Holmes, Physical Geology
7. F. G. H. Blyth, Geology for Engineers

LAB OUTLINES:

1. International geological symbols for rocks, structures and minerals
2. Measurement of dip and strike
3. Geological map reading
4. Moh's Scale Hardness
5. Identification of rock forming minerals
6. Study of wooden models of faults and folds etc.

HU-111: COMMUNICATION SKILLS

Sr. No.	Main topics	Lecture Contents
1.	Introduction to communication Skills	1. Communication principles 2. Process of communication 3. Importance of Good communication Skills in business environments
2.	Introduction to communication Skills	1. Communication in business Organizations a. Internal- Operational b. External- Operational c. Personal 2. Challenge of communication in the global market.
3.	Study Skills	1. Brain storming 2. Time management 3. Effective reading strategies 4. Note-taking 5. Organizations 6. Summarizing
4.	Components Communication	1. Sender- Encoder 2. Message 3. Medium 4. Receiver- decoder 5. Feedback
5.	Non-Verbal communication	1. Appearance and dress codes 2. Body language 3. Silence time and space 4. Importance of listening in Communication

6.	Functional English	Defining factors in every day Communication: a) In business originations b) In social exchanges
7.	Functional English	Role-play /Speaking activities
8.	Public speaking	1. Difference between Speaking and writing 2. Reading texts of good public speeches and analysis of their components.
9.	Public speaking	1. Listening to famous Public speeches. 2. Exercises in Public speaking.
10.	Formal Presentations	1. Difference between informal and formal presentations 2. Modes of formal presentation a. Extemporaneous b. Prepared c. Reading out from a written text d. Combination of the above mentioned methods.

RECOMMENDED BOOKS:

1. Introduction to Business Communication by Zane K. Quible, Margaret H. Johson & Dennis L. Mott.
2. Business Communication Today by Courtland L. Bovee, John V. Thill& Barbara E. Schatzman.
3. Effective Business Communication by Herta A. Murphy, Herbert W. Hildebrandt & Jane P. Thomas.
4. Business Presentation by Lani Arrendondo.

ME-120 ENGINEERING DRAWING & GRAPHICS

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 and projection of planes.

Loci of Points: Loci of points and straight line, loci of crank mechanism.

Curves Used in Engineering Practice: Cycloid, Threshold, epicycloids, Pitrochoid, hypotrochoid (superior and inferior). Involutes, evolutes, Archimedean, 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 cone, 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.

RECOMMENDED BOOKS:

1. Fundamentals of Engineering Drawing by Warrem J. Luzjader.
2. Elementary Engineering by N.D. butt.
3. Elementary of Solid Geometry by M.K. Guna.
4. A first year Engineering Drawing by A.C. Parkinso.
5. Auto CAD, Release Ver. 30 for Practical Purpose.

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.

SECOND SEMESTER

MA-129 VECTOR AND COMPLEX ANALYSIS

A review of vector algebra, scalar and vector products; Scalar triple product; Vector triple product; Scalar and vector point functions; Differentiation and integration of vector point functions; Gradient of a function; Divergence, curl and their physical interpretations; Green's theorem in the plane; Gauss' divergence theorem and Stock's theorem; Cartesian tensors.

Polar and exponential forms of complex numbers; Product and quotient of complex numbers in polar form; Properties of complex numbers; Lograthim of a complex number; De Moivres Theorem, The *n*th roots of a number; Solution of equations; Circular and hyperbolic functions; Inverse hyperbolic functions; Limit, continuity and differentiability of complex functions; Analytic functions, Harmonic functions; Cauchy fundamental theorem and its consequences; Cauchy Integral formula; Derivatives of an analytic function; Singularities and calculus of residues; Contour integration.

RECOMMENDED BOOKS:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch, published by Allied Book Centre, Urdu Bazar Lahore.
2. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,
3. "Vector Analysis" by M.R. Spiegel, McGraw – Hill Book Company.
4. "Elements of Complex Variables" by Pennisi, L. L. Holt, Rinehart and Winston, U.S.A.
5. "Vector and Tensor Analysis" by N.A. Shah, A–One Publishers, Urdu Bazar, Lahore.

Phy-115 APPLIED PHYSICS

Electrodynamics: Electric field & its measurement, Gauss's Law, Applications of Gauss's Law, Magnetic field, Ampere's Law, Faraday's law, Lenz's Law, Eddy currents, Maxwell's equations, electromagnetic wave, Electromagnetic spectrum.

Waves & Oscillations: Sound Waves, Interference, Diffraction, Snell's Law, Doppler's Effect for sound and light. Ultrasonic waves, X-ray Diffraction (XRD.

Atomic and Nuclear Physics: Structure of atom, Types of Atomic Spectra, the laser, X-ray production and scattering, nuclear properties of atom, Radiations from nucleus, Laws of Radioactive disintegration, Nuclear reactors, neutron thermalization, radiation detectors, Interaction of rays and matter.

RECOMMENDED BOOKS:

1. Fundamentals of Physics, 10th edition by David Halliday, Robert Resnick, and Jearl Walker
2. University Physics. 7th edition by Zears, Zemansky and Young.
3. Physics for Scientists and Engineers with Modern Physics, 4th edition by Dougles C. Giancol.

LAB OUTLINES

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

CS-101 COMPUTING FUNDAMENTALS

Introduction to Hardware, Software Engineering, Networking, Operating Systems and Database Concepts.

Business Applications: Data acquisition, storage and presentation using MS Office.

Pseudo Code: Problem solving techniques, and Flow Charts.

Introduction to Visual Basic

Class Project: Solving specific engineering problems.

Good understanding of the world wide and internet applications.

RECOMMENDED BOOKS:

1. Computer Science an Overview, by J. Glenn Brook Shear
2. Simple Program Design, by Lesley Anne Robertson
3. Visual Basic and tutorials by Schaum Series
4. Discovering Computers by Shelly Vermaat

LAB OUTLINES

Numerous Programs

ME-100L WORKSHOP PRACTICE

1. Machine Shop: Detailed study of centre lathe and accessories. Plain and Taper turning. Basic lath operations including turning, facing, simple screw cutting/treading, knurling, Grooving (Drilling and Boring), cutting tools and their grinding. Brief Introduction of shaper, milling Sharing and Surface Grinding Machine. Assigning of Practical Jobs.

2. Fitting and Fabrication Shop: The use and care of fitter's tools. Marking out of job. Practice in Metal filing. Sawing, Drilling, dieing, Tapping and reaming. Brief introduction and use of power Hack Saw, Arbor Press, Sheet Sharing Machine, Sheet Rolling Machine, Punching Machine and Drilling Machine. Assigning of practical Jobs.

3. Carpentry Shop: The use and care of tools. Type of Timber, its defects and preservation methods practice in planning and sawing. Different types of wood joints. Study of sawing, planning, turning mortise and tenon machines. Assigning of Practical Jobs.

4. Electrical Shop: Electric shocks and treatment. The use and care of tools used by Electrician. Types and uses of cable and electrical accessories for house wiring, practice in simple house wiring, testing methods. Switch gear used on domestic installation and DB system. Earthing System. Assigning of Wiring arrangements practical.

RECOMMENDED BOOKS:

1. Workshop Technology Part-1 by W.A.J Chapman.
2. Electrical Wring by Richter and Schwan
3. Wiring Manual by Pak Cables Limited.

The contents may be modified/ refined as per university centralized policy.

IS-101 ISLAMIC & PAKISTAN STUDIES-I

PART- I ISLAMIC STUDIES Marks: 60

QUR'ĀN AND SUNNAH

1) Al-Qur'ān Al Karim

a) Significance of The Holy Qur'ān

II) Compilation of The Holy Qur'ān

b) Textual Study of **Sura Al-Hujurat** (Complete)
(Meanings of Arabic text, translation & explanation)

Sura Al-Hujurat

Focus: Impact of the teachings and commands mentioned in Sura Al-Hujurat on human life.

Main Points of discussion

- Commands of Allah regarding meeting with the Holy Prophet peace be upon him.
- Reports from wicked person to be tested.
- Brotherhood, equality, effort to compose the quarrels of groups and reconciliate between them.
- Elimination of social evils such as to laugh at people in contempt, calling others by offensive nick names, suspicion and back-biting.
- All people (mankind) are one and the most righteous gets most honour before Allah.
- Qualities of believers.
- Knowledge of Allah about the secrets of the heavens and the earth and our actions.

Sura Al-Maida

c) Textual study of Surah Al-Maida (Verses:1 to 26)
(Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in sura Al-Maida on human life.

Main Points of discussion:

- Stress on fulfillment of uqud (obligations)
- Concept of Halal (lawful) and haram (forbidden) in Islam
- Halal and haram animals and food
- Symbols of Allah
- Emphasis on helping one another in righteousness and piety
- Rules of hunting the animals for food
- Social relationship with non Muslims
- Relationship between Muslims and Ah'l Al-Kitab (people of the Book)
- Rules of purity and cleanliness
- Allah's command to do justice and act righteously
- The Covenant of Bani-Israel (The children of Isreal) with Allah and breach of their covenant
- Allah's address to Ah'l Al-Kitab (people of the Book)
- Address of prophet Moses (peace be upon him) to his people.

d) Textual Study of Sura **Al-Fur'qan:** verses: 63 to 77
(Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in Sura Al-Fur'qan on human life.

Main Points of discussion:

Characteristics of Ibad-ur-Rehman (Slaves of Allah)

2) <u>Al-Hadith Al-Sharif</u>

a) The need & Importance of Hadith

b) Textual study of Hadith: Arbaeen-e-Navavi by Imam Nawawi, Hadith: 1 to 21
(Meanings of Arabic text, translations and explanation.)

Focus: Impact of teaching and commands mentioned in Ahadith on human life.

Main points of discussion:

- Importance of intention (Niyya) in human actions
- Islam, Iman (belief), Ihsan (excellence) and the Hour.
- Rejection of Innovation (Al-Bid'ah) in religion (Din)
- Lawful, unlawful and doubtful matters
- Sincerity to Allah, His Books, His Messengers, leaders of the Muslims and common people
- Protection of lives and property of people
- Obedience of the Holy Prophet peace be upon him
- Importance of lawful food, drink, clothing and nourishing
- True believer is who likes for his brother what he likes for himself
- Honour of the blood of Muslim and others
- Respect of neighbours and guests
- Importance of good talk and silence
- Prohibition to become angry and furious
- Ihsan (excellence) with regards to everything
- Good behavior towards people
- All kinds of expectation, help and benefit from Allah
- Importance of modesty (Al-Hiya)
- To stand firm on Islam

3) <u>Den-e-Islam, The study of basic articles of faith</u>

Focus: Impact of basic articles of faith on human life.

Main points of discussion:

a) Tawheed: Fundamentals and types of Tawheed,
b) Prophet-hood and Finality of Prophet-hood,
c) The Day of Judgment

4) <u>Seera-tun-Nabi</u>

Life of The Holy Prophet (Peace be upon him) from prophet-hood to Hijra

Focus: Impact of the study of life of the Holy Prophet peace to upon him, on human life.

Main points of discussion:

- First revelation
- Message of the Holy Prophet peace be upon him to the people
- Difficulties in preaching Islam in Makka and opposition of Quresh.
- Reasons of hijra (migration) to Madina and impact of this migration

5) Islam and Modern Science

Focus: Impact of the teaching regarding Modern Science on human life.

Main points of discussion:

- The Holy Qur'ān as s guide for the modern scientific development, Surah Al-Baqra: verse164, Aal-e-Imran: verses 190-191
- Importance of science education in the modern age
- Introduction of Muslim scientists, contribution of Muslim Scholars towards science

6) Ethics

Focus: Impact of the ethics on human life.

Definition, importance and significance of Ethics

Concept of Ethics in the light of Holy Qur'ān

Al-Baqra : 83, 169 Al-Ana'am : 151,152,153 Al-Tauba : 7

Yunus : 36 Hood : 18 Al-Nah'l : 112

Al-Mutaffefeen: 1,2,3

Main points of discussion:

- Kindness with parents, kindred, orphans and needy people.
- Fair speaking to the people.
- Refrain from evil and shameful deeds
- Abstain from killing any person except by way of law
- Security of the orphan's property
- Full justice in measure and weight
- Prevention from inventing a lie
- Fraud and its bad effects.

Moral values in the light of Hadith

Bulugh-ul-Maram, Kitab-ul-Jamae, Babul Tarheeb Min Msavi-al-Akhlaq

Ahadith No.3, 4,7,14,17

Main points of discussion:

- To control anger
- Oppression is darkness
- Telling a lie is sign of hypocracy
- Backbiting

a) Ethics and character building in the light of Seerah

Ethical behaviour of the Holy Prophet (PBUH)

Significance of moral values

i) Truth (ii) Honesty (iii) Taqwa

(iv) Brotherhood (v) Patience

b) Comparative Religious Morals

i. (i)Hinduism (ii) Buddhism (iii) Judaism

(iv) Christianity (v) Islam

ii. Philosophy of Ethics in revealed and non revealed religions: an analysis

PART-II PAKISTAN STUDIES Marks: 40

1. **Ideology of Pakistan.**
   - i) Definition & Explanation.
   - ii) Aims & objectives of Formation of Pakistan.
   - iii) Ideology of Pakistan in the light of the sayings and speeches of Allama Iqbal and Quaid-e-Azam
2. **A Brief History of Muslim Society in Subcontinent**
   - i). The arrival of Muhammad Bin Qasim.
   - ii). Muslim rule in Subcontinent.
   - iii). The down fall of Muslim Rules and renaissance of Muslim rule in Sub-Continent.
3. **Historical back ground of the Ideology of Pakistan, National & Reformative Movements.**
   - i). Sheikh Mujaddad Alf-I-Sani.
   - ii). ShahWali Ullah.
   - iii). Syed Ahmad Shaeed

Sheikh Mujaddad Alf-I-Sani

- Biography, Social & Religious Services,
- Efforts against non Islamic Fundamentals.
- Effects of the Movement.

Shah Wali Ullah

- Biography

- Efforts Against non-Islamic fundamentals.
- Reforms, social and religious services.

Sayyed Ahmad Shaheed

- Biography
- Jihad against Sikhs,
- Opposition from Afghan tribes
- Martyrdom at Balakot.

4. **Educational Efforts.**
    - Services of Sir Syed Ahmad Khan (Aligarh movement)
    - Political aspects of Alighar Movement
    - Educational services of Alighar Movement
    - Impact of Alighar Movement
5. **Pakistan Movement**
    - Muslim Nationalism:
    - Evolution of Two-Nation Theory.
    - Independence of India & Muslims
    - Khilafat Movement and Non-Cooperation Movement
    - Role of Ali Brothers and Mr. Gandhi
    - Presidential Address of Allama Iqbal at Allah Abad in 1930
    - 1937 Elections. Congress behavior.
    - Pakistan Resolution 1940.
    - To safeguard the ideological state in present era

Note: - The Medium of Instruction is Urdu/English

CY-171 Petroleum Chemistry

Petroleum chemistry: Basic introduction, General characteristics, Nature, composition and chemical constitution of crude oil and natural gases

Instrumental and Spectroscopic Analytical Techniques:

Principles of spectroscopy, Electromagnetic spectrum, UV-Visible, IR, AAS spectroscopy, Mass Spectrometry, proton NMR

Physico-Chemical methods of Separation and Analysis

Chromatography, Basic principles and classification, column chromatography, paper and thin layer, ion exchange, gel permeation, gas and high performance liquid chromatographic methods, electrophoresis,

Statistical Data Treatment

Introduction, Types of Errors, Accuracy and Precision, Determinate and Indeterminate Errors, Mean, Median, Range, Variance, Coefficient of Variance, Q-Test, t-Test, F-Test, Standard Deviation, Relative Standard Deviation, Mean Standard Deviation, Confidence limit, Significant and Insignificant Figures, Numericals

RECOMMENDED BOOKS

1 Standard Handbook of Petroleum and Natural Gas Engineering, Volume I, William C. Lyons, Gulf Publishing Company, Texas. 1996.

2 Modern Fourier Transform Infra-red Spectroscopy, by Chiristy, A. A, Y. Ozaki, and V. G. Gregorou, Elsevier 2001

3 Inorganic Mass Spectrometry: Fundamentals and Applications 1st Edition by Barshick, Christopher M., Douglas C, Duckworth, and David H, Smith Marcel Dekker, 2000.

4 Organic Spectroscopy 3rd edition by William Kemp, MACMILLAN 1991.

5 X-Ray Fluoriscence Spectrometry, 2nd Edition by Jenkins, Ron, John Wiley & Sons 1999.

6 Analytical Chemistry 5th edition by Gary D. Christian, John Wiley & Sons, 1994.

7 Fundamentals of Analytical Chemistry 5th edition by Skoog, West and Holler, Saunders Collage Publishing, 1982.

LAB OULINES:

1. Determination of Heat of Solution of a given salt solution.
2. Determination of 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 of a given liquid by using Ostwald's viscometer
5. Determination of the strength of Acid/Base by conductometric titration
6. Determination of the strength of Acid/Base by potentiometric titration
7. Separation of provided black ink by Thin Layer Chromatography
8. Separation of Food Dyes by Paper Chromatography
9. Separation of Metal Cations by Paper Chromatography
10. Determination of Errors
11. Calibration of Apparatus

12. Determination of the strength of provided ion using complexometric titration
13. Determination of the strength of provided analyte using gravimetric analysis
14. Preparation of buffers solutions
15. Determination of percentage composition of provided analyte solution using spectrophotometric analysis.

THIRD SEMESTER

Pet. E-202 PETROLEUM GEOLOGY & GEOPHYSICAL EXPLORATION

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.

Modes of deformation of rocks, parts, varieties and classification of folds, faults, joints and unconformities, expression of the above features on geological field maps, Geological mapping and the application of photogrammety

Geophysical exploration methods with emphasis on seismic methods and History of exploration in Pakistan.

Rock deformation and formation of different types of structures like faults, folds, etc. and interpreting subsurface formations through various maps

RECOMMENDED BOOKS:

1. Basic Exploration Geophysics, by E. S. Robinson
2. Geophysical Prospecting, by Milton, B. Dobrin
3. Geology of petroleum, A.I. Levorsen.
4. Basic Petroleum Geology, Peter K. Link.
5. Petroleum Geology of Pakistan, Iqbal B. Kadri.

Pet. E-203 PETROPHYSICS

Introduction to formation evaluation, core analysis. Fundamental properties of fluid permeated rocks; porosity, Permeability, fluid saturations, compressibility, surface kinetics. Core sampling and preservation.Measurement of basic rock properties. Interpretation of basic core analysis data.Special rock properties; electrical, acoustic, thermal.

Application of core analysis data. Example calculations of petrophysical properties with the help of computers.

RECOMMENDED BOOKS:

1. Applied Petroleum Reservoir Engineering, B.C. Craft & M.F. Hawkins.
2. Fundamental of Reservoir Engineering, L.P. Dake.
3. Petroleum Reservoir Engineering Physical Properties, James W. Amyx.

LAB OUTLINES:

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.
11. To measure the permeability of given Core sample using Gas Permeameter

Pet.E-211 DRILLING ENGINEERING-I

Purpose of drilling, Planning the well, Rotary drilling-its introduction and basic operations, Basic rig components and brief introduction to their function mud pumps rating and capacities. Development in drilling system, Rotary drilling bits, Bits types, standard classification of bits, Bit selection and evaluation, Introductions to drilling fluids, their function general nature and composition. Different types of drilling mud, Drilling mud additives,Drilling mud calculations, Air, natural gas, and aerated mud used as drilling fluids, Calculation of air and horsepower requirements.Pressure relations in the earth and bore hale. The hydrostatic heads of liquids, the hydrostatic heads of mud and cement slurries, Formation pressures and its types, Total overburden pressure, Drilling hazards and their remedies. Types of Different Wells, Typical Drilling Rig Organization, Dull Bit Grading, Formation Pressure Measurement using Different Techniques, Underbalanced Drilling (UBD).

RECOMMENDED BOOKS:

1. Drilling Technology by Cole
2. Applied Drilling Engineering by A. T. Bourgoye Jr., K. K. Millheim
3. Fundamentals Of Sustainable Drilling Engineering, by M. Enamul Hossain, Abdulaziz Abdullah Al-Majed, ISBN: 978-0470878170
4. Oil well Drilling Engineering Principles & Practice by Hussain Rabia
5. Fundamentals of Casing Design by Hussain Rabia
6. Casing Design Theory & Practice by S. S. Rehman, G. V. Chilingarian

7. Drilling fluids Technology by Max R. Annis, Martin v. Smith

LAB OUTLINES

1. Layout of Drilling Engineering Laboratory.
2. Introduction of different models of Rig components.
3. Density of Mud Determination using Mud Balance
4. Prepare a mud of known density
5. To determine the Gel strength of a drilling mud using Fann V. G. meter
6. To determine the Plastic viscosity, Apparent viscosity and Bigham Yield point and true yield point using Fann V.G meter.
7. To determine the Gel strength of a drilling mud using BaroidRheometer
8. To determine the viscosity using Rotational Viscometer
9. To determine the viscosity using Rotational Viscometer
10. To prepare mud cake by standard filter press and mud cell assembly
11. To study the filtration loss quality of a drilling mud by Baroid Miniature filter press
12. To determine the clay/ sand contents of the drilling mud using sieve analysis
13. To determine the oil, water, solids and clay content of the drilling mud
14. To determine API gravity, specific gravity of drilling mud

MA-224 MULTIVARIATE CALCULUS

The concept of limit, continuity and differentiation in functions of several variables; Geometric interpretation of partial derivatives; Total differential; Chain rule; Implicit differentiation; Maxima and minima of functions of two independent variables. Taylor's and Maclaurin's series for functions of two variables.

Double Integration; Fubini's Theorems; Change of order; Geometrical Interpretation of double integral; Applications to find volumes and areas; Multiple Integration and applications.

Integration in vector field; Vector differentiation and integration; Gradient, Divergence and curl; Directional derivatives.

RECOMMENDED BOOKS:

1 "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch., published by Allied Book Centre, Urdu Bazar Lahore.

2 "Calculus" by Thomas & Finny published by Addison Wesley

3 "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons,

4 "Calculus" by Howard Anton.

5 "Calculus" by Swokowski.

C.E-210 STRENGTH OF MATERIALS

Types of stresses and strains. Load extension diagrams.

Hooke's Law. Temperature stresses.

Geometrical properties of plane areas. (Centroid, Moment of Inertia & Product of Inertia) Shearing Force and Bending Moments 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 respectively.

Principles of testing machine, Impact Loads and Hardness.

RECOMMENDED BOOKS:

1. Strength of Materials by A. Pytel, F.L. Singer.
2. Mechanics of Materials by R.C. Hibbeler.
3. Mechanics of Engineering Materials by F.V. Warnock, P.P. Benham
4. ASTM Standard 2005.

LAB OUTLINES

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.

IS-201 ISLAMIC & PAKISTAN STUDIES-II

PART- I ISLAMIC STUDIES Marks: 60

1. Al-Qur'ān Al-Karim

1. Miracles (Ijaz) of the Holy Qur'ān
2. Principle of interpretation (Tafseer)
3. Textual Study of the Holy Qur'ān.

Surah Luqman (Meanings of Arabic text, translation & explanation)

Focus: Impact of the teachings and commands mentioned in Surah Luqman on human life.

Main points of discussion:

- Characteristics of the righteous people (Al-Mohsineen) and their reward
- Explanation of Lah wal Hadith and torment for its buyer
- Universal logical arguments on Allah as the Creator
- Conquering the Universe
- Advices of Luqman to his son: not to associate anyone with Allah, to establish Salat, (prayer) enjoin good, forbid evil, bear the difficulties, not to speak to others with your face turned away, not to walk proudly and lower your voice
- Orders of Allah to recognize the rights of parents
- Amr-Bill Maruf and Nahi Anil Munkar, Need, importance and methods of Preaching Characteristics of a Preacher
- Allah has subjected to man everything in the earth and the heavens and bestowed on him all His favour
- Punishments for a disbeliever
- Stress on fear of Allah the Lord and the Judgment Day
- Knowledge of Allah

Surah Al-Noor

with Al-Baqra: 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 (Subjective study of the Sura)

Focus: Impact of the teachings and commands mentioned in surah Al-Noor on human life.

Main Points of discussion:

- Introduction to the criminal law of Islam, concept of crime and punishment.
- Classification of crimes in Islamic Criminal Law: Hudood and Tazirat.
- Hudood: Zina (adultery, fornication),
- Qad'f (false accusation),
- Li'ān (accusation of a wife of zina),
- Drinking intoxicating liquors, narcotics.
- theft, Dacoity, Robbery, Murder, Apostasy and Rebellion.
- If'k story (slander)
- Privacy, Hijab (woman's veil)

2- Al-Hadith Al-Sharif

1- Compilation of Hadith.

2- A Brief Introduction of Sihah Settah and its compilers.

3- Textual study of Hadith:

Bulugh-ul-Maram. Kitab-ul-Jami (Bab-ul-Adab, Bab-ul-Bir Wa Sela

(Meanings of Arabic text, translation and explanation)

Focus: Impact of teachings and commands mentioned in Ahadith on human life.

Main points of discussion:

Bab-ul-Adab: (Good Behavior)

- Obligations on a Muslim for a Muslim
- Golden principal to and lead a satisfied life and to control one's greed
- What is righteousness? What is sin?
- Emphasis on the respect of human sentiments
- Social manners
- Awareness of a meal blessed with auspiciousness
- Manners of salam and greeting Muslims and non-Muslims
- Manners regarding sneeze, eating, drinking, wearing cloths, putting on and off shoes and walking with shoes
- Restriction of trailing garments arrogantly
- Restriction of overspending

Bab-ul-Bir Wa Sila: (Kindness and joining the ties of relationship)

- Golden principal for expansion of one's provision and an increase in life span
- Prohibition to sever ties of relationship

- Unlawful to be undutiful to mothers, to bury daughters alive, to refuse others and to demand from others.
- Hatred actions
- Pleasure and displeasure of Allah result form pleasure and displeasure of parents
- Rights of neighbours
- Most serious sins
- Prohibition of reviling parents
- Prohibition for a Muslim to avoid his brother
- Importance of any miner act of goodness
- Importance of help provided for others
- Reward of concealing the faults of others
- Re-compensation of kindness from others

3- Deen-e-Islam

Pillars of Islam; Shahada, Salat, Saum, Zakat, Hajj and Jihad

Focus: Impact of Shahada, Salat, Saum, Zakat, Hajj and Jihad on human life.

Main points of discussion:

- **Shahada** (Witness) Importance and philosophy of witness that no God but Allah and Muhammad (peace be upon him) is His Messenger.
- **Salat** (Prayer) Imposition of prayer, orders and significance.
- **Saum** (Fasting) Meaning of Fasting obligation of Fasting, significance, disbursement, physical and spiritual advantages.
- **Zakāt:** The Economic system of Islam, Importance of Zakāt, Prohibition of Riba (Interest). Comparison between Islamic Economic system and socialism, Capitalism & Communism,
- **Hajj:** Imposition of Hajj, commands and rites of Hajj, financial social and spiritual advantages of Hajj.
- **Jihad** (Striving in the cause of Allah)**:** Importance, significance and its kinds:
    - Against one's soul: to control its ego and desires (The greatest Jihad)
    - Against ignorance
    - Against Satan,
    - Against the enemy
    - Against disbelievers by the Holy Qur'an etc.

4- Seerah-Tun-Nabi

Focus: Impact of the life of the Holy Prophet peace be upon him on human life.

Main points of discussion:

- Life of the Holy Prophet (Peace be upon him) at Madina, Madina Pact
- The Holy Prophet (Peace be upon him) as a Perfect Man.
- Mohammedan Revolution.

5- Ethics

Focus: Impact of ethics on human life.

Main points of discussion:

(a) **1. Ethics and Religion**

- **Ethical behavior of the Prophets**
- Impact of belief on Ethics.
- Concept of worship and manners/ social relations in religion and their
  - impact on ethics

(b) **2. Ethics and character building, significance of moral values**

- Charity, Tolerance, Simplicity, Respect of mankind
- Social Etiquettes of meetings, eating & drinking and conversation, Right of people.

Verses of the Holy Qur'ān about Ethics

Aal-e-Imran: 112 Al-Nisa: 43, 90, 91 Al-Aa'raf: 35 Al-Ra'd: 30
Al-Nah'l: 90, 91 Bani IsrailI: 29-37 Al-Fat'h: 26

Main points of discussion:

Purity and cleanliness Nourishing of peace liberality to kith and kin fulfillment of contracts condemnation of misery negligence from the signs of Allah, trust in Allah

Moral values in the light of Hadith:

- Bulugh-ul-Maram, Babul Zoh'd wal Wara', Ahadith 2,6
- Babul Tarheeb Min Msavi Al-Akhlaq: Ahadith No.1,6,9

Main points of discussion:

Misery Worldly desires Avoid envy Showing of good deeds
Insulting and abusing others

PART-II PAKISTAN STUDIES Marks: 40

Formation of Pakistan

- Role of Scholars & Mashaikh, Students and Women, Journalists in the formation of Pakistan
- Contribution of Non-Muslim leaders in the struggle of Pakistan
- Initial Difficulties after Formation of Pakistan
- Anti-Muslim riots in India:
- Canal Water and distribution of Assets
- Accession of States: Junagarh & Kashmir, its background and danger for the peace of South Asia.

The Land of Pakistan

- Geographical importance
- Pak-China economic corridor
- Agricultural and industrial resources
- Man Power & Education.

Efforts for implementation of Islamic System in Pakistan

- Objectives Resolution 1949
- Islamic provisions of the Constitutions of 1956,1962 &1973.
- Process of Islamization during Zia era.

Foreign Policy of Pakistan

- Determinants and principles of Pakistan foreign policy
- Importance of Pakistan in Muslim World.
- Pakistan and international organizations: UN, OIC, SAARC, ECO & SCO
- Economic and defensive planning (Nuclear Policy)

Note: - The Medium of Instruction is Urdu/English

FOURTH SEMESTER

Pet.E-212 PROPERTIES OF RESERVOIR FLUIDS

Basic concept of phase behavior; single, binary, and multi-component systems.

Equations of State for real fluids, Calculation of phase equilibria for reservoir fluids, their sampling procedures and Determination of reservoir fluid properties by

1. Field data
2. Laboratory Analysis
3. Correlation's
4. Equations of state

Preparation of fluid analysis data for use in reservoir and production engineering calculations.

Properties of oil field waters and Hydrates.

Use of existing/available software for phase behavior calculations.

RECOMMENDED BOOKS:

1. Properties of Petroleum Fluids by William D. McCain.
2. Phase Behavior of Petroleum Reservoir Fluids by Karen Schou Pedersen, Peter L. Christensen, Jawad Azeem Shaikh, CRC Press
3. Petroleum Reservoir Rock and Fluid Properties by Abhijit Y. Dandekar, CRC Press

LAB OUTLINES:

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 % age of Sulfur in Crude Oil.

ChE-251 APPLIED THERMODYNAMICS

(1) Fundamental quantities: internal energy, enthalpy, and heat capacity (2) Definition and units of basic system parameters (3) First law of thermodynamics

(4) PVT behavior of pure substances (5) Thermodynamic properties of fluids (6) Equations of state and correlations (7) Estimation of thermodynamic properties through charts, correlations, and diagrams (8) Heat effects with and without phase change

(9) Second law of thermodynamics (10) Concept of entropy (11) Third law of thermodynamics (12) Thermodynamic analysis of flow processes

(13) The concept of equilibrium (14) Different types of equilibrium (15) Phase equilibrium (16) Degrees of freedom (17) Gibbs phase rule (18) Systems of variable composition (19) Ideal behavior (20) The chemical potential as a criterion of phase equilibrium (21) The concept of ideal gas and ideal solution (22) Raoult's law (23) P-X,Y and T-X,Y diagrams for ideal solutions (24) BUBL-P, BUBL,T, and DEW-T calculation methods (25) Flash calculations

(26) Types of heat exchangers (27) Overall heat transfer coefficient (28) Log-mean temperature difference (29) Parallel and counter flow heat exchangers (30) Multiphase and crossflow heat exchangers

RECOMMENDED BOOKS:

1. Applied Thermodynamics for Engineering Technologists, by A. McConkey, T. D. Eastop.
2. Process Heat Transfer, D.Q. Kern.
3. Surface Production Operation Volume-I, Design of Oil Handling Systems and Facilities by Ken Arnold & Manrice Stewart.

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

HU-221 TECHNICAL WRITING AND PRESENTATION SKILLS

Week	Main Topic	Lecture Contents
01.	Introduction Technical Communication	A. What is technical communication? B. Factors to consider in technical communication. C. Examining your purpose. D. Determining how to provide content.
02+03.	The Writing Process	A. Writing effective paragraphs for technology. B. Developing a clear pattern of organization.
04+05.	Getting started with technical writing	A. Recognizing different audiences. B. Involving the audience.
06.	Making writing effective	A. Achieving parallelism in writing. B. Constructing effective sentences.
07.	Memos	
08.	Assessment Week	

09.	Letter writing	E-Mails
10.	Parts of a Formal/Technical Report	• Title • Abstract • Outline/contents • Introduction • Body/procedures • Conclusion • Appendices • Use of illustrations (Tables and Figures)
11+12.	Parts of a Research Report	• Title • Abstract • Contents • Introduction • Literature review • Methodology • Analysis/Results • Discussions/interpretation • Conclusion • Recommendations • References
13+14.	Report Defense	Presentation of Reports.

C.E-240 FLUID MECHANICS

Fluid Properties: Properties of fluids, Determination of viscosity and its application to lubricated bearings.

Fluid Statics: Pressure intensity and pressure head, and their measurements. Hydrostatic forces on a submerged surface and Buoyancy and floatation.

Fluid Kinematics: Classifications of fluid flow, Equation of continuity, Bernoulli's equation, Fluid mass under acceleration and Forced vertex.

Flow Measurements: Venturimeter, orifices, mouthpieces, nozzles, pilot tube and sharp crested weirs/notches. Steady flow through Pipes, Darcy weishbach equation, Losses in pipelines, Hydraulic and energy gradient, and 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, Continuity and energy equations. Steady Flow of gasses through Venturimeter and pipes.

RECOMMENDED BOOKS:

1. Fluid Mechanics for Petroleum Engineering, Elsevier Publisher.
2. Fluid Mechanics, Walther Kanfman.
3. Fluid Mechanics, with Engineering Applications, Daugherty and Franzini.
4. Engineering fluid Mechanics, K.L. Kumarr.
5. Fluid Mechanic with Engineering Applications by Robert L. Dougherty

LAB OUTLINES:

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
3. To validate the Bernoulli's theorem
4. To measure flow rate through pipe using venture meter and to calibrate it
5. To measure flow rate through an orifice and to calibrate it
6. To measure flow rate in an open channel by Notch and to calibrate it

MA- 225 DIFFERENTIAL EQUATIONS AND TRANSFORMS

1. Formation of differential equations; Solution of various types of first order differential equations; Orthogonal trajectories, Application in physical problems. Linear differential equations of second order, Complementary function and particular integral. Solution of non-homogeneous linear differential equations of second order and higher by (i) the method of undetermined coefficients (ii) the method of variation of parameters Application of second order differential equations; System of differential equations.
2. Formation of partial differential equations; Equations reducible to ordinary differential equations. Equations of the form $Pp + Qq = R$; Solution by the method of separation of variables. Wave, heat and Laplace equations.
3. Introduction to Laplace transform: Laplace transform of elementary functions, Laplace transform theorems, Inverse Laplace transform, applications to the solutions of initial value problems, Convolution theorem and applications.
4. Periodic functions, Even and odd functions. Fourier series of functions of period 2π and arbitrary period; Half range series. Complex Fourier series, Fourier transform and applications.

RECOMMENDED BOOKS:

1. "Mathematics for Engineers and Scientists" by Muhammad Iqbal Bhatti and Muhammad Nasir Ch, published by Allied Book Centre, Urdu Bazar Lahore.
2. "Advanced Engineering Mathematics" by E. Kreyszig, published by John Wiley & Sons.
3. Elementary Differential Equations and Boundary Value Problems, by Boyce and Diprima, 10th Edition, Wiley, 2012
4. "Advanced Engineering Mathematics" by H.K. Dass, published by S. Chand & Company, New Dehli.
5. "Ordinary Differential Equations" by N.A. Shah, A-one publishers, Urdu Bazar, Lahore.

FIFTH SEMESTER

Pet.E-313 WELL LOGGING

Basic Concepts: Logging environment, porosity, permeability, fluid saturations, formation density, resistivity, invasion process and resistivity profiles.

Electrical Logs: SP logs, conventional, normal, lateral and micro devices.

Nuclear Logs: Gamma ray, neutron and formation density logs Sonic or acoustic log.

Cross plots of various logs.

Quantitative Analysis: Formation water resistivity and saturation determination. Lithology and porosity determination. 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).

RECOMMENDED BOOKS:

1. Theory, Measurement & Interpretation of Well Logs by Zaki Bassiouni, SPE Textbook Series.
2. Openhole Log Analysis and Formation Evaluation by Richard M. Bateman, SPE Textbook Series.
3. Cased Hole Log Interpretation, Principles/ Applications by Schlumberger.

LAB OUTLINES:

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

Pet.E-314 RESERVOIR ENGINEERING

Fundamental reservoirs engineering, classification of reservoir flows system, geometry of the reservoir steady state and unsteady state flow, Darcy's law of fluid flow through porous media, Dimensional analysis of Darcy's law, Basic flow equations, Pressure distribution and pressure gradient for linear, radial, compressible,

slightly compressible and incompressible steady state flow conditions. Average permeability calculations for beds in series and beds in parallel for linear and radial reservoir geometry. Determination of average pressure in radial flow system, Readjustment time, Productivity index, Specific productivity index and injectivity index, Relationship between well-bore radius and flow rate in radial flow system. Continuity equation and its derivation. Diffusivity equation and its different forms. Volumetric evaluation of oil in place and empirical reserve estimates. Different type of oil drives of reservoir.

RECOMMENDED BOOKS:

1. Applied Petroleum Reservoir Engineering by Ronald E. Terry, J. Brandon Rogers
2. Reservoir Engineering Handbook by Tarek Ahmed PhD
3. Fundamental Principles of Reservoir Engineering by Brian F. Towler
4. Oil Reservoir Engineering by Pirson.
5. The Reservoir Engineering Manual by Cole

Pet.E-322 NATURAL GAS PROCESSING & PIPELINE MANAGEMENT

Introduction to natural gas industry, natural gas properties, flow and compression calculation, gas transmission, sweetening and dehydration of crude gases, distribution of gas in the city, gas stations, pipeline welding techniques, testing and welding defects, gas appliances and their design, gas flow measurements. **Corrosion detection methods (corrosion coupons, casing potential profile tool), cathodic protection, properties of galvanic anodes, design of impressed current, G/B, Criteria of CP, interference, anodic protection, corrosion control by coatings**

RECOMMENDED BOOKS:

1. Handbook of Natural Gas Engineering by Donald & Katz.
2. Petroleum Transportation Handbook by Harold Sill Bell.
3. Gas Conditioning and Processing by John M. Campbell.
4. Petroleum Reservoir Engineering Physical Properties by James W. Amyx.
5. **Corrosion Engineering by Mars G. Fontana and Norbert D. Greene.**
6. **Control of Pipeline Corrosion by A.W. Peabody.**

LAB OUTLINES

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 + ve Displacement Meters.
10. Quizzes.

MA-343 APPLIED PROBABILITY AND STATISTICS

1. Frequency distribution.
2. Mean, Median, Mode and other measures of central tendency.
3. Standard deviation and other measures of dispersion, Coefficient of dispersion.
4. Random experiments; Sample space; Definition of probability; Addition and product rules of probability; Bayer's theorem; Discrete and continuous random variables; Discrete and continuous probability distributions. Simple random processes and their probability distributions. Approximation and application of normal distribution in Engineering.
5. Central limit theorem; Simulation of random variables; Markov processes.
6. Methods of least squares, Curve fitting, Linear Regression.

RECOMMENDED BOOKS:

1. Applied Statistics for Engineers & Scientists by Devore/Farnum, 3rd Ed. Thomas.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, 8th Ed. Pearson Educational International, 2007.
3. Probability and Statistics for Engineering and Sciences, 8th Ed. CENGAGE Learning.
4. Applied Statistics and Probability for Engineers by Montgomery, Runger, 3rd Ed. John and Wiley and Sons.
5. Probability and Random Variables and Stochastic Processes, Papoulis Athanasios, 3rd Ed. McGraw-Hill Inc.
6. Introduction to Statistical Theory by Muhammad Shehzad and Sher Muhammad, Ilmi Kitab Khana Urdu Bazar Lahore.

MA-345 NUMERICAL METHODS IN COMPUTING

1. Basic concepts: round-off errors, floating point arithmetic, Convergence
2. Solution of non-linear equations: Open methods, bracketing methods for locating roots, initial approximation and convergence criteria, Newton Raphson and Secant methods.
3. Solution of linear simultaneous equations: Jacobi's method; Gauss-Seidle method;
4. Finite differences: Difference operators and tables; Differences of polynomials;
5. Interpolation and polynomial approximation: Taylor series approximation, introduction to interpolation, Newton's polynomials, Newton's divided difference table and interpolation, Lagrange's interpolation, Chebyshev polynomials.
6. Curve fitting: Least squares line, curve fitting, Interpolation by spline functions.
7. Numerical differentiation: approximating the derivative.
8. Numerical integration: Introduction to quadrature, trapezoidal, composite trapezoidal and Simpson's rules.
9. Solution of differential equations: Taylor series method, Euler's method, Runge Kutta methods.
10. Solution of partial differential equations: Hyperbolic Equations, Parabolic Equations, Elliptic equations.
11. Computations: Numerical techniques in context of engineering applications and solutions of problems by using Matlab.

RECOMMENDED BOOKS:

1. "Numerical Methods for Engineers" by S. C Chapra & R. P Canale, McGraw-Hill.
2. "Numerical Methods using MATLAB" by John H. Mathews, Pearson Education.
3. "Applied Numerical Methods for Engineers using MATLAB" by Robert J. Schilling & Sandra L. Harris, Brooks/Cole.
4. "Numerical Methods for Engineers and Scientists" by D. Joe Hoffman.

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

SIXTH SEMESTER

Pet.E-315 PETROLEUM PRODUCTION ENGINEERING-I

Introduction to Petroleum Production system; components and working principles, deliverability of oil and gas reservoir; various estimation models and their selection on the basis of flow regimes and pressure and pressure levels, Inflow performance Relationship (IPR) models; straight line and curve IPR , time dependency of the IPR models, Wellbore/ Tubing performance of oil and gas wells; single phase and multi-phase well flow models, homogeneous and separated flow models, mechanistic and empirical models, pressure traverse and pressure drop estimation, Estimating the choke performance; single phase, multiphase, critical and sub critical flow models, Deliverability of oil and gas wells; principle of system analysis (NODAL^{TM} Analysis) with simplified well configuration, use of IPR and TPR (Tubing Performance Relationship), forecast of Well production; forecasting the behavior of and oil or gas well using the principle of Nodal analysis and material balance.

RECOMMENDED BOOKS:

1. Petroleum Production Engineering-A computer assisted approach by Boyun Guo, William C. Lyoons and Ali Ghalambor, Publisher: Elsevier Science & Technology Books.
2. Petroleum Production Systems, 2nd Edition, by Michael J. Economides, A. Daniel Hill, Christine Ehlig-Economides and Ding Zhu, Published by Prentice Hall.
3. Production Optimization using NODAL^{TM} Analysis, by H. Dale Beggs, published by OGCL, Inc., Petroskills, Tulsa Oklahoma.

Pet.E-316 FIELD OPERATIONS IN PETROLEUM ENGINEERING

Drilling Operations:	Executing Fishing, Cementing and Coring operations
Well Completion:	Performing perforation job; Liner placement; Executing Sand control procedures; Conducting Well Testing operations Drill stem testing general procedure and general considerations, Test tool components and their arrangement, Analysis of test data,
Production Operations:	Procedures related to Scale Removal, Nitrogen Shooting, Coiled Tubing operations, Acidizing, Hydraulic Fracturing, Snubbing

RECOMMENDED BOOKS:

1. Advanced Well Control by David Watson, Terry Brittenham

2. Petroleum Well Construction by Michael J. Economides, Larry T. Watters
3. Applied Drilling Engineering by A. T. Bourgoye Jr., K. K. Millheim
4. Petroleum Production Systems by Michael J. Economides, A. Daniel Hill Christine Ehlig-Economides
5. Production Operations (Volume 1, 3rd Edition) by Thomas O. Allen, Alan P.Roberts
6. Natural Gas Production Engineering by Chi U. Ikoku
7. Principles of Oil Well Production by T.E.W Nind

Pet.E-317 PETROLEUM ECONOMICS & RISK ANALYSIS

Introduction: Definition and some of basic concepts; Evaluation nomenclature, time value of money, basic interest equation, present and net present value, ABC transaction, pay-out and payback time, rate of return.

Engineering Economics: Factors and their uses, Evaluation of alternatives, Depreciation, depletion, corporation taxes, Cash flow and risk analysis.

Economics of Petroleum Industry: The need of economic analysis in petroleum industry, World supply and demand. Application of the principles of engineering economics to Exploration and drilling, estimation and evaluation of oil properties, production operations, oil transportation and crude oil processing.

RECOMMENDED BOOKS:

1. **Petroleum Production Economics, Lector Charles Uran.**
2. **Worldwide Petroleum Economics, Richard D. Seba.**

Pet.E-323 DRILLING ENGINEERING-II

Factors affecting penetration rate, Directional drilling and deviation control, Definitions and reasons for directional drilling, Planning the directional well trajectory, planning the kick off and trajectory change, Deflection tools, Deviation Control, Brief introduction to horizontal drilling, General coring methods and equipment, Routine care analysis, Practical use of core analysis data Formation damage courses and prevention of formation damage.

Drill stem testing general procedure and general considerations, Test tool components and their arrangement, Analysis of test data, Oil well cementing. Primary oil well cementing techniques, Types of cement, cement additives Factors considered for the selection of cement type, Cementing volumes, Squeeze cementing and Stage cementing.

Drilling economics, Equipment cost, slim hole drilling, Air gas drilling, methods of reducing drilling cast, Payment of drilling charges and Brief introduction to offshore drilling technology. Well Control, Managed Pressure Drilling (MPD), HTHP Drilling Challenges, Drilling Optimization Considering Different Cost Factors, Fishing Operations.

RECOMMENDED BOOKS:

1. Advanced Well Control by David Watson, Terry Brittenham
2. Petroleum Well Construction by Michael J. Economides, Larry T. Watters
3. Applied Drilling Engineering by A. T. Bourgoye Jr., K. K. Millheim
4. Oil well Drilling Engineering Principles & Practice by Hussain Rabia
5. Drill String Design Handbook by Murchison Drilling Schools, Inc.
6. Horizontal Well Technology, by S.D. Joshi.
7. Well Cementing by Erik B. Nelson
8. Formulas and calculations for Drilling Production &Workover by Norton J. Lapeyrouse

LAB OUTLINES:

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

ChE-351 CHEMICAL TECHNOLOGY OF PETROLEUM

(1) Petroleum and fuels (2) Petroleum processing (a) Separation (b) Natural gas (c) Composition (d) Stripping at the well head (e) Stripping at the gathering station (f) Natural gasoline

(3) Crude oils (a) Composition (b) Types of crude oil (c) Types of processing of crude oil (d) Separation and distillation

(4) Products of primary distillation (a) Separation by vacuum distillation (b) Indicative yield from primary distillation (c) Separation by absorption (d) Petroleum processing conversion processes (e) Cracking and reforming (f) Products treatment (g) Separation of olefins

(5) Polymeric materials from petroleum (6) Inorganic chemical from petroleum (7) Synthetic fuels (8) Synthetic detergents

RECOMMENDED BOOKS:

1. The Chemical Technology of Petroleum by William A Gruse and D. R. Stevens.
2. Petroleum Refinery Engineering by W.L. Nelson.
3. From Hydrocarbons to Petrochemicals by Lewis F. Hatch& Sami Matar.

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

SEVENTH SEMESTER

Pet.E-424 WELL TESTING

Analytical solutions of the diffusivity equation for constant Rate and constant pressure under transient and pseudo–Steady State flow regimes, Skin effect due to well damage and storage. Analytical/Numerical solution of diffusivity equation including damage and storage presented in the graphical form and its use as a diagnostic plot.

Principle of superposition and Horner's approximation of Pseudo time, Pressure Build-up Analysis-Ideal Build Up test and actual Build-up test, Determination of reservoir permeability, Skin Factor, Flow Efficiency, etc. Pseudo skin, Analysis of hydraulically fractured well, Determination of Static Drainage Area Pressure by P^* and Musket Methods. Distance to fault and areal extent determination.

Modification of Liquid Equation for gases and for Multiphase Flow, Transient equation for gases including well bore damage, storage and Turbulent Factor D. Pseudo Pressure and Pseudo time determination and calculation of K, S and D by conventional and modern methods. Two phase flow testing using pseudo pressure function Draw down Analysis of Oil and Gas wells. Multi rate Testing, Multi well Testing, Use of type curves and Derivative Curves, specialized plotting for different flow regimes, Discussion of Ramey's, Griagarten's, and Bourdet's Type curves.

RECOMMENDED BOOKS:

1. Oil Well Testing by John Lee
2. Pressure Transient Testing by John Lee et. al.
3. Advances in Well Test Analysis by Earloughar.

LAB OUTLINES:

1. Class Project.
2. Class assignment on each chapter of the book taught.
3. Quizzes/ viva voces. / Surprise tests etc.
4. Presentations.
5. Software Application.

Pet.E-425 PETROLEUM PRODUCTION ENGINEERING-II

Causes of low well productivity: Reservoir dominated factors, well bore dominated factors, mechanical failures.

Well Diagnostics: production Test, deliverability tests, Transient tests (PLT), near well bore damage characterization and Problem well analysis.

Well Performance Prediction: Decline curve analysis, Material balance method, and reservoir simulators.

Well services and work over jobs: Squeeze jobs, re-perforation, well cleaning

Stimulation Techniques:

Hydraulic Fracturing: Introduction, inducing, productivity ratio, fracture area, fracturing fluid coefficients, fractures efficiency, fracturing hydraulics, fracture design and calculation.

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.

RECOMMENDED BOOKS:

1. Petroleum Production Systems by Michael J. Economides.
2. Introduction to Petroleum Production-I & II, Dr. Skimmer.
3. Surface Operation in Petroleum Production, G.V. Chillingarian, J.O. Roberstin and S Kumar.
4. Production Optimization Nodal Analysis, SPE series.

LAB OUTLINES:

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. Graphically determining the point of gas injection for a gas lift design.
10. Universal valve spacing design for a gas lift installation.

Pet.E-426 PRINCIPLES OF RESERVOIR SIMULATION

Introduction to the concept of reservoir simulation, its advantage and limitations, developing a model for single phase, slightly compressible for infinite reservoir conditions, Selection of a reservoir simulator and computer aided design.

Theory: formulation of partial differential equations governing single phase and multiphase flow in porous media, Finite difference methods and solutions of linear equations applicable to the reservoir and Direct and iterative methods.

Practice: use of a black oil simulator, Input data and data file preparation, Fine tuning for history matching and Performance prediction.

RECOMMENDED BOOKS:

1. Basic Applied Reservoir Simulation by T. Ertekin, SPE Textbook Series
2. Fundamentals of Numerical Reservoir Simulation by Donald W. Peaceman,
3. Reservoir Simulation by Calvin, C. Mattax, SPE
4. Modern Reservoir Engineering: A Simulation Approach by Henry B. Crichlow.
5. Principles of Applied Reservoir Simulation by John R. Fanchi.
6. Principles of Hydrocarbon Reservoir Simulation by Gordon W. Thomas.

LAB OUTLINES

1. **Class Project.**
2. **Class assignment on each chapter of the book taught.**
3. **Quizzes/ viva voces. / surprise tests etc.**
4. **Presentations.**
5. **Software Application.**

Ch.E-451 ENVIRONMENT & SAFETY

(1) Pollution (a) Introduction (b) General classification (c) Sources and effects of pollutants (d) Types of pollutants

(2) Types of pollution (a) Air pollution (b) Water pollution (c) Land pollution (d) Thermal pollution (e) Noise pollution (f) Radiation pollution

(3) Introduction to oil and gas field related environment (a) Environmental policy, legislation, and guidelines (b) Environmental implication of exploration and production (c) Oil and gas exploration and production in environmentally sensitive areas (d) Environment and implication of petroleum transportation

(4) General laws of transformation and their environmental implications (a) Principle of conservation of energy (b) Principle of conservation of matter (c) Principle of increase in entropy

(5) Wastewater flows and characteristics (a) Domestic wastewater (b) Industrial wastes (c) Infill ratio and inflow (d) Evaluation of wastewater (6) Wastewater collection system (7) Wastewater processing (8) Operation of wastewater system

(9) Environmental impact assessment (EIA) (a) The principles of EIA (b) Legislation and regulatory aspects of EIA (c) Principles of public participation (d) Stages of EIA (e) Impact prediction and significance assessment (f) EIA and mitigation

(10) Safety and health (a) Occupational safety and health standards (b) Safety equipment (c) Safety inspection checklist

RECOMMENDED BOOKS:

1. Environmental management in Petroleum Industry, S.K. Wahri, Tech, A.K. Agnihotri, and J.S. Sharma.
2. Managing Drilling Operations, by K. Fraser, J. Peden, and A. Kenworthy.
3. Carbonate Depositional Environment, by Peter A. Scholle, D. G. Bebout, and C. H. Moore

LAB OUTLINES:

As defined by the concerned department (who owns the subject).

Pet.E-491 PROJECT (Phase-I)

Every student/group will be required to submit a comprehensive report on an assigned problem. It will be evaluated at the end of 8th Semester.

EIGHTH SEMESTER

Pet.E-427 RESERVOIR MANAGEMENT

Material balance equation and its different forms for oil reservoirs, K_{rg}/K_{ro} (relative permeability ratio) determination from field data and its application. Performance calculation for depletion drive reservoirs and empirical prediction technique for immiscible processes. Performance of water drive reservoirs using Frontal Advance Rate theory of Buckley and Leveret. Field development planning. Water and gas fingering and coning in reservoirs. Remedial treatments for coning.

RECOMMENDED BOOKS:

1. Oil reservoir Engineering by S.J. Pirson
2. Advanced Reservoir Engineering by Tarek Ahmed
3. Applied Petroleum Reservoir Engineering, B.C. Craft & M.F. Hawkins

LAB OUTLINES

1. Class Project.
2. Class assignment on each chapter of the book taught.
3. Quizzes/ viva voces. / Surprise tests etc.
4. Presentations.

Pet.E-428 GAS RESERVOIR ENGINEERING

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, gas in place by volumetric methods.

Unit Recovery and recovery from volumetric and water drive gas reservoir and Material balance equation method: Assumptions, derivation and application.

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 and 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, Wet Gas Reservoirs, Compositional analysis with and without the composition available. Well Testing and sampling, Performance of volumetric retrograde gas condensate reservoir and Use of M.B with retrograde reservoir.

Gas Well Testing: Deliverability testing of gas wells, Fundamental equation in deliverability testing, flow after flow test, isochronal testing and modified isochronal testing.Use of pseudo pressure in deliverability testing. Real gas pseudo pressure analysis, Transient testing, Pressure Build up and pressure draw down test. Gas gathering systems; guide lines for gas well testing, Problems in gas well testing liquid loading, Hydrate formation, wet gas stream, Irregular flow and Sour (H2S) gas, Use of computer in Gas Reserves estimation and well test analysis.

RECOMMENDED BOOKS

1. Natural Gas Reservoir Engineering by Chi U-Ikoku.
2. Gas Production Operations by Dale Beggs.
3. Gas Well Testing by David.
4. Gas Well Testing by Amanat-Ullah-Chudary.
3. Gas Reservoir Engineering by John Lee.

LAB OUTLINES:

Practical, Consist of quizzes, assignments, surprise tests, and field problem given field data.

1. To estimate gas in place and reservoir by:
    i) Volumetric Method.
    ii) Pressure Decline Method.
    iii) Material Balance Equation.
    iv) Material Balance Straight Line Equation.
2. To estimate gas in place and reservoir from water drive reservoir using:
    i) Volumetric Method.
        a. Material Balance Approach.
        b. Material Balance Straight Line Approach.
3. Water influx calculation using
    i) Van EverdinginHurs't Method
    ii) Fetkovich Method.
4. Estimation of Oil & Gas in place from wet gas reservoir or single phase gas condensate reservoir.
5. Deliverability Testing includes. Three types of test such as:
    i) Back Pressure Test.
    ii) Isochronal Test.
    iii) Modified Isochronal Test.

To estimate absolute open flow potential of the gas well, performance co-efficient C, and exponent "n" to characterize the types of flow, well condition, and well test, analysis using.

i) Graphical Approach.
ii) Analytical Approach.
iii) Theoretical Approach.
iv) Pseudo Pressure Approach.

6. Transient testing analysis of gas well,

Tests are:

i) Build up in gas well.
ii) Draw-down in gas well.

Approaches applied in transient testing

i) P Approach.
ii) P^2 Approach.
iii) Φ Approach and their comparison.

Pet.E-429 PRINCIPLES OF ENHANCED OIL RECOVERY

Factors Common to all Enhanced Recovery Methods: Principle influence on the efficiency of enhanced recovery.Linear displacement.Two and three-dimensional displacement.Injection well location.Arial sweep efficiency for pattern floods.

Water Flooding: Selection of water injection as an EOR method.Displacement mechanics and performance calculations. Practical considerations in water injection projects.

Immiscible Displacement by Gas Injection: Preliminary studies and field evaluation of injection efficiency. Injection and production well completions. Surface installations; compression and treatment methods.Special applications of gas injection.

Miscible Drive: Miscible slug flooding, thermodynamic miscibility, ternary diagram. Basic methods of miscible drive.Improved methods of miscible drive.

Gas Recycling in Gas-Condensate Reservoirs: Thermodynamics of gas recycling. Sweep efficiency, well locations, production control, production equipment, and determination of operating conditions.

Thermal Recovery Methods: Data required for the study of thermal recovery methods. Hot fluid displacement.In-situ combustion.

Other Methods of Enhanced Recovery: Use of polymers. Foam injection.Use of surfactant solutions and Micro-emulsions.Carbon dioxide flooding.

Calculations: Solution of EOR problems; development of computer algorithms and example calculations.

RECOMMENDED BOOKS:

1. Enhanced Oil Recovery by DON W. Green and g. Paul Willhite
2. Enhanced Oil Recovery by Larry W. Lake
3. Water Flooding by G. Paul Willhite by DON W. Green and g. Paul Willhite
4. Hydrocarbon Phase Behavior by Tarek Ahmed
5. Dynamics of Petroleum Reservoirs under Gas Injection by Rafael Sandrea and Ralph Nielsen.

LAB OUTLINES:

1. Significance of Enhanced Oil Recovery
2. Comparison of different EOR Methods
3. Ways to select proper method for Production Enhancement
4. Surface facilities requirement for injection
5. Behavior of fluid and reservoir properties with time
6. Schemes for Water Flooding

Pet.E-492 PROJECT (Phase – II)

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

Note:

Freshly admitted students, especially foreign students, may have to take additional subjects as pre-requisites, over and above the credits required towards completion of the degree. These subjects will not be counted towards completion of their degree requirement.