

**Department  
of  
Petroleum Engineering**

Syllabi for:

1. 4 Year B.Tech Petroleum Engineering
2. 5 Year Dual Degree B.Tech in Petroleum Engineering and M.Tech in Petroleum Engineering

Effective from 2012-13



Indian School of Mines  
Dhanbad-826004  
Jharkhand, India

**COURSE STRUCTURE OF III SEMESTER B. TECH  
PETROLEUM ENGG**

(Effective from 2012– 13 session)

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs. |
|---------|------------|--|-----------|----------|----------|-------------|
| 1       | MMR 13101  | <b>Mechanical Engineering – I</b>  | 3         | 1        | 0        | 7           |
| 2.      | AMR 13101  | <b>Methods of Applied Mathematics – I</b>  | 3         | 1        | 0        | 7           |
| 3.      | GLC 13152  | <b>Geology for Petroleum Engineers</b>   | 3         | 0        | 0        | 6           |
| 4       | PEC 13101  | <b>Drilling Fluids &amp; Cements</b>   | 3         | 1        | 0        | 7           |
| 5.      | PEC 13102  | <b>Drilling Technology</b>   | 3         | 1        | 0        | 7           |
| 6.      | PEC 13201  | Petroleum Engineering Practical- I<br>(Drilling Fluids Lab)  | 0         | 0        | 2        | 2           |
| 7.      | GLC 13252  | Geology for Petroleum Engineers Practical  | 0         | 0        | 2        | 2           |
| 8.      | PEC 13801  | Project & Term Paper   | 0         | 0        | 2        | 2           |
| 9.      | HSE        | Humanities and Social Sciences Optional papers:<br>(Sessional Theory Paper)<br><b>Any one of the following</b> | 3         | 0        | 0        | 6           |
| i.      | HSE 13301  | History of Science and Technology  |           |          |          |             |
| ii.     | HSE 13302  | Philosophy of Science.   |           |          |          |             |
| iii.    | HSE 13303  | Gandhian Studies   |           |          |          |             |
| iv.     | HSE 13304  | Oral Communication Skills  |           |          |          |             |
| v.      | HSE 13305  | Oral Presentation Skills   |           |          |          |             |
| vi.     | HSE 13306  | Literary Communication   |           |          |          |             |
| vii.    | HSE 13307  | Present History of India   |           |          |          |             |
|         |            | <b>Total</b>   | <b>18</b> | <b>4</b> | <b>6</b> | <b>46</b>   |

**COURSE STRUCTURE OF IV SEMESTER B. TECH  
PETROLEUM ENGG.  
(Effective from 2012– 13 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | MMR 14101  | Mechanical Engineering – II                                     | 3         | 1        | 0        | 7                     |
| 2.      | AMR 14101  | Numerical and Statistical Methods                               | 3         | 1        | 0        | 7                     |
| 3.      | PEC14101   | Petroleum Production Operations-I                               | 3         | 1        | 0        | 7                     |
| 4       | PEC14102   | Elements of Reservoir Engineering                               | 3         | 1        | 0        | 7                     |
| 5.      | MSR 14151  | Managerial Economics  | 3         | 0        | 0        | 6                     |
| 6.      | MER 22131  | Surveying (Sessional Theory Paper)                              | 3         | 0        | 0        | 6                     |
| 7.      | HSC 14306  | English for Professional Communication (Sessional Theory Paper) | 3         | 0        | 0        | 6                     |
| 8.      | PEC14201   | Petroleum Engineering Practical-II (Reservoir Engineering Lab)  | 0         | 0        | 2        | 2                     |
| 9.      | MER 22231  | Surveying Practical   | 0         | 0        | 2/2      | 1                     |
| 10.     | PEC 14601  | Educational Excursion   | 0         | 0        | 0        | (2)                   |
| 11.     | PEC 14801  | Project and Term Paper  | 0         | 0        | 2        | 2                     |
| 12.     | PEC14501   | Composite Viva-Voce   | 0         | 0        | 0        | (4)                   |
| 13.     | SWC 14701  | Co-curricular Activities  | 0         | 0        | 0        | (3)                   |
|         |            | <b>Total</b>  | <b>21</b> | <b>4</b> | <b>5</b> | <b>51+(9)<br/>=60</b> |

**COURSE STRUCTURE OF V SEMESTER B. TECH  
PETROLEUM ENGG.  
(Effective from 2013 – 14 session)**

| <b>Sl. No.</b> | <b>Course No.</b> | <b>Name of the course</b>  | <b>L</b>  | <b>T</b> | <b>P</b> | <b>Credit Hrs.</b> |
|----------------|-------------------|--|-----------|----------|----------|--------------------|
| 1              | PEC 15101         | Applied Petroleum Reservoir Engineering and Management                   | 3         | 1        | 0        | 7                  |
| 2.             | PEC 15102         | Petroleum Production Operations-II                                       | 3         | 1        | 0        | 7                  |
| 3.             | GLC 15153         | Sedimentary and Petroleum Geology  | 3         | 0        | 0        | 6                  |
| 4              | ACC 15103         | Physical Chemistry   | 3         | 0        | 0        | 6                  |
| 5.             | AMR 15101         | Methods of Applied Mathematics – II                                      | 3         | 1        | 0        | 7                  |
| 6.             | PEC 15303         | Reservoir Fluid Thermodynamics (Sessional Theory Paper)                  | 3         | 0        | 0        | 6                  |
| 7.             | PEC 15201         | Petroleum Engineering Practical – III (Production & Product Testing Lab) | 0         | 0        | 2        | 2                  |
| 8.             | GLC 15253         | Sedimentary and Petroleum Geology Practical                              | 0         | 0        | 2        | 2                  |
| 9.             | ACC 15203         | Physical Chemistry Practical   | 0         | 0        | 2/2      | 1                  |
| 10.            | PEC 15801         | Project and Term Paper   | 0         | 0        | 4        | 4                  |
|                |                   | <b>Total</b>   | <b>18</b> | <b>3</b> | <b>9</b> | <b>48</b>          |

**COURSE STRUCTURE OF VI SEMESTER B.TECH  
PETROLEUM ENGG.  
(Effective from 2013 – 14 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | PEC16101   | Directional Drilling  | 3         | 1        | 0        | 7                     |
| 2.      | PEC16102   | Petroleum Formation Evaluation  | 3         | 1        | 0        | 7                     |
| 3.      | PEC16103   | Natural Gas Engineering   | 3         | 1        | 0        | 7                     |
| 4       | AMR 16101  | Advanced Numerical Methods  | 3         | 1        | 0        | 7                     |
| 5.      | EER 16101  | Applied Electrical Engineering  | 3         | 1        | 0        | 7                     |
| 6.      | ECR 14101  | Microprocessors & Applications (Sessional Theory Paper)                                       | 3         | 0        | 0        | 6                     |
| 7.      | PEC16201   | Petroleum Engineering Practical – IV<br>Process Lab Practical/<br>Simulation and Modeling Lab | 0         | 0        | 3        | 3                     |
| 8.      | PEC16501   | Composite Viva Voce   | 0         | 0        | 0        | (4)                   |
| 9.      | PEC16801   | Project & Term Paper  | 0         | 0        | 4        | 4                     |
|         |            | <b>Total</b>  | <b>18</b> | <b>5</b> | <b>7</b> | <b>48+(4)<br/>=52</b> |

**COURSE STRUCTURE OF VI SEMESTER DUAL DEGREE  
COURSE  
(B.TECH PETROLEUM ENGINEERING. & M.TECH  
PETROLEUM ENGINEERING)  
(Effective from 2013 – 14 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | PEC16101   | Directional Drilling  | 3         | 1        | 0        | 7                     |
| 2.      | PEC16102   | Petroleum Formation Evaluation  | 3         | 1        | 0        | 7                     |
| 3.      | PEC16103   | Natural Gas Engineering   | 3         | 1        | 0        | 7                     |
| 4       | AMR 16101  | Advanced Numerical Methods  | 3         | 1        | 0        | 7                     |
| 5.      | EER 16101  | Applied Electrical Engineering  | 3         | 1        | 0        | 7                     |
| 6.      | PEC 52301  | Energy Management & Policy (Sessional Theory Paper)   | 1         | 2        | 0        | 4                     |
| 7.      | PEC16201   | Petroleum Engineering Practical – IV<br>Process Lab Practical/<br>Simulation and Modeling Lab | 0         | 0        | 3        | 3                     |
| 8.      | PEC16501   | Composite Viva Voce   | 0         | 0        | 0        | (4)                   |
| 9.      | PEC16801   | Project and Term Paper  | 0         | 0        | 4        | 4                     |
|         |            | <b>Total</b>  | <b>16</b> | <b>7</b> | <b>7</b> | <b>46+(4)<br/>=50</b> |

**COURSE STRUCTURE OF VII SEMESTER B.TECH  
PETROLEUM ENGG.**

**(Effective from 2014– 15 session)**

| Sl. No. | Course No.             | Name of the course   | L         | T        | P        | Credit Hrs.           |
|---------|------------------------|--|-----------|----------|----------|-----------------------|
| 1       | PEC17101               | Oil and Gas Well Testing   | 3         | 1        | 0        | 7                     |
| 2.      | PEC 17102              | Offshore Drilling and Petroleum Production Practices                         | 3         | 1        | 0        | 7                     |
| 3.      | GPD 17163<br>GLD 17154 | Petroleum Exploration – Geophysical Methods (Section A).                     | 2         | 0        | 0        | 8                     |
|         |                        | Petroleum Exploration – Geological Methods (Section B)                       | 2         | 0        | 0        |                       |
| 4       | MSC 17152              | Industrial Engg. And Management  | 3         | 0        | 0        | 6                     |
| 5.      |                        | Elective paper   | 3         | 0        | 0        | 6                     |
| 6.      | PEC 17301              | Health Safety and Environment in Petroleum Industry (Sessional Theory paper) | 3         | 0        | 0        | 6                     |
| 7.      | PEC17801               | Petroleum Engineering Projects   | 0         | 0        | 6        | 6                     |
| 8.      | PEC17901               | Vocational Training*   | 0         | 0        | 0        | (5)                   |
| 5.      |                        | <i><b>ELECTIVES: ANY ONE OF FOLLOWING</b></i>                                |           |          |          |                       |
| i.      | PEE17101               | Unit Operations for Petroleum Industry                                       |           |          |          |                       |
| ii.     | PEE17102               | Transportation and Marketing of Petroleum and Petroleum Products             |           |          |          |                       |
| iii.    | PEE17103               | Well Performance   |           |          |          |                       |
| iv.     | PEE17104               | Oil shale and Shale Gas  |           |          |          |                       |
| v.      | CHE 17106              | Polymer Science and Technology   |           |          |          |                       |
| vi.     | CHE 17107              | Multi-Component Separation   |           |          |          |                       |
|         |                        | <b>Total</b>   | <b>19</b> | <b>2</b> | <b>6</b> | <b>46+(5)=<br/>51</b> |

\* Vocational Training taken at the end of VI semester is credited in VII Semester.

**COURSE STRUCTURE OF VII SEMESTER DUAL DEGREE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2014– 15 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs.           |
|---------|------------|--|-----------|----------|----------|-----------------------|
| 1       | PEC17101   | Oil and Gas Well Testing   | 3         | 1        | 0        | 7                     |
| 2.      | PEC 17102  | Offshore Drilling and Petroleum Production Practices                         | 3         | 1        | 0        | 7                     |
| 3.      | GPD 17163  | Petroleum Exploration - Geophysical Methods (Section A).                     | 2         | 0        | 0        | 8                     |
|         | GLD 17154  | Petroleum Exploration - Geological Methods (Section B)                       | 2         | 0        | 0        |                       |
| 4       | MSC 17152  | Industrial Engg. and Management  | 3         | 0        | 0        | 6                     |
| 5.      |            | Elective Paper   | 3         | 0        | 0        | 6                     |
| 6.      | PEC 17301  | Health Safety and Environment in Petroleum Industry (Sessional Theory paper) | 3         | 0        | 0        | 6                     |
| 7.      | PEC 17801  | Petroleum Engineering Projects   | 0         | 0        | 6        | 6                     |
| 8.      | PEC17901   | Vocational Training*   | 0         | 0        | 0        | (5)                   |
| 5.      |            | <b>ELECTIVES: ANY ONE OF FOLLOWING</b>                                       |           |          |          |                       |
| i.      | PEE17103   | Well Performance   |           |          |          |                       |
| ii.     | PEE 17104  | Oil shale and Shale Gas  |           |          |          |                       |
| iii.    | CHE 17106  | Polymer Science and Technology   |           |          |          |                       |
| iv.     | CHE 17107  | Multi-Component Separation   |           |          |          |                       |
| v.      | CHE 17108  | Corrosion Engineering  |           |          |          |                       |
|         |            | <b>Total</b>   | <b>19</b> | <b>2</b> | <b>6</b> | <b>46+(5)=<br/>51</b> |

\* Vocational Training taken at the end of VI semester is credited in VII Semester.



**COURSE STRUCTURE OF VIII SEMESTER B.TECH  
PETROLEUM ENGG.  
(Effective from 2014 – 15 session)**

| Sl. No. | Course No. | Name of the course                            | L         | T        | P        | Credit Hrs.            |
|---------|------------|---|-----------|----------|----------|------------------------|
| 1       | PEC 18101  | Petroleum Engineering Design                  | 3         | 1        | 0        | 7                      |
| 2.      | PEC18102   | Enhanced Oil Recovery Techniques              | 3         | 1        | 0        | 7                      |
| 3.      | PEC18103   | Reservoir Modeling and Simulation             | 3         | 1        | 0        | 7                      |
| 4       | PEC18104   | Pipeline Engineering                          | 3         | 1        | 0        | 7                      |
| 5.      |            | Elective Paper                                | 3         | 1        | 0        | 7                      |
| 6.      | PEC18801   | Petroleum Engg. Projects and Seminar          | 0         | 0        | 6        | 6                      |
| 7.      | PEC18501   | Composite Viva Voce                           | 0         | 0        | 0        | (4)                    |
|         |            | ELECTIVES: ANY ONE OF FOLLOWING               |           |          |          |                        |
| i.      | PEE18101   | Oil and Gas Processing System Design          |           |          |          |                        |
| ii.     | PEE18102   | Coal Bed Methane & Gas Hydrates               |           |          |          |                        |
| iii.    | PEE18103   | Advanced Offshore Engineering                 |           |          |          |                        |
| iv.     | PEE18104   | Oil and Gas Marketing and Resource Management |           |          |          |                        |
| v.      | PEE18105   | Deep Sea Production System                    |           |          |          |                        |
| iv.     | CHC18102   | Petroleum Refining and Petrochemicals         |           |          |          |                        |
| v.      | CHC16103   | Process Equipment and Piping Design           |           |          |          |                        |
| vi.     | CHC16105   | Process Control and Instrumentation           |           |          |          |                        |
|         |            | <b>Total</b>                                  | <b>15</b> | <b>5</b> | <b>6</b> | <b>41+(4)<br/>= 45</b> |

**COURSE STRUCTURE OF VIII SEMESTER DUAL DEGREE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2014– 15 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs.            |
|---------|------------|--|-----------|----------|----------|------------------------|
| 1       | PEC 18101  | Petroleum Engineering Design                               | 3         | 1        | 0        | 7                      |
| 2.      | PEC18102   | Enhanced oil Recovery Techniques                           | 3         | 1        | 0        | 7                      |
| 3.      | PEC52101   | Well Intervention and Well Stimulation Techniques          | 3         | 1        | 0        | 7                      |
| 4       | PEC52102   | Oil and Gas Marketing and Resource Management              | 3         | 1        | 0        | 7                      |
| 5.      |            | <b>Elective (any one)</b>                                  | <b>3</b>  | <b>1</b> | <b>0</b> | <b>7</b>               |
| 6.      | PEC 18301  | Reservoir Modeling and Simulation (Sessional Theory Paper) | 3         | 1        | 0        | 7                      |
| 7.      | PEC18501   | Composite Viva Voce  | 0         | 0        | 0        | (4)                    |
| 8.      | PEC 18801  | Petroleum Engg. Projects and Seminar                       | 0         | 0        | 6        | 6                      |
|         |            | <b>ELECTIVES: ANY ONE OF FOLLOWING</b>                     |           |          |          |                        |
| i.      | PEE 18101  | Oil and Gas Processing System Design                       |           |          |          |                        |
| ii.     | PEE18102   | Coal Bed Methane & Gas Hydrates                            |           |          |          |                        |
| iii.    | PEE18106   | Subsea Integrity Management                                |           |          |          |                        |
| iv.     | PEE18107   | Offshore Structures Design                                 |           |          |          |                        |
| v.      | PEE52109   | Fluid Flow through Porous Media                            |           |          |          |                        |
| vi.     | PEE52110   | Carbon Capture and Sequestration                           |           |          |          |                        |
| vii.    | CHC18102   | Petroleum Refining and Petrochemicals                      |           |          |          |                        |
| viii.   | CHC 6103   | Process Equipment and Piping Design                        |           |          |          |                        |
| ix.     | CHC16105   | Process Control and Instrumentation                        |           |          |          |                        |
|         |            | <b>Total</b>   | <b>18</b> | <b>6</b> | <b>6</b> | <b>48+(4)<br/>= 52</b> |

**COURSE STRUCTURE OF IX SEMESTER DUAL DEGREE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2015– 16 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs.                  |
|---------|------------|--|-----------|----------|----------|------------------------------|
| 1.      | PEC 51102  | Oil and Gas Property Evaluation, Economics and Risk Analysis | 3         | 1        | 0        | 7                            |
| 2.      | PEC 51103  | Advanced Well Completion Practices                           | 3         | 1        | 0        | 7                            |
| 3.      | PEE 51101  | Oil and Gas Field Development and Planning                   | 3         | 1        | 0        | 7                            |
| 4.      |            | <b>Elective – I</b>  | <b>3</b>  | <b>1</b> | <b>0</b> | <b>7</b>                     |
| 5.      |            | <b>Elective – II</b>   | <b>3</b>  | <b>1</b> | <b>0</b> | <b>7</b>                     |
| 6.      | PEC 19801  | Project & Dissertation (Interim)                             | 0         | 0        | 8        | 8                            |
| 8.      | PEC 19802  | Seminar & Viva Voce  | 0         | 0        | 0        | (4)                          |
|         |            | <b>Elective Papers</b> (Any Two of the following)            |           |          |          |                              |
| i.      | PEE 51102  | Multilateral & Horizontal Well Technology                    |           |          |          |                              |
| ii.     | PEE 51103  | Well Servicing   |           |          |          |                              |
| iii.    | PEE 51104  | Integrated Reservoir Management                              |           |          |          |                              |
| iv.     | PEE 51105  | Drilling System Design                                       |           |          |          |                              |
| v.      | CHC 17101  | Chemical Process Plant Design and Economics                  |           |          |          |                              |
| vi.     | CHC 17102  | Transport Phenomena  |           |          |          |                              |
|         |            | <b>Total</b>   | <b>15</b> | <b>5</b> | <b>8</b> | <b>43 +<br/>(4) =<br/>47</b> |

**COURSE STRUCTURE OF X SEMESTER DUAL DEGREE  
COURSE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2015– 16 session)**

| <b>Sl. No.</b> | <b>Course No.</b> | <b>Name of the course</b>                                | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit Hrs.</b> |
|----------------|-------------------|--|----------|----------|----------|--------------------|
| 1              | PEC110801         | Project & Dissertation                                   | 0        | 0        | 0        | (20)               |
| 2.             | PEC 11090         | Seminar on Dissertation                                  | 0        | 0        | 0        | (5)                |
| 3.             | PEC110802         | Viva Voce on Dissertation                                | 0        | 0        | 0        | (10)               |
| 4              | PEC10903          | Evaluation of Teaching Assignment/ Development Work etc. | 0        | 0        | 0        | (5)                |
|                |                   | <b>Total</b>   |          |          |          | <b>40</b>          |

**COURSE STRUCTURE OF III SEMESTER B. TECH  
PETROLEUM ENGG  
(Effective from 2012– 13 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs. |
|---------|------------|--|-----------|----------|----------|-------------|
| 1       | MMR 13101  | Mechanical Engineering – I   | 3         | 1        | 0        | 7           |
| 2.      | AMR 13101  | Methods of Applied Mathematics – I   | 3         | 1        | 0        | 7           |
| 3.      | GLC 13152  | Geology for Petroleum Engineers  | 3         | 0        | 0        | 6           |
| 4       | PEC 13101  | Drilling Fluids & Cements  | 3         | 1        | 0        | 7           |
| 5.      | PEC 13102  | Drilling Technology  | 3         | 1        | 0        | 7           |
| 6.      | PEC 13201  | Petroleum Engineering Practical- I<br>(Drilling Fluids Lab)  | 0         | 0        | 2        | 2           |
| 7.      | GLC 13252  | Geology for Petroleum Engineers Practical  | 0         | 0        | 2        | 2           |
| 8.      | PEC 13801  | Project & Term Paper   | 0         | 0        | 2        | 2           |
| 9.      | HSE        | Humanities and Social Sciences Optional papers:<br>(Sessional Theory Paper)<br><b>Any one of the following</b> | 3         | 0        | 0        | 6           |
| i.      | HSE 13301  | History of Science and Technology  |           |          |          |             |
| ii.     | HSE 13302  | Philosophy of Science.   |           |          |          |             |
| iii.    | HSE 13303  | Gandhian Studies   |           |          |          |             |
| iv.     | HSE 13304  | Oral Communication Skills  |           |          |          |             |
| v.      | HSE 13305  | Oral Presentation Skills   |           |          |          |             |
| vi.     | HSE 13306  | Literary Communication   |           |          |          |             |
| vii.    | HSE 13307  | Present History of India   |           |          |          |             |
|         |            | <b>Total</b>   | <b>18</b> | <b>4</b> | <b>6</b> | <b>46</b>   |

## COURSE SYLLABUS

|                               |   |               |               |               |
|-------------------------------|---|---------------|---------------|---------------|
| <b>COURSE NO.</b><br>AMR13101 | <b>COURSE NAME</b><br>METHODS OF APPLIED<br>MATHEMATICS – I | <b>L</b><br>3 | <b>T</b><br>1 | <b>P</b><br>0 |
|-------------------------------|---|---------------|---------------|---------------|

### **COURSE CONTENT:**

Introduction to Strength of Materials; Stress-strain diagram; Elastic constants and their relations, Thermal stresses and strains; Stresses in oblique planes- Principal stresses and principal planes. Theory of simple bending; Deflection of beams-integration method and moment area method.

Analysis of stresses in pressure vessels - thin and thick cylinders. Torsion of solid and hollow circular shafts.

Introduction to theory of Machines; Basic concepts; degrees of freedom, kinematic constraints, linkages, mechanisms. Different types of gears, gear trains, reduction ratio and torque assessment, application of gearboxes. Basic principles and constructions of governors, flywheels, brakes, clutches and dynamometers.

Case study based on laboratory setups on the above broad areas.

|                                |  |               |               |               |
|--------------------------------|--|---------------|---------------|---------------|
| <b>COURSE NO.</b><br>MMR 13101 | <b>COURSE NAME</b><br>MECHANICAL ENGINEERING–I | <b>L</b><br>3 | <b>T</b><br>1 | <b>P</b><br>0 |
|--------------------------------|--|---------------|---------------|---------------|

### **COURSE CONTENT:**

#### **Part-I:**

#### **Complex Variables:**

Limit, continuity and differentiability of function of complex variables. Analytic functions. Cauchy-Riemann's equations, Cauchy's integral theorem, Morera's theorem, Cauchy's integral formula, Taylor's and Laurent's series, singularities, Residue theorem, contour integration.

#### **Special Functions:**

Solution of Bessel equation, recurrence relations and generating function for  $J_n x$ , orthogonal property and integral representation of  $J_n x$ . Solution for Legendre equation, Legendre polynomial, Rodrigue's formula, orthogonality property and generating function for  $P_n x$ .

**Part-II:****Laplace Transform:**

Laplace transform of simple functions, properties of Laplace transform, t-multiplication and t-division theorems, Laplace Transform of derivatives, integrals and periodic functions. Inverse Laplace transform and its properties, convolution theorem. Use of Laplace transform in evaluating complicated and improper integrals and solution of ordinary differential equations related to engineering problems.

**Partial Differential Equations:**

Classification of partial differential equations, solutions of one dimensional wave equation, one dimensional unsteady heat flow equation and two dimensional steady heat flow equation by variable separable method with reference to Fourier trigonometric series.

| <b>COURSE</b>   | <b>COURSE NAME</b>                     | <b>L</b> | <b>T</b> | <b>P</b> |
|-----------------|--|----------|----------|----------|
| <b>GLC13152</b> | <b>GEOLOGY FOR PETROLEUM ENGINEERS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:****Mineralogy and Petrology**

1. Minerals: General properties; Classification of minerals and properties of common rock-forming minerals.
2. Petrology: Rocks; Classification and description of some common rocks.
3. **Stratigraphy**
4. Principles of stratigraphy; Concepts of palaeontology; Fossils, their mode of preservation and significance as indices of age and climate; Concept of index fossils; Broad stratigraphic subdivisions and associated rock types of important coal belts and oil fields of India.
5. **Structural Geology**
6. Interpretation of topographic (structural) maps; Attitude of planar and linear structures; Effects of topography on outcrops. Unconformities, folds, faults and joints - their nomenclature, classification and recognition. Forms of igneous intrusions - dyke, sill and batholith. Effects of folds and fractures on strata and their importance in exploration activities.

| COURSE NO. | COURSE NAME                 | L | T | P |
|------------|-----------------------------|---|---|---|
| PEC 13101  | DRILLING FLUIDS AND CEMENTS | 3 | 1 | 0 |

**COURSE CONTENT:**

**A. Drilling Fluids:**

1. **Overview of Drilling Fluids:** Clay chemistry and its application to drilling fluids, Types of clays, hydration, flocculation, aggregation and dispersion.
2. **Classification, Types and applications of Drilling Fluids:** Water based, oil based, emulsion based, polymer based, Surfactant based, Foam based and Aerated drilling fluids.
3. **Drilling Fluid Characteristics:** Basic functions, properties, maintenance and treatments of drilling fluids.
4. Drilling fluid calculations.
5. **Rotary Drilling Hydraulics :** Rheology of drilling fluids, Pressure loss calculations and Rig hydraulics.
6. Mud logging.

**B. Cements:**

1. **Cementing, Cements & cement slurry:** Objectives of cementing, oil well cements, Classification of cement, Slurry design, Slurry additives, Factors influencing cement slurry design, Cementing equipments.
2. **Cementing Methods:** Primary cementing, Stage cementing, Liner cementing, Plugging, Squeeze Cementing techniques in practice. Deep well cementing, Characteristics of good quality cementation.
3. Cementing calculations.

| COURSE NO. | COURSE NAME         | L | T | P |
|------------|---------------------|---|---|---|
| PEC 13102  | DRILLING TECHNOLOGY | 3 | 1 | 0 |

**COURSE CONTENT:**

1. **Well Planning:** Introduction to oil well drilling, Drilling planning approaches.
2. **Rotary Drilling Method:** Rig parts, selection and general layout.



3. **Drilling Operations & Practices:** Hoisting, circulation, Rotation, power plants and Power transmission, Rig wire line system handling & storage.
4. **Casing Design:** Design of casing string, Liner design and setting, Casing landing practices, Buckling criteria and Calculation of well head loads. Casing while drilling.
5. **Drill String:** Parts function and design.
6. **Drill Bits:** Classification and design criteria of drag, rotary, roller, diamond and PDC bits.
7. **Coring:** Different methods of core drilling.
8. **Well Problems and Solutions:** Fatigue failure, Pipe sticking, Lost-circulation, Sloughing shale, Swabbing, surge, gas cap drilling, Blow out and kick control.
9. **Oil Well Fishing:** Fish classification, tools and techniques.

| COURSE NO. | COURSE NAME                       | L | T | P |
|------------|-----------------------------------|---|---|---|
| HSE 13301  | HISTORY OF SCIENCE AND TECHNOLOGY | 3 | 0 | 0 |

#### **COURSE CONTENT:**

1. Introduction to the History of Science- Emergence and Character of Science, Science in the Ancient world, The Dawn of History: Babylon-China-India, Classical Science.
2. Greek and Romans, Science during the Medieval Age, The Dark Age, The Arabian and the Indian Science, Birth of Modern Science: Renaissance and Scientific Revolution, Eighteen-Century Science, Application of Science, Industrial Revolution, Causes and Consequences, Present Day Science, Impact of Science on Society, Growth of Indian Mineral Industry, including Mining and Petroleum Industry.

| COURSE NO. | COURSE NAME           | L | T | P |
|------------|-----------------------|---|---|---|
| HSE 13302  | PHILOSOPHY OF SCIENCE | 3 | 0 | 0 |

#### **COURSE CONTENT:**

1. Introduction: Rationale for study of Philosophy of Science prevalence of imbalances; General Approach, Nature, Scope and Relation of the subject with Historical Development.; Science and Philosophy vis-à-vis need for Intellectual and Moral Balance.

2. Scientific and Philosophical approaches to knowledge development and Knowledge application (Emphasis on Earth and Mineral Sciences)
3. Foundations of Philosophy: Nature, Concept, Scope, Methodology, Divisions and Implications.
4. Concept and Nature of Science: Origin/Aim, Methodology, Scope and Development: Nature of Scientific Methods; Movements; Scientific Thought; Divisions of Science; Scientific Laws and Scientific Explanations.
5. Convergence of Science and Philosophy: Unified Theory; Space Time Relationship; Patterns of Change; Deeper issues and broad involvements of Science; Status of Scientific Proposition and Concepts of Entities, Epistemic and Ontological aspects.
6. Philosophical Analysis and Scientific Practice: Philosophical Base of Eastern Thought and their parallel in Science; The Essential of Unity between Eastern Thought Pattern and Western Science, Need for harmony between Intuitive Thought and Rational Knowledge; Philosophers of Science with reference to Western Thought, Philosophers of Science – Western and Eastern.
7. Inter-relationship of Science and Culture: Science and Aesthetics, Science and Human Values, Science in the full tradition, Science vis-à-vis Human Conduct and Social Affairs; Social Significance of Science; Implications of Philosophy of Science for a new peaceful Social Order, Synthesis of Eastern “World View” and Western “Materialism”.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>      | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-------------------------|----------|----------|----------|
| <b>HSE 13303</b>  | <b>GANDHIAN STUDIES</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction to Gandhi's Life and Philosophy; Fundamentals of Gandhian Economics; Gandhi's Concept of Human Nature, Perfectibility of Man; Ethical Ideas of Gandhi- Truth, Ahimsa, Brahmacharya, Non-stealing, Non-possession and Voluntary Poverty. Gandhi's Interpretation of History and Society.

2. Public Welfare and Sarvadoyo Philosophy – Antyodaya; Sarvadoya Socialism and Capitalism; Nature of Sarvodaya’s Economy from Gandhi to Vinobha; Concept of Production and Distribution in Sarvodaya Economy and it’s Utility in our Socio- economic and Scientific/ Technical development; Non- violent Economy vis-à-vis Centralized Industrial Economy and Rural Economy.
3. Study of the Current Industrial Problems and Priorities as against the Gandhian Ideology.
4. Gandhian approach to Man-power Management, Prospects, Co-operative Production and Consumption, Rural Entrepreneurship, Finance, Plan changes for helping the disadvantaged sections of the society.
5. Man and machine- Problems of Automation and Gandhi’s View.
6. Gandhi’s Political Views: The State as an organ of Violence, Political Sovereignty of the People, Decentralization of Political Power, Concept of Freedom, The Idea of Political Condition- Ram Rajya.
7. Satyagraha: The Importance of Truth Force, Self Suffering, Winning over the opponent by Love.
8. Relevance of Gandhian Ideas in the contemporary Economic and Political situation.
9. Note: Use of Video Films shall be made to support the classroom teaching.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>               | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|----------------------------------|----------|----------|----------|
| <b>HSE 13304</b>  | <b>ORAL COMMUNICATION SKILLS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

The nature, purpose and characteristics of good conversation, Phonological forms to use in speech, Developing conversation skills with a sense of stress, intonation , and meaning, Use of question tags, Starting, maintaining and finishing conversations, Standard conversational exchange, Spoken language idioms, Effective listening and attention to others, Gestures and body language, Do's and Don'ts in conversation, Telephonic conversation, Functions of English in conversation: introductions, greetings, clarifications, explanations, interruptions, opinions, Agreement and

disagreement, complaints, apologies, Participating in informal discussions and situations, Using information to make some decision, i.e., making social arrangements with friends, Reproducing information in some form (question/answer summarizing, oral reporting, etc.)

| <b>COURSE NO.</b> | <b>COURSE NAME</b>              | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---------------------------------|----------|----------|----------|
| <b>HSE 13305</b>  | <b>ORAL PRESENTATION SKILLS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

### **COURSE CONTENT:**

Characteristics of good presentation, Assessing the audience and its needs, Planning a presentation, Different presentation styles, Using the presentation matrix, The informative presentation, The demonstrative presentation, The persuasive presentation, Presentation structure and design, Materials and logistics, Visual aids and their development and use, Rehearsing and delivering, Using performance techniques, Overcoming anxiety and stress, Opening and closing, Getting and maintaining audience attention, Using language to optimal effect, Body language and gestures, Linguistic aspects: introducing, sequencing, signaling, quoting, clarifying and summarizing, Handling questions.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>            | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-------------------------------|----------|----------|----------|
| <b>HSE 13306</b>  | <b>LITERARY COMMUNICATION</b> | <b>3</b> | <b>0</b> | <b>0</b> |

### **COURSE CONTENT:**

1. Exposer to recent literary and creative trends in English and their relation with the values, culture and norms of behaviour; linguistic and cultural process.
2. What and how of literary communication for improvement of proficiency in the use of English language
3. Analysis and interpretation of five to six recent short stories from different parts of the world to make the sensitive and different intensification of the skills of conceiving the ideas, situations and solutions, and rendering them into appropriate expression on a higher plane of finish.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>              | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---------------------------------|----------|----------|----------|
| <b>HSE 13307</b>  | <b>PRESENT HISTORY OF INDIA</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Idea of a Nation: Defining Nation, Citizenship Duties, Profession, Society, Modern Nation- State as it emerged after 1789, The Socio-Economic context of the new 'Nation'.
2. The Modern Individual: Transition from pre-modern definition and social location of Individuals to the growth of idea of free Individual, Social Contract, The Duties of an Individual, Atomization of Individual and a critique to it.
3. Colonial Rule in India: Colonial redefinition of Nation, Individual, Society in India- a critique of Pre-colonial mode of life by the colonial theorists, The 'Progressive' colonial alternatives, the ambiguity in colonial 'Image' of India.
4. Nation and the Nationalists: The Ideological Contestation of Colonial Images by the Nationalists, Critique of Colonialism by Gandhi, Nehru, Tagore, S.C. Bose, Aurobindo Ghosh, M.N. Roy, J.P. Narayan. Problematizing Colonial Ideas, Impact of Colonialism in India, Problems with the Nationalist Critique of Colonialism. Colonialists and Nationalists on the idea of 'Science', 'Modernity' and 'Development'.
5. Re-inscribing Indian Femininity: Changing Views of Indian Femininity vis-à-vis female Sexuality.
6. Threats of Neo-Colonialism: The Challenges to the Nation, Post Colonial Critique of Colonialism and Nationalism, Individual and Society in a Changing World Order.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                         | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEC 13201</b>  | <b>PETROLEUM ENGINEERING<br/>PRACTICAL</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE CONTENT:**

1. Practical related to measurements of drilling fluids properties like mud weight, Plastic viscosity, Gel strength, Filtration loss, Sand content etc.
2. Practical related to the setting point and consistency of cement slurry.

|                   |  |          |          |          |
|-------------------|--|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                     | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>GLC 13252</b>  | <b>GEOLOGY FOR PETROLEUM ENGINEERS</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE CONTENT:**

1. Study of physical properties of minerals.
2. Study of common rocks with reference to their structures, mineral composition and uses.
3. Interpretation of Topographic Maps
4. Interpretation of geological Maps - 1 : Attitude and Cross sections
5. Outcrop completion - 1 : One point problem and V - rule
6. Outcrop completion - 2 : Three point problem
7. Interpretation of geological Maps - 2 Unconformable beds
8. Interpretation of geological Maps - 3: Folded beds
9. Interpretation of geological Maps - 4: Faults and dykes

**COURSE STRUCTURE OF IV SEMESTER B. TECH  
PETROLEUM ENGG.  
(Effective from 2012– 13 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | MMR 14101  | Mechanical Engineering – II                                     | 3         | 1        | 0        | 7                     |
| 2.      | AMR 14101  | Numerical and Statistical Methods                               | 3         | 1        | 0        | 7                     |
| 3.      | PEC14101   | Petroleum Production Operations-I                               | 3         | 1        | 0        | 7                     |
| 4       | PEC14102   | Elements of Reservoir Engineering                               | 3         | 1        | 0        | 7                     |
| 5.      | MSR 14151  | Managerial Economics  | 3         | 0        | 0        | 6                     |
| 6.      | MER 22131  | Surveying (Sessional Theory Paper)                              | 3         | 0        | 0        | 6                     |
| 7.      | HSC 14306  | English for Professional Communication (Sessional Theory Paper) | 3         | 0        | 0        | 6                     |
| 8.      | PEC14201   | Petroleum Engineering Practical-II (Reservoir Engineering Lab)  | 0         | 0        | 2        | 2                     |
| 9.      | MER 22231  | Surveying Practical   | 0         | 0        | 2/2      | 1                     |
| 10.     | PEC 14601  | Educational Excursion   | 0         | 0        | 0        | (2)                   |
| 11.     | PEC 14801  | Project and Term Paper  | 0         | 0        | 2        | 2                     |
| 12.     | PEC14501   | Composite Viva-Voce   | 0         | 0        | 0        | (4)                   |
| 13.     | SWC 14701  | Co-curricular Activities  | 0         | 0        | 0        | (3)                   |
|         |            | <b>Total</b>  | <b>21</b> | <b>4</b> | <b>5</b> | <b>51+(9)<br/>=60</b> |

## COURSE SYLLABUS

| COURSE NO. | COURSE NAME                | L | T | P |
|------------|----------------------------|---|---|---|
| MMR 14101  | MECHANICAL ENGINEERING –II | 3 | 1 | 0 |

### **COURSE CONTENT:**

Introduction to thermodynamics; Analysis of various thermodynamic processes, P-V and T-S diagrams . Analysis of air standard cycles – Otto, Diesel and Dual cycles. Classifications, applications and performance estimation of internal combustion engines; Fundamentals of simple open cycle and closed cycle gas turbines and reciprocating air compressors – single and multi-stage.

Performance study and power estimation on laboratory experimental data

Introduction to Fluid Mechanics; Properties of fluid, classifications ideal fluid, Newtonian fluid and non-Newtonian fluids, Newton’s law of viscosity. Fluid pressure and its measurement-Piezometers, Manometers, Mechanical gauges. Continuity equation, types of flow. One dimensional equation of motion, Bernoulli’s equation, applications of Bernoulli’s equation, venturimeter, Flow through pipes – Darcy-Weisbach’s equations.

Classification, basic construction and applications of different types of pumps and water turbines. Performance study and power estimation based on laboratory experimental data.

| COURSE NO. | COURSE NAME                       | L | T | P |
|------------|-----------------------------------|---|---|---|
| AMR 14101  | NUMERICAL AND STATISTICAL METHODS | 3 | 1 | 0 |

### **Part-I: Numerical Methods**

Solution of algebraic and transcendental equation by bisection, iteration, false position and Newton-Raphson methods.

Solution of a system of linear simultaneous equations by Gauss elimination, Gauss-Jordan, Crout’s triangularisation, Jacobi and Gauss-Seidel methods.

Finite difference, Symbolic relations, Interpolation and Extrapolation, Newton-Gregory forward and backward, Gauss forward and backward, Stirling, Bessel and Lagrange’s formulae, Inverse interpolation by Lagrange and iterative



methods, Numerical differentiation and integration: Trapezoidal, Simpson's 1/3<sup>rd</sup>, Simpson's 3/8<sup>th</sup> and Weddle quadrature formulae.

Numerical solution of first order ordinary differential equations by Taylor's series, Picard's, Euler's, Modified Euler's, Runge-Kutta and Milne's methods. Solution of simultaneous first order and second order ordinary differential equations with initial conditions by Runge-Kutta and Milne's methods. Numerical solution of boundary value problems by finite difference method.

## Part II: Statistical Methods

Moments, skewness and kurtosis.

Probability: Various approaches of probability, two theorems (without proof), conditional probability, Bayes theorem.

Random variable: Definition, probability mass & density functions, distribution function, mathematical expectation and moment generating function.

Probability distributions: Bernoulli, binomial, Poisson and normal distributions.

Theory of least squares and curve fitting.

Correlation and Regression: Simple, multiple & partial correlation coefficients, regression lines, regression coefficients and their properties.

Test of significance: Normal test, t-test, chi square test and F test.

| COURSE NO. | COURSE NAME                           | L | T | P |
|------------|---------------------------------------|---|---|---|
| PEC 14101  | PETROLEUM PRODUCTION<br>OPERATION - I | 3 | 1 | 0 |

### COURSE CONTENT:

- Well Equipment:** Well Head Equipments, Christmas tree, valves, hangers, flow control devices, packers, tubular and flow lines.
- Well Completion Design:** Perforating Oil & Gas Wells - Conventional and Unconventional techniques viz. through tubing and tubing conveyed underbalanced perforating techniques, type size and orientation of perforation holes. Well activation, use of compressed air & liquid Nitrogen. Down-hole equipment selection, servicing, installation & testing, smart wells- intelligent completions.

3. **Production System Analysis & Optimization:** Self flow wells - PI & IPR of self flowing and artificial lift wells, production testing - back pressure test, flow after flow test & isochronal test, surface layout, test design & analysis of test data. Production characteristics of Horizontal and multilateral wells - coning, IPR & skin factor. Multiphase flow in tubing and flow-lines. Sizing, selection and performance of Tubing, chokes and surface pipes. Production Optimization – Nodal System analysis.
4. **Well Production Problems and mitigation:** Scale formation, paraffin deposition, formation damage, water production, gas production, sand deposition etc.
5. **Designing Gravel Pack for Sand Control:** Sand control techniques, Formation Sand Size analysis, optimum gravel - sand ratio, gravel pack thickness, gravel selection, gravel packing fluid & gravel pack techniques.
6. **Well Servicing & Workover:** Workover system, workover rigs and selection, rig less workover including Endless/ Coiled tubing unit, minor & major workover jobs-diagnosis & remedial measures water shut off and gas shut off-Chemical treatment and conformance control. Workover & completion fluids - types & selection, Formation damage, Workover planning & economics, asphaltine wax.
7. **Introduction to Artificial Lift Techniques.**
8. **Introduction to Shale Oil, Shale Gas and Oil Shale:** concept of exploration and production strategies.

| COURSE NO. | COURSE NAME                       | L | T | P |
|------------|-----------------------------------|---|---|---|
| PEC 14102  | ELEMENTS OF RESERVOIR ENGINEERING | 3 | 1 | 0 |

**COURSE CONTENT:**

1. Introduction to reservoir engineering
2. Characteristics of crude oil and natural gas, classification of crude and its physicochemical properties.
3. **Reservoir Rock Properties** : Porosity and permeability determination, combination of permeability in parallel & series beds, porosity permeability relationship, fluid saturation determination and significance, effective and relative permeability, wettability, capillary pressure characteristics, measurements and uses. Coring and Core Analysis

4. **Reservoir Fluids:** Phase behavior of hydrocarbon system, ideal & non ideal system, equilibrium ratios, reservoir fluid sampling, PVT properties determination, different correlations and laboratory measurements, data reduction, evaluation and application.
5. **Flow of Fluids through Porous Media :** Darcy's law, single and multiphase flow, linear, radial & spherical flow, steady state & unsteady state flow, GOR, WOR equations
6. **Special type of flow:** flow through fractures, Water and gas coning.
7. **Reservoir Pressure Measurements and Significance:** Techniques of pressure measurement.
8. **Reservoir Drives :** Reservoir drive mechanics and recovery factors
9. **Reserve estimation:** resource & reserve concept, Different reserve estimation techniques: Volumetric, MBE, decline curve analysis;, latest SPE/ WPC/ IS classification

| <b>COURSE NO.</b> | <b>COURSE NAME</b>          | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-----------------------------|----------|----------|----------|
| <b>MSR 14151</b>  | <b>MANAGERIAL ECONOMICS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

#### **COURSE CONTENT :**

1. Nature, scope and methods of managerial economics.
2. Managerial Economic Concepts – Incremental concept; Opportunity Cost concept; Equi-marginal concept; discounting concept; Risk & Uncertainty.
3. Law of Diminishing Marginal Utility.
4. Demand Analysis – Meaning & type; Law of Demand – features; Exceptions; Market Demand Schedule & Curve; Elasticity of Demand – Price elasticity, cross elasticity & income elasticity.
5. Indifference Curve approach and its properties.
6. Supply – its law, elasticity & curve.
7. Types of markets; Pricing under various market conditions – Perfect competition, imperfect competition & monopolistic competition.
8. Profit & Profit measurement.
9. Inflation – meaning; Demand-pull, cost-push inflation; Inflationary gap; Causes and steps to control inflation.
10. National Income – Concepts & methods of measurement; Difficulties in measuring national income.

|                                 |                    |          |          |          |
|---------------------------------|--------------------|----------|----------|----------|
| <b>COURSE NO.</b>               | <b>COURSE NAME</b> | <b>L</b> | <b>T</b> | <b>P</b> |
| MER 22131                       | SURVEYING          | 3        | 0        | 0        |
| <b>(Sessional Theory Paper)</b> |                    |          |          |          |

**COURSE CONTENT:**

1. **Introduction to Surveying:** Objective of surveying and its importance, Classification, principles of surveying, Application of Surveying in various fields of Engineering.
2. **Linear measurements:** Conventional Instruments for measuring distances, ranging and chaining out of survey lines, Obstacle in chaining and errors in chaining, corrections Principles, offsets, booking field notes, problems.
3. **Linear measurements (EDMs):** Theory and characteristics of electromagnetic waves, radio waves, infra red, laser waves, principle of distance measurement with EDMs
4. **Angular measurements:** Principle and construction of prismatic compass, bearing of lines, local attraction, magnetic declination and examples.
5. **Theodolite:** The essentials of transit theodolite, definition and terms, temporary adjustments, measurement of horizontal and vertical angles, different operations and sources of error, theodolite traversing, Omitted Measurements.
6. **Total Station:** Principle, working and construction. Corrections to be applied.
7. **Leveling instruments:** Definition, different type of leveling instruments, curvatures and refraction corrections, reciprocal leveling, errors in leveling and problem solving.
8. **Plane Table Surveying:** General, Methods, Intersection, Traversing, Resection, two point problem and three points problem etc.
9. **Contouring:** General, Contour Interval, Characteristics, Methods of locating contours, Interpolation etc.
10. **Global Positioning System (GPS):** Theory, principles and applications
11. **GIS:** Introduction to GIS, Its application in mapping.

|                   |   |          |          |          |
|-------------------|---|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                    | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>HSC 14306</b>  | <b>ENGLISH FOR<br/>PROFESSIONAL<br/>COMMUNICATION</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

**Part I -- Professional Oral Communication**

**Course Introduction:** Professional Communication: Need, principle, channels, forms and barriers; Speaking for professional Purposes: Nature of Oral Communication, Oral Communication Process, and characteristics of Oral Communication

**Group Discussion:** Group Discussion(GD): nature, uses and importance; Leadership function in GD; developing leadership qualities and positive group behaviour; Starting discussions: opening the discussion, stating objectives, suggesting good group procedure (Time management, speaking procedure, etc); Giving opinions, asking for opinions and supporting opinions in GD; Making suggestions and asking for suggestions; Balancing points of view, expressing advantages, disadvantages and consequences; Some pitfalls in discussions, fallacies in argument and rebuttal, concluding and controlling discussions

**Job Interview:** Job Interview: The interviewing process, types of interviews and interview formats; Pre-interview preparation techniques, self-analysis, skills assessment, company analysis, job analysis, practice, developing interview file; Projecting success: The beginning, the middle and the end of the interview; Interview Strategies; Upholding the personality and overcoming interviewing hazards

**Part II --Professional Writing**

**Report Writing:** Report Writing: Characteristics of business reports, reports and other forms of communication, features of good reports; Types of reports (Formal/informal); Structure of formal reports: Front matter, main body and back matter; Style of reports: Readability of reports, choice of words and phrases, construction and length of sentences and paragraphs

**Business Correspondence:** Official communication: nature and principles of business correspondence; Structure of

business letters; Business letter formats; Letter giving instructions; Letters of requests and inquiries; Letters of complaints; Employment letters and applications; CV and resume writing; Business memos: Forms and structure; Writing an effective memo.

| COURSE NO. | COURSE NAME  | L | T | P |
|------------|--|---|---|---|
| PEC 14201  | PETROLEUM ENGINEERING<br>PRACTICAL – II<br>(Reservoir Engineering Lab) | 0 | 0 | 2 |

**COURSE CONTENT:**

Practical related to porosity, permeability, Saturation properties of cores,  
Practical related to TPD, BHP chart analysis.

| COURSE NO. | COURSE NAME                                       | L | T | P |
|------------|---|---|---|---|
| AMR 14201  | NUMERICAL AND<br>STATISTICAL METHODS<br>PRACTICAL | 0 | 0 | 3 |

**COURSE CONTENT:**

**A. Numerical Methods:**

1. Numerical solution of non-linear algebraic and transcendental equation by bisection, iteration, false position, secant and Newton Raphson methods.
2. Numerical solution of system of linear simultaneous equations by Gauss elimination and Gauss's Seidel methods
3. Interpolation by Lagrange's interpolation formula.
4. Numerical evaluation of definite integral by Trapezoidal, Simpson's  $1/3^{rd}$ , Simpson's  $3/8^{th}$ , Weddle and Gaussian quadrature formulae.
5. Numerical solution of first order ordinary differential equation by Euler's, Modified Euler's, second and fourth order Runge-Kutta, Adams-Moulton and Milne's methods.

**B. Scope of practice sessions:**

Computation of raw moments, central moments, coefficient of variation, coefficients of skewness and kurtosis; Fitting of straight line, second degree polynomial (parabola), power curve and exponential curve; Computation of product moment correlation, multiple and partial correlation

coefficients; Regression coefficients and regression lines, plane and regression. Application tests of significance based on numerical data.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>         | <b>L</b> | <b>T</b> | <b>P</b>   |
|-------------------|----------------------------|----------|----------|------------|
| <b>MER 22231</b>  | <b>SURVEYING PRACTICAL</b> | <b>0</b> | <b>0</b> | <b>2/2</b> |

**COURSE CONTENT:**

Study of theodolite and traversing with theodolite, study of levels and ordinary leveling with tilting level, study of total station and measurement with total station. Study of Global Positioning System (GPS) and measurement with GPS.

**COURSE STRUCTURE OF V SEMESTER B. TECH  
PETROLEUM ENGG.  
(Effective from 2013 – 14 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs. |
|---------|------------|--|-----------|----------|----------|-------------|
| 1       | PEC 15101  | Applied Petroleum Reservoir Engineering and Management                   | 3         | 1        | 0        | 7           |
| 2.      | PEC 15102  | Petroleum Production Operations-II                                       | 3         | 1        | 0        | 7           |
| 3.      | GLC 15153  | Sedimentary and Petroleum Geology  | 3         | 0        | 0        | 6           |
| 4       | ACC 15103  | Physical Chemistry   | 3         | 0        | 0        | 6           |
| 5.      | AMR 15101  | Methods of Applied Mathematics – II                                      | 3         | 1        | 0        | 7           |
| 6.      | PEC 15303  | Reservoir Fluid Thermodynamics (Sessional Theory Paper)                  | 3         | 0        | 0        | 6           |
| 7.      | PEC 15201  | Petroleum Engineering Practical – III (Production & Product Testing Lab) | 0         | 0        | 2        | 2           |
| 8.      | GLC 15253  | Sedimentary and Petroleum Geology Practical                              | 0         | 0        | 2        | 2           |
| 9.      | ACC 15203  | Physical Chemistry Practical   | 0         | 0        | 2/2      | 1           |
| 10.     | PEC 15801  | Project and Term Paper   | 0         | 0        | 4        | 4           |
|         |            | <b>Total</b>   | <b>18</b> | <b>3</b> | <b>9</b> | <b>48</b>   |



## COURSE SYLLABUS

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 15101</b>  | <b>Applied Petroleum Reservoir Engineering and Management</b> | <b>3</b> | <b>1</b> | <b>0</b> |

### **COURSE CONTENT:**

1. Introductory Lecture: Overview of reservoir engineering and reservoir management
2. **Introduction to oil & gas field development:** Rational development plan, Rate and order of drilling well, well spacing & pattern, selection of development scheme, economic aspect of development of oil and gas fields.
3. Generalized Oil & Gas MBE and its modification
4. Drive Mechanism and recovery factors; production behaviour of oil & gas reservoirs
5. Water influx : steady and unsteady state models
6. Performance prediction of depletion drive, gas cap drive, water drive and combination drive
7. Reservoir pressure maintenance techniques, their advantages and limitations
8. Immiscible Displacement processes: Theory & practices- Buckley Leverette treatment of fractional flow and frontal advance equations, water flood performance
9. Reservoir Management: concepts, components and applications

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                         | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEC 15102</b>  | <b>PETROLEUM PRODUCTION OPERATION - II</b> | <b>3</b> | <b>1</b> | <b>0</b> |

### **COURSE CONTENT :**

1. **Gathering and collection of oil and gas:** GGS, CTF and GCS - layout, sequential treatment, and safety features on installations.
2. **Field Processing of Oil & Gas:** Flash and stage separation of oil & gas; oil & gas separators, mist extractor, fluid level and pressure control system. Control valve sizing, Vertical and horizontal separators, metering separators. Working pressure and safety feature in oil &

- gas separators. Special problems in oil and gas separation. Removal of suspended solid & water from oil & gas. Scrubbers and wash tank. Demulsification and desalting.
3. **Storage of Petroleum and Petroleum Products:** Different types of storage system, Types & features of storage tanks, fixed roof and floating roof tanks. Design of storage tanks with introduction to API codes, Specification, maintenance and operation of tank batteries, Vapour control and gravity conservation measures. Vapour recovery system. LPG & LNG storage.
  4. **Metering and Measurements:** Metering of oil & gas, Sampling and Testing of crude oil. Gauging equipment and methods. Water and sediment determination. Orifice and other metering devices and their characteristics.
  5. **Well Stimulation Techniques - Design & Selection:** Type & description, design of matrix acidization and acid fracturing. Design of hydraulic fracturing (mini, massive & high energy frac.). Wave technology & microbial stimulation
  6. Introduction to cash flow analysis related to petroleum economics, concepts of Payout, NPV, IRR.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                           | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>GLC 15153</b>  | <b>SEDIMENTARY AND<br/>PETROLEUM GEOLOGY</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT :**

**SECTION – A (Sedimentary Geology)**

**Introduction:** Sedimentary processes, Textural properties, Pore morphology and its significance, Sedimentary structures, Important rock groups with special reference to sandstones and carbonates, Reconstruction of sedimentary environment, Tectonics, sedimentation and sequence stratigraphy, Role of sedimentology in petroleum exploration. Elements of basin modeling.

**SECTION – B (Petroleum Geology)**

1. Physical and chemical characteristics of crude oil, Origin of oil, source rock and maturation.
2. **Migration of oil:** mechanism, pattern and barriers.
3. Reservoir rocks and cap rocks
4. **Entrapment of oil:** types and mechanism.
5. Geology of prospective basins of India.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>        | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---------------------------|----------|----------|----------|
| <b>ACC 15103</b>  | <b>PHYSICAL CHEMISTRY</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

- 1. ADVANCED ELECTROCHEMISTRY:** Reversible and irreversible cells; Fuel cells; Reference electrodes and indicator electrodes; Ion selective electrodes; Application of electrode potentials; Potentiometric titration;
- 2. CORROSION AND CORROSION CONTROL:** Principles of corrosion, methods of corrosion control, cathodic and anodic protection, corrosion inhibitors. Surface coatings, Corrosion Monitoring. Case Studies of Corrosion in Petroleum industry including metals and alloys used in Petroleum Industry.
- 3. ADVANCED SURFACE CHEMISTRY:** Interfacial phenomena; Wetting; Surface tension measurements; Electrokinetic phenomena; Zeta potential and its measurement. Adsorption: Types of adsorption isotherm, Gibb's adsorption equation, BET equation, surface area of adsorbents, Application of Adsorption on the surface of solids, adsorption of high molecular compounds.
- 4. ANALYTICAL TECHNIQUES:** UV-Vis Spectrophotometry, Atomic Absorption Spectrophotometer (AAS), IR Spectroscopy, Liquid and Gas Chromatography and Solvent extraction methods.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                             | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>AMR 15101</b>  | <b>METHODS OF APPLIED<br/>MATHEMATICS - II</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

**PART I:**

**Special Functions**

Solution of Associated Legendre equations, Associated Legendre Functions, Recurrence relations for Associated Legendre Functions, Bessel Function of 1<sup>st</sup> and 2<sup>nd</sup> kinds, Hankel function, Equations reducible to Bessel's equation, Modified Bessel functions,

**Finite Element Method**

Variational principles, Functionals, Euler's equations, Approximation by piecewise polynomial, Rayleigh-Ritz method, Galerkin methods, Element properties, Natural coordinate system, Two dimensional triangular elements, Three dimensional tetrahedral element, Shape functions, Element stiffness matrix, One dimensional heat transfer element, Finite element solution of two dimensional fluid-flow problems.

## **PART II:**

### **Integral Transform**

Fourier integrals, Fourier Sine and Cosine integrals, complex form of Fourier integrals, Fourier transforms, Fourier Sine and cosine transforms, properties. Inversion and convolution with problems, Parseval's identity for Fourier transforms, Fourier transforms of derivatives of a function, multidimensional Fourier transform with problems, Introduction to Hankel transform.

### **Partial Differential Equations**

Solution of Laplace equation in three dimensions (Cartesian and Polar), Spherical Harmonics, Solution of Poisson Equation in two dimensions, Solution of heat conduction and wave equations using variable separable methods and integral transforms, namely, Laplace and Fourier transforms techniques.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>   | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEC 15303</b>  | <b>RESERVOIR FLUID<br/>THERMODYNAMICS<br/>(Sessional Theory Paper)</b> | <b>3</b> | <b>0</b> | <b>0</b> |

### **COURSE CONTENT:**

- 1. Work Calculations:** Work calculation for compression/expansion of ideal and non ideal gases, compression cycles and horse power calculations - single, double and multistage with and without clearance.
- 2. Thermodynamics of Gases and Liquid Hydrocarbons:** Free energy & work function, Mollier diagrams, perfect & imperfect gaseous mixtures, Equation of state, Law of

- corresponding states, Joule Thompson effect, Arrhenius equation and activation energy. Fugacity and fugacity coefficient of gases and gaseous mixtures, Lewis fugacity rules and Third law of thermodynamics.
3. **Solution Thermodynamics:** Vapour liquid equilibria, equilibrium constant, partial molar properties, chemical potential, Raoult's law and Henry's law, ideal and non ideal solutions, Activity and activity coefficients, Gibb's Duhem equation, Gibb's adsorption equation.
  4. **Phase Rule:** Phase rule of single, two, three, multi component and multi phase systems, phase behaviour in different conditions, Thermodynamic aspects of phase equilibria. Calculation of phase equilibria. Ternary and pseudo ternary phase diagrams
  5. **Fluid Flow Thermodynamics:** Single phase flow & multiphase flow through vertical, incline and horizontal conduits. Pressure traverse curves and their applications. Venturi flow, nozzle flow, pipe internal flow, annular flow and nozzle flow thermodynamics of multiphase & multicomponent system.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 15201</b>  | <b>Petroleum Engineering<br/>Practical – III<br/>(Production &amp; Product Testing<br/>Lab)</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE CONTENT:**

Practical related to measurements of viscosity, surface tension, fire point- Flash point, Cloud point, Pour point, Diesel Index, Bromine number, RVP, Sulphur content, Carbon Residue, Water content, ASTM distillation of Petroleum and Petroleum Products.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                      | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>GLC 15253</b>  | <b>SEDIMENTARY AND<br/>PETROLEUM GEOLOGY<br/>PRACT.</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE CONTENT:**

Practical related to Sedimentary and Petroleum Geology.

|                   |   |          |          |            |
|-------------------|---|----------|----------|------------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                      | <b>L</b> | <b>T</b> | <b>P</b>   |
| <b>ACC 15203</b>  | <b>PHYSICAL CHEMISTRY<br/>PRACTICAL</b> | <b>0</b> | <b>0</b> | <b>2/2</b> |

**COURSE CONTENT:**

Practical related to FTIR studies of a few samples, Determination of molecular weight of polymer from viscosity measurement, Estimation of ions by UV-Vis Spectrophotometer, Potentiometric titrations, Conductometric titration, Adsorption of solute on solid, Corrosion rate Determination by immersion test/ potentiostatic polarization method.

**COURSE STRUCTURE OF VI SEMESTER B.TECH  
PETROLEUM ENGG.  
(Effective from 2013 – 14 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | PEC16101   | Directional Drilling  | 3         | 1        | 0        | 7                     |
| 2.      | PEC16102   | Petroleum Formation Evaluation  | 3         | 1        | 0        | 7                     |
| 3.      | PEC16103   | Natural Gas Engineering   | 3         | 1        | 0        | 7                     |
| 4       | AMR 16101  | Advanced Numerical Methods  | 3         | 1        | 0        | 7                     |
| 5.      | EER 16101  | Applied Electrical Engineering  | 3         | 1        | 0        | 7                     |
| 6.      | ECR 14101  | Microprocessors & Applications (Sessional Theory Paper)                                       | 3         | 0        | 0        | 6                     |
| 7.      | PEC16201   | Petroleum Engineering Practical – IV<br>Process Lab Practical/<br>Simulation and Modeling Lab | 0         | 0        | 3        | 3                     |
| 8.      | PEC16501   | Composite Viva Voce   | 0         | 0        | 0        | (4)                   |
| 9.      | PEC16801   | Project & Term Paper  | 0         | 0        | 4        | 4                     |
|         |            | <b>Total</b>  | <b>18</b> | <b>5</b> | <b>7</b> | <b>48+(4)<br/>=52</b> |

**COURSE SYLLABUS**

| COURSE NO. | COURSE NAME          | L | T | P |
|------------|----------------------|---|---|---|
| PEC 16101  | DIRECTIONAL DRILLING | 3 | 1 | 0 |

**COURSE CONTENT:**

- 1. Directional Drilling:** Objectives, Types of deflection tools, tool orientation, Directional well profiles, Well path deflection & correction.
- 2. Down Hole Motors:** Positive displacement motors and Turbo-drills - motor description, Power calculation and applications. Auto-track and verti-track system. Rotary Steerable motors, Geo-steering tools.
- 3. Horizontal Well Drilling:** Horizontal well objectives and selection, Different profiles, Drilling techniques, Mud requirements & characteristics, casing and drill string requirements and completion programs.

4. **Slant Hole Drilling:** Objectives and selections, Well profiles and applications.
5. **Down the Hole Well Surveying:** Well surveying objectives, surveying methods, Surveying Analysis methods and calculations for well coordinates.
6. **Measurements While Drilling:** Objectives of MWD/ LWD, SWD, MWD tools, Telemetry system and data interpretation.
7. Directional drilling problems and their remedies.
8. **Special Methods of Drilling :** Aerated drilling, Underbalanced drilling, Overbalanced drilling, HPHT Drilling, Variable pressure regime, Plasma drilling, Electrical Drilling, Top drive drilling, Re-entry drilling, Jet Drilling, Extended reach drilling, Multilateral drilling, Slim hole drilling, coil tubing drilling, Geo-steering & **Drilling automation.**
9. **Drilling Economics.**
10. **Computer Application in Drilling**

|                   |   |          |          |          |
|-------------------|---|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                        | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>PEC 16102</b>  | <b>PETROLEUM FORMATION<br/>EVALUATION</b> | <b>3</b> | <b>1</b> | <b>0</b> |

#### **COURSE CONTENT:**

1. Petrophysical measurements to sub-surface engineering.
2. **Indirect Methods:** SP and resistivity logs, radioactive logs, acoustic logs (principles, types of tools, limitation and applications). Evaluation of CBL/ VDL, USIT, SFT, RFT.
3. **Production Logging:** Introduction, type of tools, principles, limitations and applications.
4. **Special Type of Logging Tools:** Casing inspection tools (principles, application and limitation), Formation micro scanner (FMS), NMR logging principles. Logging in high-angle wells.
5. **Log Interpretation and Analysis Techniques.**
  - a) Standard log interpretation methods.
  - b) Cross-plotting methods: neutron-density, sonic-density and sonic-neutron etc.
  - c) Clean sand interpretation
  - d) Concepts of invasion – RXO, Tornado charts.
  - e) Shaly sand interpretation.



| COURSE NO. | COURSE NAME             | L | T | P |
|------------|-------------------------|---|---|---|
| PEC 16103  | NATURAL GAS ENGINEERING | 3 | 1 | 0 |

**COURSE CONTENT:**

1. **Introduction:** Composition of Natural Gas, Utilization of Natural Gas, Natural Gas Industry, Natural Gas Reserves, Types of Natural Gas Resources, Future of the Natural Gas Industry.
2. **Properties of Natural Gas:** Physical properties of natural gas and hydrocarbon liquids associated with natural gas. Reservoir aspects of natural gas.
3. **Gas Compression:** Types of Compressors, Selection, Thermodynamics of Compressors, Compression calculations. Heat and Mass Transfer Principles and Applications in Natural Gas Engineering, Use of Mollier Diagrams.
4. **Gas Flow Measurement:** Process control and instrumentation in natural gas processing plants.
5. **Natural Gas Processing:** Field separation and oil absorption process, Refrigeration and low temperature processing, Liquefaction Process, Dehydration of Natural Gas, Sweetening of Natural gas and sulphur recovery. Processing for LPG, CNG, system, Conversion of gas to liquid.
6. **Gas Gathering, Transport and Storage:** Gas Gathering System. Steady Flow in Simple Pipeline System, Steady State and non Steady State Flow in Pipelines, Solution for Transient Flow. Transmission of Natural Gas, Specifications. Underground Storage and Conservation of Natural Gas.
7. **Unconventional gas:** Coal Bed Methane, Natural Gas Hydrate, Basin Centered Gas, Tight Gas Sands, Shale Gas. Current Technology for Shale Gas and Tight Gas Exploration and Production.
8. **LNG: Production and Utilization**
9. Issue and Challenges to Enhance Supply of Natural Gas.

|                   |                                       |          |          |          |
|-------------------|---------------------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                    | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>AMR 16101</b>  | <b>ADVANCED NUMERICAL<br/>METHODS</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Solution of tridiagonal system, Evaluation of largest and smallest eigen values and corresponding eigen vectors by Power method.
2. Complex root of non-linear equations by Newton-Raphson method, Solution of simultaneous non-linear algebraic and transcendental equations, Numerical evaluation for double and triple integrals with constant and variable limits and its application, Solution of integral equations by numerical methods.
3. Numerical solution of simultaneous first order ordinary differential equations and higher order differential equation subject to initial condition by single step and multistep methods, Numerical solution of higher order linear and non-linear ordinary differential equations subject to different boundary conditions by finite difference method, Numerical solution of characteristic value problems.
4. Classification of Partial differential equations, Finite difference approximations of partial derivatives of functions of two and three variables, Numerical solution of elliptic partial differential equations: Solutions of Laplace and Poisson equations in two variables by five-point formula, Solution of Laplace equation in two variables by ADI method, Solution of mixed boundary value problem, Algorithm for elliptic partial differential equation in three variables.
5. Solution of Parabolic partial differential equations: Solution of heat conduction in two variables by explicit and implicit methods i.e. Schmidt, Laosonen, Crank-Nicolson and Durfort-Frankel methods, Gauss-Seidel iterative method for Crank-Nicolson scheme, Solution of parabolic partial differential equation with derivative boundary conditions, Solution of heat conduction equation in three variables by ADE and ADI methods, Stability and convergence criteria.
6. Solution of hyperbolic partial differential equations: Solution of wave equation in two variables by explicit and

implicit methods and algorithm for hyperbolic equations of three variables.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                        | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>EER 16101</b>  | <b>APPLIED ELECTRICAL<br/>ENGINEERING</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Operation and characteristics of three-phase Induction motors; Methods of starting & speed control of three phase induction motor; Ward-Leonard method of speed control of DC motor; Basic principles of Thyristor controlled variable speed AC and DC motors;
2. Principles of rate making of electricity and power factor improvement; Substation arrangement; Circuit breakers; Protective relays:- Inductions pattern over current relay, thermal overload relay, earth fault relay, Lightning Arrester, Fuses :- types and selection.
3. Power Cables: Types & selection, Types of motor enclosure, FLP enclosures for hazardous area equipment, intrinsically safe circuit.
4. Industrial application & control of electrical motors: Types of electric motors and their application in industry; Controllers for the speed control of dc & ac motors.
5. Diesel – Electrical oil rigs.
6. I.E. rules applied to mines & oil fields.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>   | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>EIR 14101</b>  | <b>MICROPROCESSORS &amp;<br/>APPLICATIONS<br/>(Sessional Theory Paper)</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Intel 8085 CPU Architecture and Pin Outs, Timing Diagram, Stacks and Subroutines, Addressing Modes, Instruction sets, Programming, Interrupt Structure and Serial I/O, Memory and I/O Interface.
2. Intel 8086 CPU Architecture and Pin Outs, Minimum and Maximum Mode, Memory Segmentation, Addressing Modes, Simple Programs, Clock Generators, Memory and I/O Interface.

3. Interfacing Different Peripherals: Programmable Interval Timer (8254), Programmable Peripheral Interface (8255) and Programmable Interrupt Controller (8259). Introduction to Programmable DMA Controller (8237) and Programmable Communication Interface (8251). Interfacing of A/D and D/A converters, Multiplexers and Data Selectors with microprocessors.
4. Microprocessor Applications: - Segment display, Measurement of Electrical Quantities (Frequency, Phase Angle and Power Factor, Impedance), Measurement of Physical Quantities (Temperature, Strain, Deflection, Level and Speed of Motor), Traffic Control, Generation of Square wave / Pulse.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 16201</b>  | <b>Petroleum Engineering<br/>Practical – IV<br/>(Process and Simulation<br/>Lab.)</b> | <b>0</b> | <b>0</b> | <b>2</b> |

**COURSE CONTENT:**

Practical related to the Heat transfer, Process control, Air and water flow bench, Flame propagation, Heat conductivity etc.

Practical and training regarding application of oil field Simulators

**COURSE STRUCTURE OF VI SEMESTER DUAL DEGREE  
COURSE  
(B.TECH PETROLEUM ENGINEERING. & M.TECH  
PETROLEUM ENGINEERING)  
(Effective from 2013 – 14 session)**

| Sl. No. | Course No. | Name of the course  | L         | T        | P        | Credit Hrs.           |
|---------|------------|---|-----------|----------|----------|-----------------------|
| 1       | PEC16101   | Directional Drilling  | 3         | 1        | 0        | 7                     |
| 2.      | PEC16102   | Petroleum Formation Evaluation  | 3         | 1        | 0        | 7                     |
| 3.      | PEC16103   | Natural Gas Engineering   | 3         | 1        | 0        | 7                     |
| 4       | AMR 16101  | Advanced Numerical Methods  | 3         | 1        | 0        | 7                     |
| 5.      | EER 16101  | Applied Electrical Engineering  | 3         | 1        | 0        | 7                     |
| 6.      | PEC 52301  | Energy Management & Policy (Sessional Theory Paper)   | 1         | 2        | 0        | 4                     |
| 7.      | PEC16201   | Petroleum Engineering Practical – IV<br>Process Lab Practical/<br>Simulation and Modeling Lab | 0         | 0        | 3        | 3                     |
| 8.      | PEC16501   | Composite Viva Voce   | 0         | 0        | 0        | (4)                   |
| 9.      | PEC16801   | Project and Term Paper  | 0         | 0        | 4        | 4                     |
|         |            | <b>Total</b>  | <b>16</b> | <b>7</b> | <b>7</b> | <b>46+(4)<br/>=50</b> |

**COURSE SYLLABUS**

|            |                          |
|------------|--------------------------|
| PEC 16101: | Common with VI B.Tech PE |
| PEC 16102: | Common with VI B.Tech PE |
| PEC 16103: | Common with VI B.Tech PE |
| AMR 16101: | Common with VI B.Tech PE |
| EER 16101: | Common with VI B.Tech PE |
| PEC 16201: | Common with VI B.Tech PE |
| PEC 16501: | Common with VI B.Tech PE |
| PEC 16801: | Common with VI B.Tech PE |

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                        | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 52301</b>  | <b>ENERGY MANAGEMENT &amp;<br/>POLICY</b> | <b>1</b> | <b>2</b> | <b>0</b> |
|                   | <b>(Sessional Theory Paper)</b>           |          |          |          |

**COURSE CONTENT:**

Markets for oil, gas, coal, electricity and renewable energy resources and alternate fuels. Legal and policy aspects of supply and trading in energy. Regulations of energy industries, Industry privatization. International context of liberalization of energy markets. Land acquisition policy, Carbon credit, Modeling techniques for supply and demand, market structure, transportation models, game theory, futures markets, environmental issues, energy policy, energy regulation, input/output models, linear and nonlinear programming models, energy conservation, and dynamic optimization. Development of appropriate models and their application to current issues in energy markets. Energy audit.

**COURSE STRUCTURE OF VII SEMESTER B.TECH  
PETROLEUM ENGG.**

**(Effective from 2014– 15 session)**

| <b>Sl. No.</b> | <b>Course No.</b> | <b>Name of the course</b>  | <b>L</b>  | <b>T</b> | <b>P</b> | <b>Credit Hrs.</b>    |
|----------------|-------------------|--|-----------|----------|----------|-----------------------|
| 1              | PEC17101          | Oil and Gas Well Testing   | 3         | 1        | 0        | 7                     |
| 2.             | PEC 17102         | Offshore Drilling and Petroleum Production Practices                         | 3         | 1        | 0        | 7                     |
| 3.             | GPD 17163         | Petroleum Exploration – Geophysical Methods (Section A).                     | 2         | 0        | 0        | 8                     |
|                | GLD 17154         | Petroleum Exploration – Geological Methods (Section B)                       | 2         | 0        | 0        |                       |
| 4              | MSC 17152         | Industrial Engg. And Management  | 3         | 0        | 0        | 6                     |
| 5.             |                   | Elective paper   | 3         | 0        | 0        | 6                     |
| 6.             | PEC 17301         | Health Safety and Environment in Petroleum Industry (Sessional Theory paper) | 3         | 0        | 0        | 6                     |
| 7.             | PEC17801          | Petroleum Engineering Projects   | 0         | 0        | 6        | 6                     |
| 8.             | PEC17901          | Vocational Training*   | 0         | 0        | 0        | (5)                   |
|                |                   | <i>ELECTIVES: ANY ONE OF FOLLOWING</i>                                       |           |          |          |                       |
| i.             | PEE17101          | Unit Operations for Petroleum Industry                                       |           |          |          |                       |
| ii.            | PEE17102          | Transportation and Marketing of Petroleum and Petroleum Products             |           |          |          |                       |
| iii.           | PEE17103          | Well Performance   |           |          |          |                       |
| iv.            | PEE17104          | Oil shale and Shale Gas  |           |          |          |                       |
| v.             | CHE 17106         | Polymer Science and Technology   |           |          |          |                       |
| vi.            | CHE 17107         | Multi-Component Separation   |           |          |          |                       |
|                |                   | <b>Total</b>   | <b>19</b> | <b>2</b> | <b>6</b> | <b>46+(5)=<br/>51</b> |

\*Vocational Training taken at the end of VI semester is credited in VII Semester.

**COURSE SYLLABUS**

| COURSE NO. | COURSE NAME            | L | T | P |
|------------|------------------------|---|---|---|
| PEC 17101  | OIL & GAS WELL TESTING | 3 | 1 | 0 |

### COURSE CONTENT

1. Principles of Fluid Flow for steady state, semi steady state & non steady state conditions.
2. Diffusivity Equation Derivation & Solutions, Radius of investigation, principle of superposition, Horner's approximation.
3. **Drill Stem Testing:** Equipment, DST chart observation and preliminary interpretation. Well preparation for testing, Multiple well testing. Effect of reservoir heterogeneities & Well bore conditions, fractured reservoir application.
4. **Pressure Transient Tests:** Drawdown and buildup-test analysis, determination of permeability and skin factor, Analysis of pressure-buildup tests distorted by phase redistribution, Well-test interpretation in hydraulically fractured wells, Interpretation of well-test data in naturally fractured reservoirs, Wellbore effects, Multilayer reservoirs, Injection well testing, Multiple well testing, Wireline formation testing. Wireline while drilling formation testing . Interference testing, Pulse testing,
5. **Well-test analysis by use of type curves:** Fundamentals of type curves, Ramey's type curve, McKinley's and Gringarten et al type curves.
6. **Gas well testing:** Basic theory of gas flow in reservoir, Flow-after-flow test, Isochronal test, etc.
7. **Applications of well testing:** Well testing in horizontal wells, Extended Reach wells & multi-laterals wells, tests with and without flow measurement.
8. **Computer-aided well test analysis:** Derivative plot, diagnostic plot evaluation, data preparation, nonlinear regression, Introduction to well testing softwares.

| COURSE NO. | COURSE NAME           | L | T | P |
|------------|-----------------------|---|---|---|
| PEC 17102  | OFFSHORE DRILLING AND | 3 | 1 | 0 |



**PETROLEUM PRODUCTION  
PRACTICES**

**COURSE CONTENT:**

1. Introduction to offshore oil and gas operations.
2. **Sea States and Weather:** Meteorology, oceanography, ice, sea bed soil.
3. Buoyancy and stability.
4. **Offshore Fixed Platforms:** Types, description and operations.
5. **Offshore Mobile Units:** Types, description and installation. Station keeping methods like conventional mooring & dynamic positioning system.
6. **Offshore Drilling:** Difference in drilling from land, from fixed platform, jackup, ships and semi submersibles. Use of conductors and risers. Deep sea drilling.
7. **Offshore Well Completion** - Platforms and subsea completions, Deep water applications of subsea technology.
8. **Offshore Production:** Oil processing platforms, gas processing platforms, water injection platforms, storage, SPM and SBM, transportation and utilities.
9. **Deep water technology:** Introduction, definition & prospects. Deep water regions, Deep water drilling rig – selection and deployment, Deep water production system, Emerging deep water technologies – special equipment and systems, Remote operation vessels (ROV).
10. **Divers and Safety:** Principles of diving use of decompression chambers, life boats.
11. Offshore Environmental Pollution and Remedial Measures.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>   | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>GPD 17163</b>  | <b>PETROLEUM EXPLORATION -<br/>GEOPHYSICAL METHODS<br/>(SECTION - A)</b> | <b>2</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. **Magnetic Method:** The geomagnetic field, Magnetic anomalies. Magnetic survey instrument, Field method of magnetic surveys. Reduction of magnetic data, diurnal and geomagnetic correction. Interpretation of magnetic anomalies. Magnetic response of simple geometric shapes. Application of magnetic survey.

2. **Gravity Method:** Units of gravity, gravity measuring instruments, gravity survey, gravity anomalies, Gravity data reduction, Drift, Latitude, Elevation, and Free-air correction. Free-air and Bouguer anomalies. Gravity response of simple geometric shapes. Interpretation of gravity anomalies and application of gravity methods.
3. **Seismic Methods:** Geometry of refracted ray path, planar interface. Two layer case with horizontal interface. Methodology of refraction profiling. Field surveys arrangements. Recording instruments and energy source. Corrections applied to refraction data. Interpretation of refraction data. Application of seismic refraction method, Passive seismic
4. Geometry of reflected ray path, planar interface, single horizontal reflector. Importance of seismic reflection survey over seismic refraction survey technique. Common depth point (CDP) profiling and stacking. 2-D data processing and interpretation of reflection data. Introduction to 3-D data acquisition, processing and interpretation. Applications of seismic method in oil exploration, Concept of 4-D seismic and its application.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>GLD 17154</b>  | <b>PETROLEUM EXPLORATION -<br/>GEOLOGICAL METHODS<br/>(SECTION - B)</b> | <b>2</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

Surface indications of subsurface oil and gas accumulations. Oil accumulation parameters. Regional structural plan and local structures. Time of accumulation vis-avis time of oil generation. Geochemical methods of prospecting: Soil geochemical surveys; Source rock characterization and Hydro-geochemistry as a tool for oil exploration. Development Geology. Theoretical principles of prognostication of hydrocarbon reserve. Role of plate tectonics in Hydrocarbon accumulation onshore and offshore. Sequence of geological methods of oil exploration.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>          | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-----------------------------|----------|----------|----------|
| <b>MSC 17152</b>  | <b>INDUSTRIAL ENGG. AND</b> | <b>3</b> | <b>0</b> | <b>0</b> |

## MANAGEMENT

### COURSE CONTENT :

1. Basic functions of Management – Planning, organizing, staffing, directing and controlling.
2. Introduction to Industrial Engineering techniques.
3. Productivity: definition, measurement.
4. Work study and its role in improving productivity of an organization.
5. Types of production systems.
6. Introduction to production planning and control.
7. Concepts of Human Resource Management – Selection, Training & Development.
8. Finance Management – Capital Budgeting Techniques. Pay-back period, ARR, NPV, IRR, PI; Sources of capital; Cost concepts and Break-even analysis.
9. Project Management – Introduction, Network construction & identification of critical activities in CPM & PERT

| COURSE NO. | COURSE NAME  | L | T | P |
|------------|--|---|---|---|
| PEC 17301  | HEALTH,SAFETY &<br>ENVIRONMENT MANAGEMENT<br>IN PETROLEUM INDUSTRY<br>(Sessional Theory Paper) | 3 | 0 | 0 |

### COURSE CONTENT:

#### Health Hazards in Petroleum Production Refining and Utilization:

1. Toxicity, Physiological, Asphyxiation, respiratory and skin effect of Petroleum Hydrocarbons (including mixtures), sour gases (eg Hydrogen sulphide and carbon monoxide etc) with their thresh-hold limits.
2. Effect of corrosive atmosphere and additives during acidizing, sand control and fracturing jobs etc.

#### Safety System:

1. Hazards analysis, developing a safe process, failure mode analysis, safety analysis (API-14C) safety analysis function evaluation chart (synergic approach).
2. Manual & automatic shut down system, blow down systems.
3. Gas detection system
4. Fire detection and suppression systems.

5. Personal protection systems & measures.
6. HSE Policies, standards & specifications
7. Disaster & crisis management.

**Environment:**

1. Environment concepts, impact on eco-system, air, water and soil.
2. The impact of drilling & production operations on environment, Environmental transport of petroleum wastes.
3. Offshore environmental studies, offshore oil spill and oil spill control.
4. Oil mines regulations and other environmental legislations.
5. Environmental impact assessment.
6. Waste treatment methods, waste disposal method, remediation of contaminated sites.
7. Air & noise pollution

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEE 17101</b>  | <b>UNIT OPERATIONS FOR<br/>PETROLEUM INDUSTRY</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction to unit operations and its application in petroleum engineering.
2. Fluid mechanics: Fluid statics- hydrostatic equilibrium, decantation-gravity and centrifugal; fluid flow regimes-laminar and turbulent, fluid rheology; basic flow equation through pipes-Bernoulli's equation, momentum equation with their correction for friction; flow of Newtonian and non Newtonian fluid through pipe, brief description on varieties of pumps and flow-meters; agitation and mixing of fluids-purpose and equipments .
3. Mass Transfer and its application: introduction to phase equilibria, basic concept of diffusion and interphase mass transfer; introduction to distillation; absorption; adsorption; liquid-liquid extraction; introduction to stage and continuous contact mass transfer units-plate column, packed bed and fluidized bed.
4. Heat transfer and its application: Various modes of heat transfer, principle of heat flow through solid and fluids;

concept of steady and unsteady state heat transfer; determination of overall heat transfer coefficient for composite system; Heat transfer to fluid with and without phase change; evaporation; brief description on various heat exchangers .

5. Operations involving particulate solid: Introduction to filtration, sedimentation, settling and de-oxygenation

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEE 17102</b>  | <b>TRANSPORTATION AND<br/>MARKETING OF PETROLEUM<br/>AND PETROLEUM PRODUCTS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Mode of Transportation of petroleum & petroleum products.
2. Basics of pipeline construction, operation and protection.
3. Pump and compressor stations. Instrumentation and control.
4. Metering and measurements of oil and gas.
5. Traffic management, Fire and safety rules.
6. Indian and Global supply scenario of petroleum and petroleum products. Product quality control. Bulk distribution and handling-domestic, commercial and industrial.
7. Storage of petroleum products in fixed installations. Standards and regulations.
8. Role of International oil companies and OPEC pricing mechanism. Administered and market determined pricing mechanism in India. Conservation of petroleum & its products, Spot and other market control mechanism.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>      | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-------------------------|----------|----------|----------|
| <b>PEE 17103</b>  | <b>WELL PERFORMANCE</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction: Objectives of well tests, Reservoir models, Plotting methods

2. Fundamentals of Flow in Porous Media: Material balance concepts (constant compressibility and dry gas systems), Steady-state and pseudo-steady state flow concepts, Inflow Performance Relations (IPRs) for Gas-Oil and Gas-Condensate Reservoir Systems, Development of the diffusivity equation: Liquid and gas systems.
3. Solutions/Models for Well Test Analysis: Steady-state, pseudo steady-state, and transient radial flow, Dimensionless variables — radial flow diffusivity equation, Solutions of the diffusivity equation (various cases - concept of "type curves"), Variable-rate convolution: general and single-rate drawdown cases, Wellbore Phenomena
4. Well Test Analysis: Variable-rate convolution: Single-rate pressure build-up case, Conventional analysis of pressure drawdown/buildup test data
5. Analysis of gas well tests, Un-fractured and fractured wells, and dual porosity reservoirs, Design of well tests, Software for the analysis of well test data
6. Analysis and Modeling of Production Data: Production analysis: Introduction, empirical analysis/forecasting, and deliverability testing, Decline type curve analysis, Software for the analysis of production data

| <b>COURSE NO.</b> | <b>COURSE NAME</b>             | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--------------------------------|----------|----------|----------|
| <b>PEE 17104</b>  | <b>OIL SHALE AND SHALE GAS</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

**OIL SHALE:**

1. Nature, origin and distribution of oil shale.
2. Petrology and geochemistry of oil shale.
3. Oil shale retorting and extraction process.
4. Characterization of oil shale.
5. Supercritical extraction oil from shale.
6. Mathematical modeling of oil shale pyrolysis.
7. Economic factor of shale oil production.

**SHALE GAS:**

1. History of shale gas production.
2. Extraction methods: development of current practices.
3. Location and size of production areas: estimated reserves and economics.

4. Environmental issues in shale gas exploration.
5. Shale gas markets and globus impact on energy scenario.

|                   |                                       |          |          |          |
|-------------------|---------------------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                    | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>CHE 17106</b>  | <b>POLYMER SCIENCE AND TECHNOLOGY</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. **Classification of polymers:** Natural and synthetic polymers; Thermosets and thermoplasts; Copolymers; Terpolymers; Degradable and non-degradable polymers.
2. Addition polymerization; Condensation polymerization; Ring opening polymerization; Copolymerization; Polymerization by coordination catalyst; Molecular weight distribution of polymers.
3. **Manufacturing processes of important polymers:** Plastics-polyethylene; polypropylene, polyvinyl chloride and copolymers, polystyrene; phenol-formaldehyde, epoxides; urethane; teflon; Rubbers and elastomers; Fibres - cellulosic (rayon), polyamides (6;6 Nylon), polyesters (Dacron), acrylic;
4. Polymeric oils.
5. **Micro-structure of polymer chains:** Configuration and conformation; Simple and hindered rotation;
6. End-to-end distances; Crystallinity and melting; Glass transition temperature; Physical states of polymers and mode of motion of polymer chains; Measurement of viscosity; Cohesive energy density; Compatibility and solubility parameters; Polymer additives, blends and composites.
7. **Flow properties of polymers:** Bulk deformation, elongation and shear flow; Non-Newtonian flow.
8. Polymer fabrication techniques: Formation of flat sheets and films; Laminations; Foam formation; Extrusion, injection molding, blow molding, compression and transfer molding; Spinning of fibres
9. **Mechanical properties of polymers:** Rheology of polymers; Rubber elasticity; Visco-elasticity; Creep

10. and stress relaxation; Dynamic behavior; Stress and fracture of rubber and glassy polymers. Polymer degradation. Conducting polymers; Smart polymers.
11. Ecology and environmental aspects of polymer industries.

|                   |                                   |          |          |          |
|-------------------|-----------------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>CHE 17107</b>  | <b>MULTI COMPONENT SEPARATION</b> | <b>3</b> | <b>0</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction to the Fundamentals of Distillation.
2. Multicomponent flash calculation
3. Isothermal flash calculation, Adiabatic flash calculation
4. Approximate methods for multicomponent – multistage separation
5. Design methods and simulation methods for multistage contactor
6. Fenske – Underwood – Gilliland (FUG) method for distillation
7. Multistage counter-current cascade – Group method for absorber and stripper
8. Rigorous method for multicomponent – multistage separation
9. Introduction to MESH equation
10. Historical development of different rigorous multicomponent distillation calculation method.
11. Classification of different method based on solution scheme
12. Thiele – Geddes method with theta ( $\theta$ ) method of convergence
13. Wang and Henke tridiagonal matrix algorithm for complex distillation column



**COURSE STRUCTURE OF VII SEMESTER DUAL DEGREE  
COURSE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2014– 15 session)**

| Sl. No. | Course No.             | Name of the course   | L         | T        | P        | Credit Hrs.           |
|---------|------------------------|--|-----------|----------|----------|-----------------------|
| 1       | PEC17101               | Oil and Gas Well Testing   | 3         | 1        | 0        | 7                     |
| 2.      | PEC 17102              | Offshore Drilling and Petroleum Production Practices   | 3         | 1        | 0        | 7                     |
| 3.      | GPD 17163<br>GLD 17154 | Petroleum Exploration - Geophysical Methods (Section A).<br>Petroleum Exploration - Geological Methods (Section B) | 2<br>2    | 0<br>0   | 0<br>0   | 8                     |
| 4       | MSC 17152              | Industrial Engg. and Management  | 3         | 0        | 0        | 6                     |
| 5.      |                        | Elective Paper   | 3         | 0        | 0        | 6                     |
| 6.      | PEC 17301              | Health Safety and Environment in Petroleum Industry (Sessional Theory paper)                                       | 3         | 0        | 0        | 6                     |
| 7.      | PEC 17801              | Petroleum Engineering Projects   | 0         | 0        | 6        | 6                     |
| 8.      | PEC17901               | Vocational Training*   | 0         | 0        | 0        | (5)                   |
|         |                        | <b>ELECTIVES: ANY ONE OF FOLLOWING</b>   |           |          |          |                       |
| i.      | PEE17103               | Well Performance   |           |          |          |                       |
| ii.     | PEE 17104              | Oil shale and Shale Gas  |           |          |          |                       |
| iii.    | CHE 17106              | Polymer Science and Technology   |           |          |          |                       |
| iv.     | CHE 17107              | Multi-Component Separation   |           |          |          |                       |
| v.      | CHE 17108              | Corrosion Engineering  |           |          |          |                       |
|         |                        | <b>Total</b>   | <b>19</b> | <b>2</b> | <b>6</b> | <b>46+(5)=<br/>51</b> |

\*Vocational Training taken at the end of VI semester is credited in VII Semester.

## **COURSE SYLLABUS**

|            |                           |
|------------|---------------------------|
| PEC 17101: | Common with VII B.Tech PE |
| PEC 17102: | Common with VII B.Tech PE |
| GPD 17163: | Common with VII B.Tech PE |
| GLD 17154: | Common with VII B.Tech PE |
| MSC 17152: | Common with VII B.Tech PE |
| PEC 17301: | Common with VII B.Tech PE |
| PEC 17801: | Common with VII B.Tech PE |
| PEC 17901: | Common with VII B.Tech PE |
| PEE 17103: | Common with VII B.Tech PE |
| PEE 17104: | Common with VII B.Tech PE |
| CHE 17106: | Common with VII B.Tech PE |
| CHE 17107: | Common with VII B.Tech PE |

| <b>COURSE NO.</b> | <b>COURSE NAME</b>           | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|------------------------------|----------|----------|----------|
| <b>CHE 17108</b>  | <b>CORROSION ENGINEERING</b> | <b>3</b> | <b>0</b> | <b>0</b> |

### **COURSE CONTENT:**

1. Electrochemical and thermodynamic principles, Nernst equation and electrode potentials of metals, EMF and galvanic series, merits and demerits; origin of Pourbaix diagram and its importance to iron, aluminium and magnesium metals
2. Exchange current density, polarization - concentration, activation and resistance, Tafel equation; passivity, electrochemical behaviour of active/passive metals, Flade potential, theories of passivity
3. Atmospheric, pitting, dealloying, stress corrosion cracking, intergranular corrosion, corrosion fatigue, fretting corrosion and high temperature oxidation; causes and remedial measures
4. Purpose of testing, laboratory, semi-plant and field tests, susceptibility tests for IGC, stress corrosion cracking and pitting, sequential procedure for laboratory and on-site corrosion investigations, corrosion auditing and corrosion map of India
5. Corrosion prevention by design improvements, anodic and cathodic protection, metallic, non-metallic and inorganic coatings, mechanical and chemical methods and various corrosion inhibitors.

**COURSE STRUCTURE OF VIII SEMESTER B.TECH  
PETROLEUM ENGG.**

(Effective from 2014 – 15 session)

6.

| Sl. No. | Course No. | Name of the course                            | L         | T        | P        | Credit Hrs.            |
|---------|------------|---|-----------|----------|----------|------------------------|
| 1       | PEC 18101  | Petroleum Engineering Design                  | 3         | 1        | 0        | 7                      |
| 2.      | PEC18102   | Enhanced Oil Recovery Techniques              | 3         | 1        | 0        | 7                      |
| 3.      | PEC18103   | Reservoir Modeling and Simulation             | 3         | 1        | 0        | 7                      |
| 4       | PEC18104   | Pipeline Engineering                          | 3         | 1        | 0        | 7                      |
| 5.      |            | Elective Paper                                | 3         | 1        | 0        | 7                      |
| 6.      | PEC18801   | Petroleum Engg. Projects and Seminar          | 0         | 0        | 6        | 6                      |
| 7.      | PEC18501   | Composite Viva Voce                           | 0         | 0        | 0        | (4)                    |
|         |            | ELECTIVES: ANY ONE OF FOLLOWING               |           |          |          |                        |
| i.      | PEE18101   | Oil and Gas Processing System Design          |           |          |          |                        |
| ii.     | PEE18102   | Coal Bed Methane & Gas Hydrates               |           |          |          |                        |
| iii.    | PEE18103   | Advanced Offshore Engineering                 |           |          |          |                        |
| iv.     | PEE18104   | Oil and Gas Marketing and Resource Management |           |          |          |                        |
| v.      | PEE18105   | Deep Sea Production System                    |           |          |          |                        |
| iv.     | CHC18102   | Petroleum Refining and Petrochemicals         |           |          |          |                        |
| v.      | CHC16103   | Process Equipment and Piping Design           |           |          |          |                        |
| vi.     | CHC16105   | Process Control and Instrumentation           |           |          |          |                        |
|         |            | <b>Total</b>                                  | <b>15</b> | <b>5</b> | <b>6</b> | <b>41+(4)<br/>= 45</b> |

## COURSE SYLLABUS

| COURSE NO. | COURSE NAME                  | L | T | P |
|------------|------------------------------|---|---|---|
| PEC 18101  | PETROLEUM ENGINEERING DESIGN | 3 | 1 | 0 |

### **COURSE CONTENT :**

**Development of Oil & Gas Fields:** Selection of development scheme, economic aspect of development of oil and gas fields. Production variants, performance prediction, Recovery factor, Stages of preparation of development plans. Computation of economic indices viz. Capital investment, payout period, IRR, Profile, Economic life etc. Analysis of different variants based on technical and economic considerations. Economic development of Marginal fields.

**Design Oil and gas separation system:** Design of two phase and three phase separators and Heater treaters, **Oil & Gas collection and handling**

### **Artificial Lift Technology:**

**Basic principles and descriptions:** Gas-lift - continuous and intermittent, chamber lift, plunger lift/sucker rod pumping, hydraulic pumping - piston & jet type.

**Design of Continuous gas lift system (pressure operated valves)** - graphical and analytical methods.

**Design of Intermittent gas lift system;** single point injection standard tubing installation (Pressure operated valves) - graphical and analytical methods.

**Design of Sucker rod pumping system,**  
**Characteristics and Selection of electric submersible pumping systems**

| COURSE NO. | COURSE NAME                      | L | T | P |
|------------|----------------------------------|---|---|---|
| PEC 18102  | ENHANCED OIL RECOVERY TECHNIQUES | 3 | 1 | 0 |

### **COURSE CONTENT:**

1. Introduction: Historical background and review of primary and secondary recovery, injection rate and pressures in secondary recovery.
2. Flood Patterns and Coverage: Basic flooding networks, directional permeabilities, off pattern wells, natural and induced fractures.

3. Microscopic displacement of fluids in a reservoir: Capillary forces, viscous forces, phase trapping, mobilization of trapped phases.
4. Macroscopic displacement of fluids in a reservoir: Areal sweep efficiency, vertical sweep efficiency, displacement efficiency, mobility ratio, well spacing.
5. Flow of immiscible fluids through porous media. continuity equation, equation of motion, solution methods Water flooding, Fractional flow equation, Frontal advance theory. Recovery efficiency, permeability heterogeneity.
6. Water flooding performance calculations: Frontal advance method, viscous fingering method, Stiles method, Dykstra-Parsons Method, Water for water flooding.
7. Gas Injection-Immiscible Displacement: Dispersed gas injection, external gas cap gas injection, foam drive process for oil recovery.
8. Chemical Flooding: Polymer flooding and mobility control processes, flow of polymers through porous media, polymer augmented water flooding, in-situ permeability modification, foam as mobility controller, WAG process; Micellar/polymer flooding, phase behavior of microemulsions, phase behavior and IFT, wettability alterations, Alkali flooding.
9. Miscible Displacement Processes: Mechanism of miscible displacement, phase behavior related to miscibility, fluid properties in miscible displacement, design procedure and criteria, high pressure gas injection, enriched gas injection, LPG flooding, Carbon dioxide flooding, alcohol flooding.
10. Thermal Recovery Processes: mechanism of thermal flooding, hot water flooding, cyclic steam injection, estimation of oil recovery from steam drive, in-situ combustion, air requirement for in-situ combustion.
11. Microbial oil recovery
12. Surface facilities for EOR processes: Treatment of water for reservoir compatibility. Design consideration for water handling and injection system. Pumps types & sizing, Infectivity problems. Gas compression for injection, gas compressors. Design consideration for gas collection and distribution system for injection.
13. EOR Project Evaluation.

|                   |  |          |          |          |
|-------------------|--|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                       | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>PEC 18103</b>  | <b>RESERVOIR MODELING AND SIMULATION</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction & Overview: Definition, Objectives and applications of reservoir simulation with brief overview of the system, steps of the reservoir simulation.
2. Modeling concepts: type of models, check list for designing a model, concept of grid blocks, initial and boundary conditions, various flow models, concept of proper grid orientation
3. Designing of model equations- black oil model and compositional model
  - a. Simplification of model equations with realistic solution:
  - b. Selection & Preparation of data: Rock data, fluid data, mechanical data, production data., Thickness and depth etc . Sensitivity of results to data accuracy
  - c. Pseudo functions :Pseudo-relative permeability & Capillary pressure functions, VE pseudo functions
4. Solution techniques for model equations: Analytical vs. numerical solutions
  - a. Conversion of complex PDE to simplified algebraic equation using finite difference method, concept of Explicit & Implicit functions
  - b. Selecting Grid & Time-step sizes: Selection of gridblock size example grids, Selection of time steps, Numerical dispersion, Grid orientation, Cost considerations
  - c. Selecting the Numerical solution method. Terminology, Formulating options, Numerical Dispersion, Choosing the formulation option, Matrix Equations, Solution methods, Selecting the Equation-solving technique.
5. History Matching: Validity of the Reservoir Model, Strategy & Plans, Adjustment of parameters, Pressures, Pressure gradients, GOR-WOR behavior Automatic History Matching.
6. Forecasting Future Performance: Planning prediction cases, Preparation of input data, Making a smooth transition from history to predictions, Review & Analysis of predicted performance, Evaluating & Monitoring predicted performance

7. Simulating Special Processes: Concept of Compositional Simulation, Miscible displacement, Chemical & polymer flooding, Steam simulation and steam drive, In-Situ combustion, Special Data requirements.

| COURSE NO. | COURSE NAME          | L | T | P |
|------------|----------------------|---|---|---|
| PEC 18104  | PIPELINE ENGINEERING | 3 | 1 | 0 |

#### COURSE CONTENT :

1. Objective and scope of pipeline as a means of fluid transportation with special reference to crude oil/gas/refined products, Economics of Pipeline transportation.
2. **Design of Pipeline:** Factors influencing oil, gas and refined products as pipeline design; Hydraulic surge and water hammer; specific heat of liquids; river crossing; pipe size and station spacing etc.
3. Theory and different formulae of the flow of fluids in oil/gas pipelines; basic equations for the flow of fluids through pipes; different flow equations for laminar and turbulent flow of compressible and incompressible fluids (Newtonian); Introduction to the flow of Non-Newtonian fluids through pipes; multiphase flow and loop pipelines.
4. **Construction and Maintenance of pipelines;** Route location survey, materials; project specifications; general equipment specifications (Pipes, valves and fittings); Installation of expansion loops and thermodynamic tapping plant. Pigging, Pigging Technology: pig launcher and receiver, intelligent pigging, types of pigs.
5. Corrosion protection and control; Design of cathodic protection system, Pipeline automation.
6. **Offshore Pipeline:** Design and control of Sag and Over bend; Description of stinger; and Riser, articulated stinger, construction of offshore pipeline, Method of underwater welding.
7. **Hydrates, Wax & Scale:** Formation and prevention. Crude conditioning and use of additives to improve flow conditions.
8. City distribution network of oil/gas. Lease and custody transfer.

| COURSE NO. | COURSE NAME                          | L | T | P |
|------------|--------------------------------------|---|---|---|
| PEE 18101  | OIL AND GAS PROCESSING SYSTEM DESIGN | 3 | 1 | 0 |

**COURSE CONTENT:**

- Oil desalting:** Operation, variables, Heater treater design.
- Natural Gas Dehydration:** (a) Glycol Process: operation, effect of variables, dew point depression, stage calculation.
- NTU - graphical and analytical methods, Absorber sizing. Lean oil absorption. (b) Solid-bed process: design & operation, effect of process variables, Regeneration and cooling calculations. Hydrocarbon recovery. (c) Hydrate formation & inhibition.
- Natural Gas Sweetening:** Acid gases, Toxicity, Pipeline specification. Solid-bed Process : Design, operation & effect of variables. Adsorbent selection. Multistage Separation, Hengstebach's Flash calculation, stabilizer design. Amine and other absorptive process details.
- Crude & Condensate Stabilization:** LTX Stabilization.
- Oil & Gas Treatment :** Oil desalter, emulsion treatment theory and practice, Emulsifiers & Demulsifiers, Gravity Separation, coalescence, coalescing media, electrostatic coalescers.
- Treating Equipment:** Vertical, horizontal, Electrostatic, Process heat duty, Sensible heat of natural gas, Water, Heat transfer from fire-tube. Heat exchangers- types, fluid placement, sizing, number of tubes.

| COURSE NO. | COURSE NAME                       | L | T | P |
|------------|-----------------------------------|---|---|---|
| PEE18102   | COAL BED METHANE AND GAS HYDRATES | 3 | 1 | 0 |

**COURSE CONTENT:**

**COAL BED METHANE:**

Present status of coal bed methane. Formation and properties of coal bed methane. Thermodynamics of coal bed methane. Exploration & Evaluation of CBM. Drilling, completion and logging of coal bed methane wells. Hydro-fracturing of coal seam, Activation of well. Production installation and surface



facilities. Well operation and production equipment. Treating and disposing produced water. Testing of coal bed methane wells.

**NATURAL GAS HYDRATES:**

Introduction & present status of gas hydrates. Formation and properties of gas hydrates. Thermodynamics of gas hydrates. Exploration & evaluation of gas hydrates. Phase behavior of gas hydrates. Kinetics of gas hydrates. Drilling and completion of gas hydrate wells. Prevention & control of gas hydrates. Gas hydrates accumulation in porous medium. Gas extraction from gas hydrates. Uses and application of gas hydrates.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                       | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEE 18103</b>  | <b>ADVANCED OFFSHORE<br/>ENGINEERING</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction: Deviations from Onshore drilling, Challenges , Rig types:Jack-up, Semi-sub, Floaters
2. Deepwater Drilling: Introduction - History & Geology, Floating Drilling Rigs and chronological Advancements, Basic Floating Rig equipment, Rig Automation
3. Dynamic Positioning: Types and Basic operations of a DP system, Major components of the DP system , DP rig vs moored rig , Types of thrusters used by DP vessels, Basic layout of a power distribution system onboard a DP vessel and associated protection systems, Power management system. Watch Circles - Drive-off ; Drift-Off.
4. Open Water Operations: Remotely operated vehicles: Wellhead components for open water operations, Guidance systems; Guideline system; Guideline less system; Mudmat, connector selection, Jetting structural casing versus cementing in a drilled hole , Operational Procedures, Special considerations , high currents, shallow water , flows, drill with mud – “pump and dump” concept , Special cementing operations.
5. Riser Systems: Riser system Components, Buoyancy, Riser Tensioners & Tensioning Criteria, Basic Riser Analysis, Riser Operations, Emergency Disconnect, High Current Operations.

6. Subsea Wellheads: Overview of Wellhead Components, Tool Description, Wellhead sizing.
7. BOP System: Wellhead & LMRP Connectors, RAM preventers, Annular Preventers, Choke & Kill line valves, LMRP, Landing & latching the BOP, Control System, Back-up system, BOP Stack Testing, Diverter System.
8. Deepwater Casing & Cementation: Review of conductor and surface casing design, Casing design process flow, Casing seat Selection, Kick Tolerance, Burst, Collapse, Tensile and bucking criteria & Calculations, Software assisted Casing Design, Casing running, Casing connections, Cementing Procedures , Casing and liner cementing; squeeze cementing, Cementation Hardware.
9. Well Abandonment ; Abandonment Guidelines & Regulations: Plug placement; balance plug calculations; inflow test, Barrier placement.
- 10 Review and case studies.

|                   |  |          |          |          |
|-------------------|--|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>   | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>PEE18104</b>   | <b>OIL AND GAS MARKETING<br/>AND RESOURCE<br/>MANAGEMENT</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction: The development of Oil & Gas Industry, Structure of Oil & Gas Industry, Introduction to Indian Oil & Gas Industry, India Hydrocarbon vision 2025.
2. Petroleum Resource classification, Analysis of resource management.
3. Natural Gas: What is Natural Gas, Measuring Natural Gas, Pipeline quality natural Gas
4. Demand, Supply & Storage of natural gas: Gas production, Source of demand in India, The supply system, Pipeline Operations & Network, Storage of Natural Gas, Liquefied Natural gas Plant & Operations, Gas Sales Pattern in India, Gas Pipeline Regulations in India, Gas Trading, Gas Pricing
5. Coal Bed Methane: Introduction, Present status of Coal Bed Methane, CBM Storage and sales, CBM Pricing in India
6. Crude Oil: Crude oil/ specification, Measuring/ Custody transfer of Crude Oil, Crude Oil Transportation, Crude Oil

- Production in India, Crude Oil refineries, Products from Crude Oil
7. International & National Institutions of Oil & Gas: API, OPEC, OECD, OADB, DGH, PNGRB, CHT, PII, PPAC, PCRA.
  8. Petroleum Contracts: NELP - Role & Background , Types of Contracts and fiscal components, Production sharing contracts in India, Crude Oil trading and pricing, CBM Contracts
  9. Trade Practices & Taxation: Norms on various trade practices, Elements of Petroleum Development Policy, Financial and taxation issues.
  10. Risk Management: source of risk, managing risks by risk reduction, diversification, and uncertainty and decision analysis by decision tree.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|-----------------------------------|----------|----------|----------|
| <b>PEE 18105</b>  | <b>DEEP SEA PRODUCTION SYSTEM</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Concept of deep sea development: Direct tie back and FPSO based development.
2. Hydrate, Wax, Scale and Asphaltene equilibrium curves and the effect of low temperature. Analysis of well bore and pipeline heat transfer processes.
3. Concept of cool down time and its application for the development concept.
4. Basic multiphase flow concepts, Flow patterns, hold up and pressure drop in multiphase flow lines. Slugging phenomena – Concepts of transient vs hydrodynamic slugging .Design of the receiving facility- Slug catcher vis a vis Separators.
5. Outlines of thermodynamic inhibitors (MEG and Methanol) and basic calculation methods for hydrate formation prevention.
6. Introduction to LDHIs and their chemistry for hydrate prevention.
7. Field techniques used for the dissociation of the hydrate plugs in pipelines.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                               | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC18102</b>   | <b>PETROLEUM REFINING AND<br/>PETROCHEMICALS</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Genesis, occurrence, exploration and production of crude oil. Composition and Evaluation of crude oil and testing of petroleum products.
2. Atmospheric and vacuum distillation. Pretreatment of crude oil and transportation.
3. Cracking processes - Thermal cracking, Vis-breaking, Coking. Catalytic cracking (FCC), Hydro cracking,
4. Rebuilding processes: Alkylation, Aromatization, Polymerization; Isomerisation; Reforming
5. Treatment Processes- Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability. Product treatment processes - various solvent treatment processes, Dewaxing ,Clay treatment, hydro treatment and Hydro fining.
6. Feedstock of petrochemical industries; Developments of petrochemical industries in India and abroad; Cracking of naphtha and gas for the production of Olefins. Production of acetylene from methane Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                             | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC16102</b>   | <b>PROCESS EQUIPMENT AND<br/>PIPING DESIGN</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

**Section-A**

1. Detailed design and drawing of enclosures, supports and standard flanges, storage vessels including Unfired Pressure Vessels, Reaction Vessels.
2. Cyclone Separator and Gravity Thickener: Detailed Design And Drawing Of Cyclone Separator And Gravity Thickener.
3. Cooling Towers: Detailed Design and Drawing of Cooling Towers.
4. Heat Exchangers: Detailed Design And Drawing of Various Types of Heat Exchangers.

5. Distillation Column: Detailed Design And Drawing Of Distillation Column.
6. Absorber: Detailed Design and Drawing of Absorber.
7. Dryer: Detailed Design and Drawing of Dryer.

**Section-B**

1. Fundamentals of fluid flow through pipes-Calculation of pressure drop for Newtonian & non-Newtonian fluids, incompressible & compressible fluids and two-phase flow, Calculation of Economic pipe diameter, insulation thickness, equivalent length, Slurry transport and pipelines Engineering flow diagram, nomenclature and equipment elevation.
2. Piping layout, line pressure drop, piping analysis, stress analysis of curved pipelines, yard piping, Piping codes, standards and specifications-ASME, ASTM, API Piping components-pipes, pipe ends, pipe fittings, end fittings, flanged joints, valves, valve codes and standards, valve classification, valve components, bolts, gaskets (fasteners and sealing elements)Piping materials-selection, cost and installation Design of heat exchanger piping, Thermosyphonre boiler piping, Pressure relief piping Steam tracing design, Thermowell design, Expansion loops and expansion joints Design of pipeline network-Pinch analysis Pipeline operation and maintenance-friction reduction, cleaning, coating, wear, leak detection, water hammer.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                         | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC 16105</b>  | <b>PROCESS CONTROL AND INSTRUMENTATION</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Importance, aims and objectives of process control.
2. Laplace transform, block diagram, Forcing function, Concept of transfer function; dynamics of first, second and higher order linear systems, open loop and closed loop systems; linearization; feedback control; stability; root locus diagram; frequency response analysis; Bode stability criterion; Nyquist stability criterion; design of

controller; dynamics of some complex processes; control valves and introduction to real time computer control of process equipment; cascade, feed forward, adaptive control; SISO; MIMO.

3. Application of control systems to chemical process equipments such as chemical reactors, heat exchangers, distillation columns, boilers etc.
4. A/D conversion, PLC architecture; Multi-variable control strategies.
5. Principles of measurement. Error Analysis, Static and dynamic characteristics of instruments.
6. Industrial instruments for measurement of pressure, temperature, flow and level.

**COURSE STRUCTURE OF VIII SEMESTER DUAL DEGREE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2014– 15 session)**

| Sl. No. | Course No. | Name of the course   | L         | T        | P        | Credit Hrs.            |
|---------|------------|--|-----------|----------|----------|------------------------|
| 1       | PEC 18101  | Petroleum Engineering Design                               | 3         | 1        | 0        | 7                      |
| 2.      | PEC18102   | Enhanced oil Recovery Techniques                           | 3         | 1        | 0        | 7                      |
| 3.      | PEC52101   | Well Intervention and Well Stimulation Techniques          | 3         | 1        | 0        | 7                      |
| 4       | PEC52102   | Oil and Gas Marketing and Resource Management              | 3         | 1        | 0        | 7                      |
| 5.      |            | <b>Elective (any one)</b>                                  | <b>3</b>  | <b>1</b> | <b>0</b> | <b>7</b>               |
| 6.      | PEC 18301  | Reservoir Modeling and Simulation (Sessional Theory Paper) | 3         | 1        | 0        | 7                      |
| 7.      | PEC18501   | Composite Viva Voce  | 0         | 0        | 0        | (4)                    |
| 8.      | PEC 18801  | Petroleum Engg. Projects and Seminar                       | 0         | 0        | 6        | 6                      |
|         |            | <b>ELECTIVES: ANY ONE OF FOLLOWING</b>                     |           |          |          |                        |
| i.      | PEE 18101  | Oil and Gas Processing System Design                       |           |          |          |                        |
| ii.     | PEE18102   | Coal Bed Methane & Gas Hydrates                            |           |          |          |                        |
| iii.    | PEE18106   | Subsea Integrity Management                                |           |          |          |                        |
| iv.     | PEE18107   | Offshore Structures Design                                 |           |          |          |                        |
| v.      | PEE52109   | Fluid Flow through Porous Media                            |           |          |          |                        |
| vi.     | PEE52110   | Carbon Capture and Sequestration                           |           |          |          |                        |
| vii.    | CHC18102   | Petroleum Refining and Petrochemicals                      |           |          |          |                        |
| viii.   | CHC 6103   | Process Equipment and Piping Design                        |           |          |          |                        |
| ix.     | CHC16105   | Process Control and Instrumentation                        |           |          |          |                        |
|         |            | <b>Total</b>   | <b>18</b> | <b>6</b> | <b>6</b> | <b>48+(4)<br/>= 52</b> |

## COURSE SYLLABUS

PEC 18101: Common with VIII B.Tech PE

PEC 18102: Common with VIII B.Tech PE

PEC 18501: Common with VIII B.Tech PE

PEC 18801: Common with VIII B.Tech PE

PEE 18101: Common with VIII B.Tech PE

PEE 18102: Common with VIII B.Tech PE

PEE 52106: Common with II M.Tech PE

PEE 52107: Common with II M.Tech PE

PEE 52110: Common with II M.Tech PE

PEE 52111: Common with II M.Tech PE

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 52101</b>  | <b>WELL INTERVENTION &amp;<br/>STIMULATION TECHNIQUES</b> | <b>3</b> | <b>1</b> | <b>0</b> |

### COURSE CONTENT :

1. Work-over operations. Work over fluids. Scraping, well circulation, Water and gas Shut-off, Squeeze cementing. Handling water and gas coning.
2. Production packers, Packers calculation, Well activation. Repair of wells, Paraffin and scale removal. Planning and evaluation of workover jobs. Corrosion, Bacteria & Scale control.
3. Well treatment; acidizing oil & gas wells. Hydro-perforation. Hydraulic fracturing. Stimulation designing, Proppants and their placement. Thermal stimulation techniques. Down-hole heaters. Horizontal well related development on the subject.
4. Sand-control, Screens, Gravel packs.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>   | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEC52102</b>   | <b>OIL AND GAS MARKETING<br/>AND RESOURCE<br/>MANAGEMENT</b> | <b>3</b> | <b>1</b> | <b>0</b> |

### COURSE CONTENT:

1. Introduction: The development of Oil & Gas Industry, Structure of Oil & Gas Industry, Introduction to Indian Oil & Gas Industry, India Hydrocarbon vision 2025.



2. Petroleum Resource classification, Analysis of resource management.
3. Natural Gas: What is Natural Gas, Measuring Natural Gas, Pipeline quality natural Gas
4. Demand, Supply & Storage of natural gas: Gas production, Source of demand in India, The supply system, Pipeline Operations & Network, Storage of Natural Gas, Liquefied Natural gas Plant & Operations, Gas Sales Pattern in India, Gas Pipeline Regulations in India, Gas Trading, Gas Pricing
5. Coal Bed Methane: Introduction, Present status of Coal Bed Methane, CBM Storage and sales, CBM Pricing in India
6. Crude Oil: Crude oil/ specification, Measuring/ Custody transfer of Crude Oil, Crude Oil Transportation, Crude Oil Production in India, Crude Oil refineries, Products from Crude Oil
7. International & National Institutions of Oil & Gas: API, OPEC, OECD, OIBD, DGH, PNGRB, CHT, PII, PPAC, PCRA.
8. Petroleum Contracts: NELP - Role & Background , Types of Contracts and fiscal components, Production sharing contracts in India, Crude Oil trading and pricing, CBM Contracts
9. Trade Practices & Taxation: Norms on various trade practices, Elements of Petroleum Development Policy, Financial and taxation issues.
10. Risk Management: source of risk, managing risks by risk reduction, diversification, and uncertainty and decision analysis by decision tree.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEC 18301</b>  | <b>PETROLEUM RESERVOIR<br/>MODELING AND SIMULATION<br/>(Sessional theory paper)</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction & Overview: Organization, Design, Testing, Forecasting, Special processes, Economics, Credibility, decision making, Performance Monitoring, beneficial application, Planning a simulation study, Study

- Approach, Model design, Programming, History Matching, Predicting & Analyzing results, reporting.
2. Modeling Concepts: The concept of Gridblocks & Timesteps, Representation of wells, Mobility Weighting, Numerical Dispersion, Grid Orientation effects, Explicit & Implicit functions, Treatment of Vertical saturation & Pressure distributions, Well functions, History Matching, Well Management, Solution methods.
  3. Designing the reservoir model, Checklist for model design, Selecting the number of dimensions, Tank models, 1D, 2D (Areal, cross-sectional, radial), Multilayer, 3D, Simplification of complex problems, Pseudo-relative permeability & Capillary pressure functions, VE pseudo functions, Windowed models, Naturally fractured reservoirs, Representation of reservoir fluids, Representation of reservoir rock, Well models.
  4. Selecting reservoir rock and fluid properties data: Data for model construction, Sensitivity of results to data accuracy, Porosity & Permeability: Sources of data, developing reservoir description, rock property distribution, Thickness and depth, Capillary pressure and relative permeability: Selection and assignment of data Fluid properties, Establishing Initial pressure and saturation distribution.
  5. Selecting Grid & Time-step sizes: Selection of gridblock size example grids, Selection of time-steps, Numerical dispersion, Grid orientation, Cost considerations.
  6. Selecting the Numerical solution method.: Terminology, Formulating the equations, Material Balance & pressure equations, Formulating options, Numerical Dispersion, Choosing the formulation option, Matrix Equations, Solution methods, Selecting the Equation-solving technique.
  7. Well Management: Designing & Controlling Production Parameters.
  8. History Matching: Validity of the Reservoir Model, Strategy & Plans, Adjustment of parameters, Pressures, Pressure gradients, GOR-WOR behavior Automatic History Matching.
  9. Forecasting Future Performance: Planning prediction cases, Preparation of input data, smooth transition from history to predictions, Review & Analysis of predicted

performance, Evaluating & Monitoring predicted performance.

10. Simulating Special Processes: Compositional Simulation, Miscible displacement, Chemical & polymer flooding, Steam simulation and steam drive, In-Situ combustion, Special Data requirements.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                     | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEE18106</b>   | <b>SUBSEA INTEGRITY<br/>MANAGEMENT</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT :**

1. Introduction.
2. Sub sea structures eg. Xmas tree, manifolds, subsea assemblies. Risers, umbilical, pipelines etc.
3. Acceptance criteria, Identification of initiating events.
4. Cause analysis – Fault tree and Event tree analysis.
5. Causes of risks.
6. Failure probability estimation based on qualitative data base and structural reliability method.
7. Consequence analysis.
8. Examples: Risk analysis of subsea gas pipeline failure and dropped object analysis.
9. Integrity management of risers and umbilicals.
10. Corrosion management.
11. Life cycle cost as a decision making tool in pipeline design.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                        | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEE 18107</b>  | <b>OFFSHORE STRUCTURES<br/>AND DESIGN</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Offshore field developments, Analysis of offshore structures, Offshore platforms & their stability, Buoyant force calculation, Bracing & framing patterns in offshore structures, Welding of offshore structures, layouts of jacketed offshore platforms.
2. **Analyses of Sea environment:** Wind, waves and current forces.- Characteristics, analysis and force

evaluation, Sea soil & sea bed, Offshore piles and their foundation.

3. **Tubular/ rectangular joints:** Types, design, protection and failures.
4. Corrosion in offshore structures and its protection, Buckling & bending in offshore structures and in offshore pipe lines, Risk factors and risk analysis.
5. **Offshore mobile rigs:** Types, load and stress analysis, Fatigue calculation and safety factors, Marine risers and tensioners.
6. **Fixed platform design:** Steel templates & concrete tower type platforms - construction, fabrication and installation.
7. **Structural analyses:** Stress analysis & calculation, Skewed and finite plates; Fillets and grooves design, Offshore-static and dynamic structural analysis.

| COURSE NO. | COURSE NAME                     | L | T | P |
|------------|---------------------------------|---|---|---|
| PEE52109   | FLUID FLOW THROUGH POROUS MEDIA | 3 | 1 | 0 |

**COURSE CONTENT:**

1. **The Porous Medium:** The Physical Medium, Relevant Physical Phenomena, Pore Scale vs. Continuum Scale, Fluid and Porous Matrix Properties
2. **Mathematical Models of Porous Media:** Network Models, Statistical Descriptors, Fractal Models, Effective Medium, Mixture Theories, Double Porosity Models
3. **Balance Principles:** Mass, Momentum and Energy Conservation, Equations of Motion
4. **Single Phase Flow in a Porous Medium:** Darcy's law
5. **Constitutive Theory :**
6. **Boundary Value Problems:** Well-Posed Problems, Common Boundary Conditions, Common Solution Procedures
7. **Immiscible Multiphase Flow :** Surface Chemistry, Thermodynamics of Interface, Interfacial Tension, Capillary Pressure, Simultaneous Flow of Two Fluids
8. **Surface Phenomena :** Adsorption, Wetting, Thin Films, Transport through Membranes
9. **Miscible Displacements and Dispersion**

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                      | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|---|----------|----------|----------|
| <b>PEE52110</b>   | <b>CARBON CAPTURE AND SEQUESTRATION</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction: Scope, Objectives and Necessity of CCS
2. The contribution of fossil fuels emission to Climate change and global warming. Concept of Carbon Credit and carbon footprint.
3. Carbon capture techniques: Carbon-di-oxide emission, Scrubbing of CO<sub>2</sub> , Carbon dioxide recycling
4. Carbon dioxide sequestration: Underground storage, Potential for Geologic Storage, Application in Oil and gas industry, Carbon di oxide flooding projects, Methane recovery projects.
5. Strategy for implementing CCS technology:
6. Modelling of Cost and Performance of CCS Plants.
7. Role and function of IPCC

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                           | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC18102</b>   | <b>PETROLEUM REFINING AND PETROCHEMICALS</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. **Genesis**, occurrence, exploration and production of crude oil. Composition and Evaluation of crude oil and testing of petroleum products.
2. Atmospheric and vacuum distillation. Pretreatment of crude oil and transportation.
3. Cracking processes - Thermal cracking, Vis-breaking, Coking. Catalytic cracking (FCC), Hydro cracking,
4. Rebuilding processes: Alkylation, Aromatization, Polymerization; Isomerisation; Reforming
5. Treatment Processes- Treatment techniques for removal of sulphur compounds to improve performance, Storage and stability. Product treatment processes - various solvent treatment processes, Dewaxing ,Clay treatment, hydro treatment and Hydro fining.

6. Feedstock of petrochemical industries; Developments of petrochemical industries in India and abroad; Cracking of naphtha and gas for the production of Olifines. Production of acetylene from methane Catalytic Reforming of petroleum feed stocks. Extraction of Aromatics.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                         | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC16103</b>   | <b>PROCESS EQUIPMENT AND PIPING DESIGN</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

**Section-A**

1. Detailed design and drawing of enclosures, supports and standard flanges, storage vessels including Unfired Pressure Vessels, Reaction Vessels.
2. Cyclone Separator and Gravity Thickener: Detailed Design And Drawing Of Cyclone Separator And Gravity Thickener.
3. Cooling Towers: Detailed Design and Drawing of Cooling Towers.
4. Heat Exchangers: Detailed Design And Drawing of Various Types of Heat Exchangers.
5. Distillation Column: Detailed Design And Drawing Of Distillation Column.
6. Absorber: Detailed Design and Drawing of Absorber.
7. Dryer: Detailed Design and Drawing of Dryer.

**Section-B**

1. Fundamentals of fluid flow through pipes-Calculation of pressure drop for Newtonian & non-Newtonian fluids, incompressible & compressible fluids and two-phase flow, Calculation of Economic pipe diameter, insulation thickness, equivalent length, Slurry transport and pipelines Engineering flow diagram, nomenclature and equipment elevation.
2. Piping layout, line pressure drop, piping analysis, stress analysis of curved pipelines, yard piping, Piping codes, standards and specifications-ASME, ASTM, API Piping components-pipes, pipe ends, pipe fittings, end fittings, flanged joints, valves, valve codes and standards, valve classification, valve components, bolts, gaskets (fasteners and sealing

elements) Piping materials-selection, cost and installation Design of heat exchanger piping, Thermosyphonre boiler piping, Pressure relief piping Steam tracing design, Thermowell design, Expansion loops and expansion joints Design of pipeline network-Pinch analysis Pipeline operation and maintenance-friction reduction, cleaning, coating, wear, leak detection, water hammer.

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                         | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC 16105</b>  | <b>PROCESS CONTROL AND INSTRUMENTATION</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Importance, aims and objectives of process control.
2. Laplace transform, block diagram, Forcing function, Concept of transfer function; dynamics of first, second and higher order linear systems, open loop and closed loop systems; linearization; feedback control; stability; root locus diagram; frequency response analysis; Bode stability criterion; Nyquist stability criterion; design of controller; dynamics of some complex processes; control valves and introduction to real time computer control of process equipment; cascade, feed forward, adaptive control; SISO; MIMO.
3. Application of control systems to chemical process equipments such as chemical reactors, heat exchangers, distillation columns, boilers etc.
4. A/D conversion, PLC architecture; Multi-variable control strategies.
5. Principles of measurement. Error Analysis, Static and dynamic characteristics of instruments.
6. Industrial instruments for measurement of pressure, temperature, flow and level.

**COURSE STRUCTURE OF IX SEMESTER DUAL DEGREE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2015– 16 session)**

| Sl. No. | Course No. | Name of the course   | L  | T | P | Credit Hrs.   |
|---------|------------|--|----|---|---|---------------|
| 1.      | PEC 51102  | Oil and Gas Property Evaluation, Economics and Risk Analysis | 3  | 1 | 0 | 7             |
| 2.      | PEC 51103  | Advanced Well Completion Practices                           | 3  | 1 | 0 | 7             |
| 3.      | PEE 51101  | Oil and Gas Field Development and Planning                   | 3  | 1 | 0 | 7             |
| 4.      |            | Elective – I   | 3  | 1 | 0 | 7             |
| 5.      |            | Elective – II  | 3  | 1 | 0 | 7             |
| 6.      | PEC 19801  | Project & Dissertation (Interim)                             | 0  | 0 | 8 | 8             |
| 8.      | PEC 19802  | Seminar & Viva Voce  | 0  | 0 | 0 | (4)           |
|         |            | <b>Elective Papers</b> (Any Two of the following)            |    |   |   |               |
| i.      | PEE 51102  | Multilateral & Horizontal Well Technology                    |    |   |   |               |
| ii.     | PEE 51103  | Well Servicing   |    |   |   |               |
| iii.    | PEE 51104  | Integrated Reservoir Management                              |    |   |   |               |
| iv.     | PEE 51105  | Drilling System Design                                       |    |   |   |               |
| v.      | CHC 17101  | Chemical Process Plant Design and Economics                  |    |   |   |               |
| vi.     | CHC 17102  | Transport Phenomena  |    |   |   |               |
|         |            | Total  | 15 | 5 | 8 | 43 + (4) = 47 |

**COURSE SYLLABUS**

|            |                          |
|------------|--------------------------|
| PEC 51102: | Common with I M.Tech PE. |
| PEC 51103: | Common with I M.Tech PE  |
| PEE 51101: | Common with I M.Tech PE  |
| PEE 51102: | Common with I M.Tech PE  |
| PEE 51103: | Common with I M.Tech PE  |
| PEE 51104: | Common with I M.Tech PE  |
| PEE 51105: | Common with I M.Tech PE  |



|                   |   |          |          |          |
|-------------------|---|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>  | <b>L</b> | <b>T</b> | <b>P</b> |
| PEC 51102         | <b>OIL &amp; GAS PROPERTY<br/>EVALUATION, ECONOMICS &amp;<br/>RISK ANALYSIS</b> | 3        | 1        | 0        |

**COURSE CONTENT:**

1. **Introduction:** Structure of oil industry, Financial aspects of the oil industry, world oil supply and demand.
2. **Principles, Methods and Techniques for Oil and Gas Property Evaluation, Project Parameters:** Time value of money in capital investment, Depreciation, depletion and amortization of oil projects, Financial measures and profitability analysis, Break-even and sensitivity analysis, Optimization Techniques.
3. **Applications and Project Evaluation of Oil Fields:** Economic evaluation of exploration and drilling operations, Estimation of oil reserves and evaluation of an oil property, Economic evaluation of production operation.
4. **Downstream Oil Activities:** Economic evaluation: Oil transportation, Crude oil processing, Distribution and Marketing, Oil and Gas prices.
5. **Taxation:** Severance and Ad Valorem taxes, Federal income taxation of oil and gas transactions, Value added taxation
6. **International Petroleum Economics:** Types of contract agreements and cash flow, Effects of various fiscal terms on petroleum economics, Cost recovery ceiling, geopolitics of the petroleum industry.
7. **Uncertainty and Risk Analysis:** Risk, uncertainty, investment and decision analysis, Risk management in energy markets including the identification of risk and the use of 'futures' and 'options' markets.
8. **Environment and pollution control:** Regulation and control of pollution and environmental modelling, monitoring and database management.
9. **Equity Participation and Merger Acquisition**

|                   |                                       |          |          |          |
|-------------------|---------------------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>                    | <b>L</b> | <b>T</b> | <b>P</b> |
| PEC51103          | ADVANCED WELL<br>COMPLETION PRACTICES | 3        | 1        | 0        |

**COURSE CONTENT:**

1. Basics of Reservoir Completion: Inflow Performance, Open Hole Completion Techniques, Perforating, Hydraulic Fracturing, Acid Fracturing and Completion.
2. Sand Control: Rock Strength and Sand control Prediction, Mitigating sand production without screens, Formation grain size distribution, Sand control screens, Standalone screens, Open hole Gravel Packs, Cased hole gravel packs and frac packs, Expandable screens, Chemical Consolidation, Choosing the appropriate method of sand control.
3. Life of Well Operations: Types and methods of Intervening, Impact on Completion Design.
4. Tubing well performance, heat transfer & sizing, Hydrocarbon Behavior, Multiphase flow & tubing performance, flow predictions, Temperature prediction and Control, Packer fluids, Production well sizing, Injection Well sizing.
5. Material Selection: Metals, Downhole Corrosion, Metallurgy Selection, Corrosion Inhibition, Seals, Control Lines and encapsulation, Coatings and liners
6. Tubing Stress Analysis: Purpose, tubular Manufacture and specifications, Stress, Strain and Grades, Axial Loads, Burst , Collapse, Triaxial Analysis, Safety and design Factors, Load Cases, Tubing Connections, Packers, Completion Equipment, Use of Software for tubing stress analysis.
7. Completion Equipment: Well Head and tubing hanger: Vertical and horizontal trees; Platform and land Christmas trees; subsea Christmas tree. Subsurface safety Valves, Packers, Expansion devices and anchor latches, Landing nipples, locks and sleeves, Mandrels and gauges, Capillary lines and cable clamps, Loss control and reservoir isolation valves, Crossovers, Flow couplings, Modules, Integrating equipment into the design process.
8. Installing the Completion: Installation Affects Completion Design, Wellbore Clean-out and mud displacement, Completion fluids and filtration, Safely running the

completion, Pre-job preparation; rig layout; running tubing; running control lines, Well clean-up and flow initiation, Procedures, Handover and post-completion Reporting,

9. Specialist Completion: Deepwater Completions: Deepwater environments; Production chemistry and well performance; stress analysis; Operational Considerations. HPHT Completions, Completions with downhole flow control, Multilateral Completions, Dual Completions, Multipurpose Completions, Underbalanced completions, Coiled tubing and insert completions, Completions for Heavy oil and steam injection, Completions for Coal Bed Methane

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                | <b>L T P</b> |
|-------------------|---|--------------|
| <b>PEE 51101</b>  | <b>OIL AND GAS FIELD DEVELOPMENT AND PLANNING</b> | <b>3 1 0</b> |

**COURSE CONTENT:**

1. The Field Life Cycle: Gaining Access, Exploration Phase, Appraisal Phase, Development Phase, Production Phase, Decommissioning.
2. Petroleum Agreements & Bidding: Invitations to bid, Motivations and form of bid, Block Award, Fiscal System, Farm-in & Farm-out, Unitisation and Equity determination.
3. Exploration: Hydrocarbon Accumulations, Exploration methods & techniques.
4. Drilling Engineering Brief overview: Well Planning, Rig types & Rig Selection, Drilling systems & Equipment, Site Preparation (Onshore & Offshore), Costs & Contracts
5. Safety & The Environment (Brief overview)
6. Reservoir Description: Data Gathering, Data Interpretation
7. Field Appraisal: Importance of Appraisal, Identifying and quantifying sources of Uncertainty, Cost benefit calculations for Appraisal.
8. Reservoir Dynamic Behaviour: Fluid Flow studies, PVT data, Drive Mechanisms. Gas Reservoirs: Difference between oil and gas field development, Gas sales profiles; Influence of Contracts; movement of GWC during production, Pressure response, Fluid displacement in the

Reservoir, Estimation of Reserves, Reservoir Simulation, Estimating the Recovery Factor, Estimating the Production Profile.

9. Well Dynamic Behaviour: Estimating the number of Development Wells, Fluid flow near the wellbore, Horizontal Wells, Production Testing & Bottom Hole Pressure Testing, Tubing Performance, Well Completions, Intelligent Wells, Artificial Lift.
10. Project & Contract Management: Phasing & Organisation, Planning & Control, Cost Estimation & Budgets, Types of Contracts.
11. Petroleum Economics: Basic principles of Development Economics, Project Cash flow, Revenue & expenditure items, CAPEX-OPEX, Host Government take, Capital Allowances, Economic Indicators, Project Screening, Sensitivity Analysis,
12. Risk Analysis: Definition of Risk and Risk Matrix,
13. Managing the Producing Field: Subsurface, surface facilities, Internal & External factors.
14. Managing Decline: Infill Drilling, Work over Activity, Enhanced Oil Recovery, Extended Reach Development
15. Decommissioning: Legislation, Decommissioning Methods

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                 | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>PEE51102</b>   | <b>MULTILATERAL AND HORIZONTAL WELL TECHNOLOGY</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT :**

Introduction & objectives of horizontal wells, ERD, Laterals etc. . Geological and reservoir aspects, & development of oil & gas field using horizontal wells. Drilling & completion of horizontal wells. Reservoir engineering concepts of horizontal wells. Well logging methods in horizontal wells. Well test analysis of horizontal wells. Well performance & productivity of horizontal Wells. Water & Gas coning in horizontal wells. Application of horizontal wells in gas reservoirs & in recovery of heavy oils, Introduction to Multistage Fracturing.

|                   |                    |          |          |          |
|-------------------|--------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b> | <b>L</b> | <b>T</b> | <b>P</b> |
| PEE 51103         | WELL SERVICING     | 3        | 1        | 0        |

**COURSE CONTENT:**

**WELL COMPLETION:**

Design of Perforators: Bullet, hydraulic perforators, shaped charge perforators and mechanical cutters;  
 Perforating process; Perforation Guns and firing head.  
 Perforating/ well activation mechanism: Underbalanced and overbalanced perforations.  
 Pressure control equipment (Well Head Lubricator Assembly);  
 Type, size and orientation of perforation holes;  
 Optimum Perforation Practices; Down-hole Equipment-Packers – their types, Tubing, Flow couplings, expansion joints, Sliding Sleeves / Side Pocket Mandrels, Blast Joints, Landing Nipples, Slickline Operations, Smart / Intelligent Wells.

**Well Sickness, diagnosis and mitigation:** Type of well sickness, Symptoms of sick wells, Testing of sick wells, Identification and Diagnosis of Well Problems, Planning of Workover Jobs; Minor & Major (Capital Repair) jobs; Water & Gas Shut-off jobs; Squeeze Cementing; Water and Gas Coning; Sand Control & its Techniques; Fishing operation, Coil Tubing Unit, Snubbing unit.

**Well Stimulation Techniques:** Acidizing of O & G Wells; Hydraulic Fracturing; Acid fracturing, Heat treatment, Down-hole Heaters. In-situ Combustion.

|                   |                                 |          |          |          |
|-------------------|---------------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>              | <b>L</b> | <b>T</b> | <b>P</b> |
| PEE 51104         | INTEGRATED RESERVOIR MANAGEMENT | 3        | 1        | 0        |

**COURSE CONTENT:**

- 1. Introduction:** Scope and Objectives
- 2. Reservoir management concepts:** Definition and history, fundamentals of reservoir management, synergy and team; integration of geosciences and engineering, integration of exploration and development technology

3. **Reservoir management process:** Setting goals, developing plans and economics, surveillance and monitoring, evaluation
4. **Data acquisition, analysis and management:** Classification of data, acquisition, analysis and application, validation, storing and retrieval
5. **Reservoir model:** Role of reservoir model in reservoir management, integration of G & G and reservoir model
6. **Reservoir performance analysis and prediction:** Naturally producing mechanism, reserves and role of various forecasting tools- volumetric method, MBE, Decline curve and mathematical simulation
7. **Reservoir Management economics:** evaluation, risk and uncertainties
8. **Reservoir management plans:** strategy for newly developed field (Green) and Secondary and EOR operated field, strategy for Green and Brown Field.

| COURSE NO. | COURSE NAME            | L | T | P |
|------------|------------------------|---|---|---|
| PEE 51105  | DRILLING SYSTEM DESIGN | 3 | 1 | 0 |

#### COURSE CONTENT:

1. Drilling rig selection and design.
2. **Casing string and drill string Design:** Conventional and conditional Design, Deep well strings, Design practices for high inclined wells, Horizontal wells and Slanted wells. Liner Design and Setting, String loading, Buckling and well head load calculations.
3. **Mud Hydraulics Design:** Rheology of drilling fluids and compatibility to bore hole conditions, Hydraulic horse power and Rig horse power calculations. Jet impact force, Hydraulics design in High inclines wells. Bit Hydraulics, Bottom drive hydraulics design.
4. **Precise Directional Control:** Directional data Analysis, Calculations for well coordinates Well path deflection tools, tool orientation, & correction.
5. **Down Hole Motors:** Positive displacement motors, Turbodrills, Rotary Steering Motors, Geosteering tools, Performance calculation and selection of of Bottom drive units.

6. **Measurements While Drilling:** MWD, LWD, SWD system, Data Telemetry and data interpretation.
7. **Special Methods of Drilling:** Aerated drilling, Electrical Drilling Rigs, Top drive drilling, Re-entry drilling, Jet Drilling, Drilling in High pressure and variable pressure regime, ERD, Multilaterals, Slim hole, coil tubing drilling.
8. **Computer Application in Drilling.**

| <b>COURSE NO.</b> | <b>COURSE NAME</b>                                     | <b>L</b> | <b>T</b> | <b>P</b> |
|-------------------|--|----------|----------|----------|
| <b>CHC 17101</b>  | <b>CHEMICAL PROCESS PLANT<br/>DESIGN AND ECONOMICS</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Basic considerations in Chemical Engineering Plant Design. Project identification, preliminary techno-economic feasibility. Process design aspects-process selection, factors affecting. Importance of laboratory development, pilot plant, scale-up methods, safety factor's, flow diagrams.
2. Selection of process equipments-standard Vs special equipments, selection Criteria, specification sheet, Process auxiliaries - piping design, layout, process control and instrumentation, Process utilities-process water, boiler feed water, wastes treatment & disposal, Oil heating system, chilling plant., compressed air vacuum.
3. Interest-types & calculations. Cost estimation-factors involved in project cost estimation, total capital investment, fixed capital and working capital, Methods of estimation of investment. Cost index and scaling for equipment cost. Estimation of total product cost-factors involved.
4. Depreciation-types & methods of determination. Profitability - alternative investment and replacement methods, practical factors in alternative & replacement investment.
5. Inventory control, scheduling a project using CPM/PERT. Project management. Optimum conditions-optimum production rates in plant operations, optimum conditions in cyclic operations. Design reports. Plant location and

layout principles, factors affecting, use of scale methods, case studies.

|                   |                            |          |          |          |
|-------------------|----------------------------|----------|----------|----------|
| <b>COURSE NO.</b> | <b>COURSE NAME</b>         | <b>L</b> | <b>T</b> | <b>P</b> |
| <b>CHC 17102</b>  | <b>TRANSPORT PHENOMENA</b> | <b>3</b> | <b>1</b> | <b>0</b> |

**COURSE CONTENT:**

1. Introduction to transport phenomena; Potential flow, Turbulent flow; molecular transport mechanisms and general properties; analogies amongst momentum, heat, and mass transport; boundary layer analysis for momentum,
2. heat, & mass transfer; estimation of transport coefficient, non-Newtonian fluids, rheological characteristics of materials, agitation of non-Newtonian fluids. Heat & mass transfer with and without chemical reaction, non-isothermal, unsteady state processes with and without chemical reactions.

-----

**COURSE STRUCTURE OF X SEMESTER DUAL DEGREE  
COURSE  
B.TECH PETROLEUM ENGINEERING & M.TECH  
PETROLEUM ENGINEERING  
(Effective from 2015– 16 session)**

| <b>Sl. No.</b> | <b>Course No.</b> | <b>Name of the course</b>                                | <b>L</b> | <b>T</b> | <b>P</b> | <b>Credit Hrs.</b> |
|----------------|-------------------|--|----------|----------|----------|--------------------|
| 1              | PEC110801         | Project & Dissertation                                   | 0        | 0        | 0        | (20)               |
| 2.             | PEC 11090         | Seminar on Dissertation                                  | 0        | 0        | 0        | (5)                |
| 3.             | PEC110802         | Viva Voce on Dissertation                                | 0        | 0        | 0        | (10)               |
| 4              | PEC 10903         | Evaluation of Teaching Assignment/ Development Work etc. | 0        | 0        | 0        | (5)                |