# ANNEXURE - A

ANDHRA UNIVERSITY: COLLEGE OF ENGINEERING  
DEPARTMENT OF METALLURGICAL ENGINEERING  
SCHEME OF INSTRUCTION & EXAMINATION  
(admitted batch of 2006-07)  
B.E. METALLURGICAL ENGINEERING

## II Year – I Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC 211(A)</td>
<td>Mathematics-III</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 212 (A)</td>
<td>Engg. Mechanics-1</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 213 (A)</td>
<td>Strength of Materials</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 214</td>
<td>Fuels, Refractories and Furnace Technology</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 215 (C)</td>
<td>Machine Drawing</td>
<td>4 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 216 (C)</td>
<td>Manufacturing Technology-1</td>
<td>4 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MT 217 P</td>
<td>Production Technology</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td>MT 218 P</td>
<td>Strength of Materials</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td>MT 219 P</td>
<td>Fuels &amp; Mechanics</td>
<td>3 3 50</td>
<td>50 100</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>33</strong></td>
<td><strong>330</strong></td>
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</table>

## II Year - II Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC 221(A)</td>
<td>Mathematics-IV</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 222 (A)</td>
<td>Materials Science &amp; Metallurgy</td>
<td>4 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 223</td>
<td>Environmental Studies (*)</td>
<td>3 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 224(D)</td>
<td>Electrical Technology</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 225 (D)</td>
<td>Industrial Electronics &amp; Microprocessor</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE  226</td>
<td>Metal Casting</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 227</td>
<td>Met. Thermodynamics &amp; Kinetics</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MT 228 P</td>
<td>Metal Casting</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td>MT 229 P</td>
<td>Electrical Technology</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>310</strong></td>
<td><strong>590</strong></td>
</tr>
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</table>

(*) Environmental studies introduced for the 2004-05 admitted batch

## III YEAR- I Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC 311((D))</td>
<td>Fluid Mechanics</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 312</td>
<td>Mineral Beneficiation</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 313</td>
<td>Mechanical Metallurgy</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 314</td>
<td>Production of Iron &amp; Ferro Alloys</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MTE 315</td>
<td>Metallography &amp; X-ray Diffraction</td>
<td>5 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MEC 316 (A)</td>
<td>Engineering Economics</td>
<td>4 3 30</td>
<td>70 100</td>
</tr>
<tr>
<td>MT 317 P</td>
<td>Mineral Beneficiation</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td>MT 318 P</td>
<td>Testing of Materials</td>
<td>3 3 50</td>
<td>50 100</td>
</tr>
<tr>
<td>MT 319 P</td>
<td>Soft Skills lab</td>
<td>3 100</td>
<td>100 1</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>38</strong></td>
<td><strong>380</strong></td>
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```
## III YEAR - II Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam hours</th>
<th>Sessional Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTE 321</td>
<td>Physical Metallurgy</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MEC 322(C)</td>
<td>Design of Machine Elements-1</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 323</td>
<td>Non-Ferrous Extractive Metallurgy</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
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<tr>
<td>MEC324 (C)</td>
<td>Industrial Engg. and Management</td>
<td>4</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
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</tr>
<tr>
<td>MTE 325</td>
<td>Metal Forming</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 326</td>
<td>Metal joining</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 327 P</td>
<td>Physical Metallurgy</td>
<td>3</td>
<td>3</td>
<td>50</td>
<td>50</td>
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</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>32</strong></td>
<td><strong>230</strong></td>
<td><strong>470</strong></td>
<td><strong>700</strong></td>
<td><strong>26</strong></td>
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</tr>
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</table>

Note: Industrial Training for a minimum of three weeks at the end of III Year II Semester during summer vacation. Assessment of the Industrial Training is made during IV Year I-Semester.

## IV Year - 1st Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam hours</th>
<th>Sessional Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTE 411</td>
<td>Corrosion &amp; Protection</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 412 (A)</td>
<td>Heat &amp; Mass Transfer</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 413</td>
<td>Heat Treatment</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MTE 414</td>
<td>Steel Making</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MT 415 P</td>
<td>Heat &amp; Mass Transfer</td>
<td>3</td>
<td>3</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>MT 416 P</td>
<td>Heat Treatment</td>
<td>3</td>
<td>3</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>MT 417 P</td>
<td>Industrial Training</td>
<td>-</td>
<td>-</td>
<td>100</td>
<td>-</td>
<td>100</td>
<td>2</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>26</strong></td>
<td><strong>320</strong></td>
<td><strong>380</strong></td>
<td><strong>700</strong></td>
<td><strong>22</strong></td>
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</table>

## IV Year – II Semester

<table>
<thead>
<tr>
<th>Code</th>
<th>Subject</th>
<th>Periods</th>
<th>Exam hours</th>
<th>Sessional Marks</th>
<th>Exam Marks</th>
<th>Total Marks</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>MEC 421 (A)</td>
<td>Instrumentation &amp; Control Systems</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MEC 422 (A)</td>
<td>Computer Aided Design</td>
<td>5</td>
<td>3</td>
<td>30</td>
<td>70</td>
<td>100</td>
<td>4</td>
</tr>
<tr>
<td>MT 424 P</td>
<td>Electro Metallurgy</td>
<td>5</td>
<td>3</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>MT 425 P</td>
<td>Computer Aided Design Lab</td>
<td>3</td>
<td>50</td>
<td>-</td>
<td>50</td>
<td>100</td>
<td>2</td>
</tr>
<tr>
<td>MT 426 P</td>
<td>Project work</td>
<td>8</td>
<td>-</td>
<td>50</td>
<td>50</td>
<td>100</td>
<td>8</td>
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<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>31</strong></td>
<td><strong>160</strong></td>
<td><strong>290</strong></td>
<td><strong>450</strong></td>
<td><strong>20</strong></td>
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</table>

D: Common for Mech, and M.P.I & Metallurgy
Vector calculus. Differentiation of vectors, curves in space, Velocity and acceleration, Relative velocity and acceleration, Scalar and Vector point functions – Vector operation \( \mathbf{\nabla} \). \( \nabla \) applied to scalar point functions – Gradient, \( \nabla \) applied to vector point functions – Divergence and Curl. Physical interpretation of \( \text{div} \ F \), \( \nabla \) applied twice to point functions, \( \nabla \) applied twice to point functions, Integration of vectors, Line integral- Circulation – Work surface integral – Flux, Green’s theorem in the plane, Stoke’s theorem, Orthogonal curvilinear co-ordinates \( \nabla \) applied to functions in orthogonal curvilinear co-ordinates, Cylindrical coordinates – spherical polar co-ordinates.


Applications of Partial Differential equations. Introduction, Methods of separation of variables, partial differential equations of Engineering, Vibration of a stretched stirring-wave equation, One-dimensional heat flow, Two dimensional heat flow, Solution of Laplace’s equation, Laplace’s equation in polar co-ordinates.


**Reference:**
MEC 212(A): ENGINEERING MECHANICS –I  

Periods/week: 5 L  
Credits: 4  
Sessionals: 30  
Exam: 70


Text books:
1. Engineering Mechanics – S.Timoshenko (relevant sections only)
2. Elements of Strength of Materials- S.Thimoshanko (relevant sections only)

MEC 213 (A) STRENGTH OF MATERIALS  

Periods/week: 5 L  
Credits: 4  
Sessionals: 30  
Exam: 70


Text books:
1. Engineering Mechanics – S.Timoshenko (relevant sections only)
2. Elements of Strength of Materials- S.Thimoshanko (relevant sections only)

MTE 214 FUELS,REFRACTORIES AND FURNACE TECHNOLOGY

Periods/week: 3L-2T  
Credits: 4  
Sessionals: 30  
Exam: 70


Text books:
1. Fuels, furnaces and refractories by O.P.Gupta

References:
1. Fuels, Technology by Hinues
2. Fuels by Gilechrist
3. Refractories by Chesty
MEC 215 (C) MACHINE DRAWING  
(Common with Mech., M.P.I, Metallurgy and Mech. Marine)

Periods/week: 4P                     Credits: 4       Sessionals: 30         Exam: 70


Orthogonal view and sectional views of machine parts. Assembly drawing of various engine components and machine tool components.

Text books:
2. Engineering Drawing, A.C. Parkinson, Wheeler publishing.

MTE 216 © MANUFACTURING TECHNOLOGY-1  
(Common with Mech., M.P.I, Metallurgy and Mech. Marine)

Periods/week: 4P                     Credits: 4       Sessionals: 30         Exam: 70

Manufacturing concepts; Product cycle; Job, batch and mass production; Primary and secondary manufacturing processes; Principle of metal casting; Terminology; Pattern; Types; Allowances; Materials; Core boxes; Selection; Testing and preparation of moulding sands; Moulding tools and equipment; Machine moulding; Core making; Sprue; Runner, gates and risers; Types and designing; Melting and pouring the metal; Shell mold casting; Investment casting; Permanent mould casting; Casting defects.

Formability of metals; Cold and hot working; Rolling; Types; Roll size; Stretch forming, metal spinning, embossing and coining; Peening; Sheet metal forming operations; Presses; Die design.

Forging materials; Forging processes; Forging techniques; Forging presses; Forging pressure distribution and forging force; Automation of forging; Swaging; Drawing; Extrusion; High energy rate forming.

Weldability; Welding metallurgy; Principles and processes of arc welding (SMAW, GTAW, GMAW, FCAW, PAW, SAW); Welding equipment; Weld positioners and fixtures; Oxyacetylene welding; Flame cutting; Brazing and soldering; Principle of resistance welding; Types of resistance welds; Seam welding; Projection welding; Resistance butt welding; Solid state welding; Weld inspection and testing.

Text Book:

Reference Books:
MT 217 P Production Technology

Periods/week: 3P  Credits: 2  Sessionals: 50  Exam:50

Use of basic tools and operations of the following trades.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Trade</th>
<th>Number of jobs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Foundry</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>Welding</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>Lathe</td>
<td>Step and taper turning -1</td>
</tr>
<tr>
<td>4</td>
<td>Milling</td>
<td>Thread cutting -1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Offset turning - 1</td>
</tr>
<tr>
<td>5</td>
<td>Shaper</td>
<td>Spur gear -1</td>
</tr>
</tbody>
</table>

MT 218 P Strength of Materials

Periods/week: 3P  Credits: 2  Sessionals: 50  Exam: 50

List of Experiments:
1. To study the stress strain characteristics of metals by using UTM by tension test.
2. To study the stress strain characteristics of metals by using Hounsfield tensometer.
3. Determination of compression strength of wood.
4. Determination of hardness using different hardness testing testing machines- Brinells, Vickers and Rockwell’s
5. Impact test by using Izod & charpy methods.
6. Deflections test on beams using UTM.
7. Tension shear test on MS rods.
8. To find stiffness & modulus of rigidity by conducting compression tests on springs.
9. Torsion tests on M.S.Shafts.
11. Punch shear test, hardness test & compression test by using Hounsfield tensometer.
12. Hardness test using UTM
13. Sieve analysis and determination of fineness number.

MT 219 P FUELS & MECHANICS

Periods/week: 3  Credits: 2  Sessional: 50  Exam:50

List of experiments:
1. To assemble the given parts of the mechanism kit for different types of mechanisms
2. To determine the moment of inertia of the given fly wheel.
3. To determine the moment of inertia of the given connecting rod.
4. To determine the modulus of rigidity of the given wire with torsional pendulum.
5. To determine the coefficient of friction with Thurston oil tester.
6. Study and valve timing diagrams of four stroke and two stroke engine.
7. Study of boilers, fuel pumps, carburetors etc.
8. To determine the volumetric efficiency of the given air compressor by
   1. Plate orifice method and 2. Tank capacity method.
9. To calibrate the given pressure gauge.
10. Determination of Flash and fire points of oils.
12. To determine the kinematic and absolute viscosity of the given sample oil using Redwood Viscometer I.
13. To determine the kinematic and absolute viscosity of the given sample oil using Redwood Viscometer II.
II YEAR - II SEMESTER

MEC 221(A) Mathematics -IV

Periods/week: 3L  Credits: 4  Sessional: 30  Exam: 70

Functions of a complex variable. Introduction $f(z)$ its limit and continuity. Derivative of $f(z)$ – Cauchy-Riemann equations, Analytic functions, Harmonic functions.

Orthogonal system, Applications to flow problems, Integration of complex functions, Cauchy’s inequality, Liouville’s theorem, Poission’s integral formulae series of complex terms- Taylor’s series – Laurent’s series, singular points-Residues, Reside theorem, Calculation of residues , Evaluation of real definite integrals, Geometrical representations, Special conformal transformations.

Statistical Methods. Probability. Addition law of probability, Independent events, Multiplication law of probability distribution, Continuous probability distribution, Expectation, Moment generating, function, repeated trials, Binomial distribution, Poisson distribution, Normal distribution, Probable error, Normal approximation to Binominal distribution, Some other distributions, sampling, sampling distribution, standard error, Testing of hypothesis, Level of significance, Confidence limits, simple sampling of attributes, Sampling of variables- Large samples, Sampling of variables- Small samples, Student’s I-distribution, $x^2$-distribution, F-distribution, Fisher’s Z-distribution.


Text book:

Reference:
3. Advanced Mathematics for Engineering students, Vol.2 and Vol.3 by Narayanan,Manica-vachagaon Pillay and Ramanaiah
Space lattice and unit cells, crystal systems. Indices for planes and directions. Structures of common metallic materials. Crystal defects: point, line and surface defects.


NDT Testing: Ultrasonic, Magnetic, Dye penetrant and visual methods and applications radiographic.

TEXT BOOKS:
1. Material Science and Engineering by V.Raghavan

REFERENCE BOOKS:


Environmental Pollution causes, Effects, standards and control (A) Air pollution ; (b) Water Pollution; (c) Soil pollution; (d) Marine pollution; (e) Noise pollution

Legal aspects of pollution
(a) Air (Prevention and control of pollution) Act
(b) Water (Prevention and control of pollution) Act
(c) Environmental Protection 1980 Act.
(d) Forest Conservation Act.

Role of People to protect environment-Rolle of NGOS
(a) Global issues (b) Green House Effect (c) Global Warming (d) Nuclear accidents
(B) Local issues causes and action
© Air pollution due to industries
(D)Automobiles
C. Public interest Litigation case studies-Success stores

Leather industries
Taaj * Mathura Refinery
Silent Valley

TEXT BOOKS

(A) Introduction to environmental sciences – Turk & Turk and Witties
(B) Environmental Sciences – P.D.Sarma
Magnetic circuits. Definitions of magnetic circuit, Reluctance, Magnetomotive force (m.m.f), magnetic flux, simple problems on magnetic circuits, Hysteresis loss.

(Chapter 8, Page Nos.155-175)


(Chapter 9, Page Nos.176-190)


(Chapter 10,11, Page Nos.208-238)


(Chapter 12,13, Page Nos.239-267)


(Chapter 16, Page Nos.323-348)

Transformers. Transformer principle, EMF equation of transformer, Transformer on load, Equivalent circuit of Transformer, Voltage regulation of transformer, losses in a transformer, Calculation of efficiency and regulation by open circuit and short circuit tests.

(Chapter 20, Page Nos.423-455)


(Chapter 21, Page Nos.463-489)


(Chapter 23, Page Nos.505-515)


(Chapter 24, Page Nos.516-526)

Electrical measurements. Principles of measurement of current, Voltage power and energy, Ammeters, Voltmeters, Wattmeter’s ,Energy Meters, Electrical conductivity Meter, Potentiometer and Megger.

Text book:
1. Elements of Electrical Engineering and Electronics by V.K.Mehta, S.Chand & Co.

Reference book:
1. A first course in Electrical Engineering, by Kothari
MEC 225 (D) INDUSTRIAL ELECTRONICS & MICROPROCESSOR
(Common for Mechanical, and M.P.I. & Metallurgy)

Periods/week: 3L-2T  Credits: 4  Sessional:30  Exam: 70


Resistance welding, Induction heating-Dielectric heating. Servomechanism: Open loop and closed loop system (Elementary treatment only).


Memories. ROM,PROM, EPROM and RAM.


Text books:
1. Industrial Electronics by Mithal (Khanna Publications)

Reference:

MTE 226 METAL CASTING

Periods/week: 3L-2T  Credits: 4  Sessional: 30  Exam: 70


Modernization and mechanization of foundries.

Text books:
1. Principles of Metal Casting, Heine, Loper and Rosenthal, Tata Mc Grawhill
2. Foundry Technology, P.C.Jain, Tata Mc Grawhill
MTE 227: METALLURGICAL THERMODYNAMICS & KINETICS

Periods/week: 3L-2T  
Credits: 4  
Sessional: 30  
Exam: 70


Fugacity, activity and equilibrium constant. Vant Hoff’s isotherm. Variation of equilibrium constant with temperature. Clausius-Clapeyron’s equation. Ellingham diagrams and application.


Textbooks:

Reference:
1. Chemical Metallurgy, J.J.Moore
2. Problems in Thermodynamics & Kinetics, G.S.Upadhyaya and R.N.Dubey
3. Metallurgical Thermodynamics, ML Kapoor Part I & II
4. Metallurgical Thermodynamics, Tupkary
MT 228P: METAL CASTING

Periods/week: 3P                  Credits: 2                         Sessional: 50                      Exam: 50

List of Experiments

1. Determination of AFS grain fineness number.
2. Determination of AFS clay contact.
3. Determination of permeability of moulding sands.
5. Determination of flowability and compatibility of moulding sands.
6. Determination of moisture content.
7. Determination of shatter index.
8. Study on the combined effect of Bentonite and moisture on green properties of moulding sands.
9. Study on melting practice and casting of simple shapes in Al.
10. Study on casting defects of aluminum casting.

MT 229 P: ELECTRICAL TECHNOLOGY

Periods/week: 3P                          Credits: 2                       Sessional: 50    Exam: 50

List of Experiments:

1. Study on Calibration of Ammeter.
2. –do–  Voltmeter
3. –do–  Watt Meter
4. –do–  Energy Meter
5. Measurement of low resistance (armature)
6. –do–  medium resistance (field)
7. –do–  insulation resistance
8. –do–  filament resistance
9. Verification of KCL and KLV
10. Superposition theorem.
11. Parameters of choke oil
12. OC and SC tests on transformer
13. OC and load test D.C. shunt machine
14. OC and Load test on D.C. separately excited machine
15. Swinburnes test
16. 3 Phase induction motor( No load and rotor block tests) load test
17. Alternator regulation by syn. Impedance method
III YEAR-1ST SEMESTER – SYLLABUS

MEC 311(D) FLUID MECHANICS
(Common for Mech, and M.P.I. & Metallurgy)

Periods/week: 3L-2T Credit: 4 Sessional: 30 Exam: 70

Properties of fluids-Viscosity – Pressure measurement and Manometers – Hydrostatic forces on surfaces.


Laminar Boundary Layer. Momentum integral equation- Flow over a flat plate- Displacement thickness, Momentum thickness and energy thickness.

Turbulent Boundary Layer. Laminar –Turbulent transition-Momentum equations and Reynold’s stresses- Fully developed turbulent flow through a pipe – Turbulent boundary layer on a flat plate – Laminar sub-layer – Boundary layer separation and control.


Compressible fluid flow. Thermodynamic relations – Continuity, Momentum and Energy equations- Velocity of sound in a compressible fluid- Mach number and its significance – Limits of incompressibility – Pressure field due to a moving source of disturbance – Propagation of pressure waves in a compressible fluids- Stagnation properties – Stagnation pressure, Temperature and density – Area velocity relationship for compressible flow – Flow of compressible fluid through nozzles- Condition for maximum discharge through nozzles – Variation of mass flow with pressure ratio – Compressible flow through a venturimeter – Pitot static tube in a compressible flow.

Text book:

Reference:
MTE 312: MINERAL BENEFICIATION

Periods/week: 3L-2T  Credits: 4  Sessional: 30  Exam: 70


Study of basic de-watering techniques like-sedimentation – filtration – drying.

Simple flow sheets for Beneficiation of Fe, Mn, Cr, Cu, Pb, Zn and beach sands.

Text books:
1. Principles of Mineral Dressing, Gaudin, A.M.

References:
2. Unit operation in Chemical Engineering.
Introduction. Importance of testing in quality control.


Text books:
1. Mechanical Metallurgy, George E.Dieter, Mc Grawhill

References:
2. Metals hand book
MTE 314: PRODUCTION OF IRON & FERRO ALLOYS

Periods/week: 3L-2T       Credits: 4       Sessionals: 30       Exams: 70


Text books:
1. Introduction to modern iron making, R.H. Tupkary
2. Introduction to modern iron making, A.K. Biswas
3. Physical Chemistry of Iron & Steel Making, C.Bodsworth

References:
1. MSTS-United Steel Corporation, Pittsburgh

MTE 315 METALLOGRAPHY & X-RAY DIFFRACTION

Periods/week: 3L-2T       Credits: 4       Sessionals: 30       Exams: 70


3. Diffraction Methods: Laue’s method, rotating crystal, Debye scherrer – Specimen preparation, film loading, powder method, Determination of crystal structure, determination of crystal structure, determination of precision lattice parameter, sources of error in measurements.


5. Chemical Analysis by X-ray techniques, X-ray fluorescence. X-ray specto meters, qualitative and quantitative analysis, micro analysis of metals and alloys, LDX, WDX.

Text books:
1. X-ray diffraction – B.D.Cullity
MEC 316 (A) ENGINEERING ECONOMICS

Periods/week: 4L                      Credits: 4                       Sessional: 30                             Exam: 70


Reference:
2. Cost accounts by Shukla and Grewal.

MT 317 P: MINERAL BENEFICIATION

Periods/week: 3P                                  Credits: 2     Sessional: 50                                       Exam: 50

LIST OF EXPERIMENTS:

1. Sampling by coning and quartering, riffle sampler.
2. Determination of average particle size by sieve analysis.
3. Determination of optimum time of sieving.
4. Studies on size reduction using laboratory Jaw Crusher.
5. Studies on size reduction using laboratory Roll Crusher.
6. Studies on size reduction using laboratory Ball Mill.
7. Heavy media separations (sink and float experiment)
8. Laboratory experimentation Froth Flotation.

MT 318 P: TESTING OF MATERIALS

Periods/week: 3P                               Credits: 2   Sessional: 50                              Exam:50

List of Experiments:
1. Dye-Penetrant Test.
3. Ericsen Cupping Test
4. Tensile & Bend Testing
5. Coating thickness
6. Shore seleroscope hardness test
7. Testing of a welded joint
8. Poldi Testing
9. Cold working & annealing
10. Fatigue testing
11. Impact testing
Communication:
Importance of communication
Non verbal communication
Personal appearance
Posture
Gestures
Facial expressions
Eye contact
Space distancing

Goal setting:
Immediate, short term, long term,
Smart goals, strategies to achieve goals

Time management:
Types of time
Identifying time wasters
Time management skills

Leadership and team management:
Qualities of a good leader
Leadership styles
Decision making
Problem solving
Negotiation skills

Group discussions:
Purpose (Intellectual ability, creativity, approach to a problem, solving, tolerance, qualities of a leader)
Group behavior, Analyzing performance

Job interviews:
Identifying job openings
Preparing resumes & CV
Covering letter
Interview (Opening, body-answer Q, close-ask Q),
Types of questions

Reference books:
1. ‘Effective Technical Communications’ by Rizvi M. Ashraf, McGraw–Hill Publication
2. ‘Developing Communication Skills’ by Mohan Krishna & Meera Banerji, Macmillan
3. ‘Creative English for Communication’ by N.Krishnaswami & T.Sriraman, Macmillan
Phase rule, principles of construction and interpretation of binary phase diagrams. Invariant reactions. Free energy composition diagrams, uses and limitations of phase diagrams. Equilibrium and non-equilibrium phases, important phase diagrams—Fe-C, Cu-Zr, Cu-Sn, Al-Si, Al-Cu, Ph-Sn, Sub-Sn. Ternary diagrams and interpretation of structures on cooling.

Solidification: Solidification of pure metals, alloys and eutectic. Homogeneous and heterogeneous nucleation, constitutional supercooling, segregation, porosity, Directional solidification, microstructure of solidified metals, zone refining.


Recovery, recrystallisation and grain-growth, strengthening mechanisms— grain boundary strengthening, solid solution strengthening, deformation of two phase aggregates, strengthening from fine particles, Fibers strengthening, Martensite-strengthening, strain hardening, preferred orientation.

Text books:
1. Physical Metallurgy - S.H.Avner
2. Physical Metallurgy - V.Raghavan
3. Physical Metallurgy - Vijendra Singh
4. Mechanical Metallurgy - G.E. Dieter

Reference book:
1. Physical Metallurgy - R.E.Reed Hill
MEC 322 (c) DESIGN OF MACHINE ELEMENTS
(Common for Mech., and M.P.I. & Metallurgy)

Periods/week: 3L-2T  
Credits: 4  
Sessionals: 30  
Exam: 70


Text books:

Reference:
MTE 323: NON-FERROUS EXTRACTIVE METALLURGY

Periods/week: 3L-2T  
Credits: 4  
Sessionals: 30  
Exam: 70


Nuclear Reactor Technology. Fuel for nuclear reactors. Basic components of a reactor characteristics and requirements. Types of reactor.

Text books:

References:
1. Metallurgy of Non-Ferrous Metals, Dennis, W.H.
2. Non-Ferrous Metallurgy, Sebryukov, N.Min, Pub. Moscow
Concepts of Industrial Management. Principles of management – Growth of management thought
functions of management, principles of organization, types of organization and committees.

Introduction to personnel management. Functions. Motivation. Theories of motivation. Hawthorne
studies, Discipline in industry, Promotions, Transfer lay off and discharge, Labour turnover.

Industrial relations. Trade unions. Industrial disputes, Strikes, Lockout, Picketing, Gherao, Settlement

Production planning and control. Types of productions, Production cycle, product design and
development, Process planning, forecasting, loading, scheduling, dispatching, routing, progress, control, simple
problems.

Plant layout. Economics of plant location, Rural Vs Suburban sites, types of layouts, types of building,
travel chart technique. Assembly line balancing simple problems.

Materials handling principles, concept of unit load, containerization, pelletisation, selection of material
handling equipment, Applications of belt conveyors, cranes, Forklift trucks in industry.

Plant Maintenance. Objective and types.

Work-study of productivity (simple problems)

Method study. Basic steps in method study. Process chart symbols. Charts, Diagrams and models used,
Principles of motion economy, Therbligs, Simo chart. Work measurement- Stop watch procedure of time study,
Performance rating and allowances, work sampling, Simple problems.

Materials Management. Introduction, Purchasing, Objectives of purchasing department, Buying
techniques, Purchase procedure, Stores and material control, Receipt and issue of materials, Store records.

Quality control-Single and double sampling plans. Control charts of variables and attributes (use of
formulae only).

Text book:
1. Industrial Engineering Management, Dr.O.P.Khanna

References:
2. Production and Operations Management, Everette Adam & Ronald Ebert
MTE 325: METAL FORMING

Periods/week: 3L-2T Credits: 4 Sessionals: 30 Exam: 70


References:

MTE 326: METAL JOINING

Periods/week: 3L-2T Credits: 4 Sessionals: 30 Exam: 70


Text books:
1. Welding and Welding Technology, R.L.Little
2. Welding Technology, N.K.Srinivasan

MTE 327 P: PHYSICAL METALLURGY

Periods/week: 3 P Credits: 2 Sessional : 50 Exam: 50

About 12 experiments on the Metallography of common ferrous and Non-Ferrous metals and alloys, experiments on thermal analysis.
IV YEAR-1ST SEMESTER

MTE 411: CORROSION & PROTECTION

Periods/week: 3L-2T  Credits: 4  Sessionals: 30  Exam: 70


Text books:
1. An introduction to Electrometallurgy, Sharan and Narain, Standard Publishers
MTE 412 (A) : HEAT & MASS TRANSFER


Periods/week: 3L-2T                                            Credits: 4      Sessionals: 30                  Exam: 70

Introduction. Basic modes of heat transfer-Rate equations-Generalized heat conduction equation in Cartesian, Cylindrical and spherical coordinate systems.

Steady state heat conduction solution for plain and composite slabs, cylinders and spheres-Critical thickness of insulation- Heat conduction through fins of uniform and variable cross section – Fin effectiveness and efficiency.

Unsteady, steady state heat conduction- Transient heat conduction – Lumped system analysis , and use of Heisler charts.


Boiling. Different regimes of boiling-Nucleate, Transition and film boiling.

Condensation. Laminar film condensation. Nusselt’s theory. Condensation on vertical flat plate and horizontal tubes- dropwise condensation.


Text books:
MTE 413: HEAT TREATMENT

Periods/week: 3L-2T  
Credits: 4  
Sessionals: 30  
Exam: 70

Phase transformation in Fe-C system, Critical temperatures. Austenite grain size designation. Inherently fine-grained and inherently coarse grained steel. Importance of grain size and its determination. Heat Treatment Furnaces and atmospheres.


Text books:
1. Heat treatment, Rajan
2. Heat treatment of metals, Zakharov

References:
1. Physical Metallurgy, V.Raghavan
2. Introduction to Physical Metallurgy, S.H.Avner
4. Physical Metallurgy for Engineers, Clark and Varney
MTE 414: STEEL MAKING

Periods/week: 3L-2T  
Credits: 4  
Sessionals: 30  
Exam: 70

History of steel making. Cementation and crucible process.


Pneumatic steel making process. Converter steel making. Acid and basic Bessemer process with respect to construction, lining of various points of OHF, fuel and R.M. operation and chemistry of the process. Developments in OHP, Tilting and twin hearth process.


Text books:
1. Steel Making, R.H.Tupkary
2. Steel Making, Kudrin
3. Steel Making, Biswas

References:
1. The making, shaping and treating of steel-USS.
MT 415 P: HEAT & MASS TRANSFER

Periods/week: 3 P Credits: 2 Sessional: 50 Exam: 50

List of Experiments:
1. Study of conduction phenomena in the composite slab system.
2. Determination of emissivity, time constant, Fourier Biot module and study of variation of temperature with respect to time on a circular disc.
3. Study of heat transfer by forced convection through a horizontal test section.
4. Study of heat transfer by forced convection through a vertical test section.
5. Determination of free convective heat transfer coefficient from a horizontal cylinder in air.
6. Determination of thermal conductivity of brass employing it as a fin.
7. Tests on natural convection and pool boiling.
8. Study of forced convection with turbulence promoters.
9. Study of condensation on fin.
10. Tests on film condensation.
11. Determination of COP of a vapour compression refrigeration system.

MT 416 P: HEAT TREATMENT

Periods/week: 3 P Credits: 2 Sessional: 50 Exam: 50

LIST OF EXPERIMENTS:
1. Annealing, Normalizing, hardening and tempering of steels.
2. Recovery and recrystallization of cold worked metal.
3. Effect of quenching media on hardening.
4. Study of welded structures.
5. Jomney End Quench Test.
7. Age hardening of aluminum alloys.
8. Effect of time and temperature on tempering.

MTE 417: INDUSTRIAL TRAINING

Credits: 2 Exam: 100

The students of Metallurgical Engineering are required to undergo 4 weeks of training during the summer vacation and submit a report. Evaluation is based on the report and an oral test.
Instrumentations: Concepts of measurements, static performance, characteristics accuracy of measurement and its analysis. Instrumentation, for measurement: Force, torque, strain, pressure, flow, temperature and vibration.

Optical Methods of Measurement: Introduction, Laser beam as a light pointer, length/displacement measurement, temperature sensors, seismographic measurement.

Introduction to fiber optics, fiber types, properties of optical fibres and a fibre optic sensor configuration.


Text Books:
1. Automatic Control Systems, by Benjamin C. Kuo.

References:
MEC 422 (A) COMPUTER AIDED DESIGN

Periods/week: 3L-2T  Credits: 4  Sessionals: 30  Exam: 70

Fundamentals of CAD - Introduction - The design process - Application of computers for design - Operating systems - Hardware in CAD: The design work station - I/O Devices - CAD system configuration - Creating database for manufacturing - Benefits of CAD.


Introduction to Finite Element Analysis - CAD techniques to finite element data preparation- Automatic mesh generation- presentation of results - 3-dimensional shape description and mesh generation- CAD applications of FEM.

CAD applications and exposure to CAD packages: Simple examples of computer aided drafting, design and analysis - Introduction to simple machine elements - Analysis of cross sectional area, centroid & moment of inertia- Kinematics of crank- slider mechanism and other simple design applications. Introduction to CAD packages like ANSYS, NASTRON, NISA-II.

Introduction to Artificial Intelligence - Applications of AI in design and CAD.

Text Books:

References:
6. CAD/CAM/CIM by Radhakrishna, New age international.

MT 424P ELECTRO METALLURGY

Periods/week: 3 P  Credits: 2  Sessional: 50  Exam: 50

List of Experiments:
1. Experimental verification of Faraday’s laws.
2. Determination of throwing power of electrolytes.
3. Electro plating of copper.
4. Electro plating of Nickel.
5. Anodizing of Aluminium.
**MT 425 P COMPUTER AIDED DESIGN LAB**

**Periods/week:** 3 P  
**Credits:** 2  
**Sessional:** 50

**CAD experiments:**

1. Initiating the graphics package; Setting the paper size, space; setting the limits, units; use of snap and grid commands.

2. Drawing of primitives (line, arc, circle, ellipse, triangle etc.)

3. Drawing a flange.

4. Drawing a Bushing assembly.

5. Dimensioning the drawing and adding text.

6. Setting the layers and application of the layers.

7. Isometric and orthographic projections.

8. Viewing in Three dimensions.


**CAM experiments:**

1. Preparation of manual part programming for CNC turning/Milling.

2. Part programming preparation through AutoCAD.

3. APT part programming for 2D - contour.

4. Machining of one job on CNC machine tool.

5. Robot programming through Teaching Box method.

6. Robot programming through computer.

**MT 426 P: DISSERTATION**

**Periods/week:** 8  
**Credits:** 8  
**Exam:** 100

The student has to submit a comprehensive Design/Experimental project report on a selected topic.