Syllabus & Evaluation Scheme

B.Voc

Bachelor of Vocational Studies

(Bachelor of Vocation)

3-Year Undergraduate Course

Based on

AICTE MODEL CURRICULUM

(EFFECTIVE FROM THE SESSION: 2019-20)
## CONTENTS

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Topic</th>
<th>Branch Code</th>
<th>Page No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Automotive Manufacturing Technology (AM)</td>
<td>101</td>
<td>3-35</td>
</tr>
<tr>
<td>2</td>
<td>Automobile Servicing (AS)</td>
<td>102</td>
<td>36-72</td>
</tr>
<tr>
<td>3</td>
<td>Production Technology (PT)</td>
<td>103</td>
<td>73-105</td>
</tr>
<tr>
<td>4</td>
<td>Industrial Tool Manufacturing (IM)</td>
<td>104</td>
<td>106-141</td>
</tr>
<tr>
<td>5</td>
<td>Refrigeration and Air Conditioning (RC)</td>
<td>105</td>
<td>142-173</td>
</tr>
<tr>
<td>6</td>
<td>Software Development (SD)</td>
<td>106</td>
<td>174-206</td>
</tr>
<tr>
<td>7</td>
<td>Graphics &amp; Multimedia (GM)</td>
<td>107</td>
<td>207-228</td>
</tr>
<tr>
<td>8</td>
<td>Banking Finance Services and Insurance (FS)</td>
<td>108</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Electronic Manufacturing Servicing (EM)</td>
<td>111</td>
<td>229-246</td>
</tr>
<tr>
<td>10</td>
<td>Medical Imaging Technology (MI)</td>
<td>112</td>
<td>247-267</td>
</tr>
</tbody>
</table>
DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc
Automotive Manufacturing Technology (AM)
Branch code: 101

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
# Evaluation Scheme
## B. Voc Automotive Manufacturing Technology

### NSFQ Level 5 SEMESTER-I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BAMV511</td>
<td>Motor Vehicle Technology –I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BAMV512</td>
<td>Automobile Electrical Equipment</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BAMV513</td>
<td>Two and Three Wheeler</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BAMV514</td>
<td>Modern Electric &amp; Hybrid Vehicles</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BAMP511</td>
<td>Metrology and Measuring Instruments Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>BAMP512</td>
<td>Electric &amp; Hybrid Vehicles Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BAMP513</td>
<td>Language Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>BAMT 511</td>
<td>Automotive Service Technician Level 5 (ASC/Q 1403)</td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT 512</td>
<td>Spare Parts Operations Executive Level 5 (ASC/Q 1502)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT 513</td>
<td>Industrial Engineer (Layout Design) (ASC/Q6401)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT 514</td>
<td>Tool Designer (ASC/Q4001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT 515</td>
<td>Equipment Designer L5 (ASC/Q 6405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

### NSFQ Level 5 SEMESTER-II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BAMV521</td>
<td>Total Quality Management</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BAMV522</td>
<td>Motor Vehicle Technology –II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BAMV523</td>
<td>Material Science and Materials</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BAMV524</td>
<td>Rapid Prototyping &amp; Reverse Engineering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BAMP521</td>
<td>Project</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>BAMP522</td>
<td>Engineering Graphics</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BAMP523</td>
<td>Mechanical Workshop Practice Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>BAMTS21</td>
<td>Automotive Service Technician Level 5 (ASC/Q 1403)</td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMTS22</td>
<td>Spare Parts Operations Executive Level 5 (ASC/Q 1502)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMTS23</td>
<td>Industrial Engineer (Layout Design) (ASC/Q6401)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMTS24</td>
<td>Tool Designer (ASC/Q4001)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMTS25</td>
<td>Equipment Designer L5 (ASC/Q 6405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total</td>
<td>TE PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BAMV631</td>
<td>Automobile Electrical System</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BAMV632</td>
<td>Automobile Drawing &amp; Design</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BAMV633</td>
<td>Automobile Engines</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BAMV634</td>
<td>Mass Production Devices</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BAMP631</td>
<td>Automobile Workshop - I</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BAMP632</td>
<td>Tool &amp; Die Making Lab.</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>BAMP631</td>
<td>Automotive Service Technician Level 6 (ASC/Q1404)</td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BAMT632</td>
<td>Automation Specialist (ASC/Q6807)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT633</td>
<td>Assembly Line Machine Setter (ASC/Q3603)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT634</td>
<td>Process Design Engineer (ASC/Q6404)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT635</td>
<td>Quality Controller (ASC/Q1605)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>610</strong></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total</td>
<td>TE PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BAMV641</td>
<td>Automobile Engine Systems</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BAMV642</td>
<td>Automotive Refrigeration and Air Conditioning</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BAMV643</td>
<td>Vehicle Performance and Testing</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BAMV644</td>
<td>Electrical &amp; Hybrid Vehicles – II</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BAMP641</td>
<td>Automotive RAC Lab</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BAMP642</td>
<td>Vehicle Performance and Testing Lab</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>BAMP641</td>
<td>Automotive Service Technician Level 6 (ASC/Q1404)</td>
<td>Any one Training (other than 3rd sem) 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BAMT642</td>
<td>Automation Specialist (ASC/Q6807)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT643</td>
<td>Assembly Line Machine Setter (ASC/Q3603)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT644</td>
<td>Process Design Engineer (ASC/Q6404)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAMT645</td>
<td>Quality Controller (ASC/Q1605)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td><strong>610</strong></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BAMV751</td>
<td>Automotive System Design</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BAMV752</td>
<td>Plant Layout &amp; Product Handling</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BAMV753</td>
<td>Industrial Engineering &amp; Safety Engineering</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BAMV754</td>
<td>CAD &amp; CAM</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BAMP751</td>
<td>CAD &amp; CAM Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BAMP752</td>
<td>Design of Automotive Systems Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BAMP761</td>
<td>Major Project</td>
<td>180</td>
<td>200</td>
<td>200</td>
<td>12</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BAMV761</td>
<td>Vehicle Safety</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BAMV762</td>
<td>Agile &amp; Lean Manufacturing Systems</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BAMP761</td>
<td>Major Project</td>
<td>180</td>
<td>150</td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>BAMP762</td>
<td>Spare Parts Operations In charge (ASC/Q1503)</td>
<td>200</td>
<td>200</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
UNIT-I:
Introduction & Chassis Layout
General study of the motor vehicle with functions of its main components and assemblies (engine excluded), Development of a Tractor and its basic function and H.P. requirements, Conventional layout of chassis, Front wheel drive, four wheel drive, rear engine vehicle, their advantages and disadvantages, Layout of Maruti car chassis and tractor chassis, Definitions of items-wheel track, wheel base, front and rear overhang, kerb weight, ground clearance.

UNIT-II:
Clutch System
Layout of conventional transmission system, Maruti car transmission system, Tractor transmission system, clutch - necessity, functions, requirements, types, Constructional details and working of single plate, multiple plate, diaphragm clutches, fluid coupling, Centrifugal and semi-centrifugal clutch, Tractor clutch, Clutch pedal free play. Torque transmitted by clutch, simple numerical problems. Clutch defects, probable causes, remedies.

UNIT-III:
Gear Box
Function and necessity, Construction and working details of sliding mesh, constant mesh, synchromesh gear boxes; epicyclic gear box - its applications and advantages. Over drive, Torque convertor, Maruti-800 car gear box, tractor gear box and P.T.O. shaft, 4 wheels drive auxiliary gear box. Gear ratio

UNIT-IV:
Final Drive
Torque tube drive, Hotchkiss drive, Universal joints, constant velocity joints, slip joints, Propeller shaft. Differential, slip differential, double reduction differential, final drive ratio. Tractor final drive construction and working, Rear axles-Fully floating, semi-floating, three quarter floating, Tractor axles

UNIT-V:
Wheels and Tyres
Road-wheels - Rim types and sizes, Tyres-conventional, radial, Tubeless tyre its advantages, Tyre sizes, wheels-front and rear, Tyre retreading, Tyre wear, wheel balancing, Tyre pressure, Advantages of filling nitrogen in tyres.

Reference Books:
Automobile Electrical Equipment

UNIT-I:
Automobile Wiring Systems & Cables
Earth-return and insulated-return systems; 6 Volt, 12 Volt and 24 Volt systems, Positive and negative earthing, Cables-starting systems cables, general purpose cables and high-tension cables; specifications and colour codes, Diagram of a typical wiring system, Wiring harness, cable connectors, circuit breakers, plastic fibre-optic wires, printed circuits, Fuses in circuits.

UNIT-II:
Storage Battery
Principle of lead-acid cells; constructional details of battery plates, separator, container, terminal, vent plug, grouping compound, Electrolyte: specific gravity of electrolyte and its variation with temperature, Effect of charging and discharging of specific gravity, Capacity of battery, Efficiency of battery,Methods of charging of battery, Internal circuit of battery charger, Care and maintenance of batteries, Checking for cell voltage and specific gravity of electrolyte, Battery tests- high discharge test, cranking motor test, open-circuit voltage test, cadmium test, life test, Battery failures, Maintenance-free batteries, VRLA batteries, Traction battery, Alkaline type batteries, Fuel cell and its types, Battery Life enhancer.

UNIT-III:
Dynamo
Principle of generation of D.C. Constructional details of a Dynamo, Armature reaction, Principle of commutation, Construction of commutator, Types of wound field generatorseries, shunt and compound wound. Other types of D.C. generators-four brush & four pole, interpole, split field and bucking field,Dyna-Starter, Generator drive.

UNIT-IV:
Alternator
Principle of generation of A.C. Constructional details of an alternator, Working of alternators, Advantages over dynamo, Types of alternators, Charging of battery with an alternator, Regulator for alternators.

UNIT V:
Regulators
Constant current and constant voltage systems, Double-contact and compensated voltage control regulators. Current-and-voltage regulator, Cut-out.

Reference Books:
1. Automotive Electricals and Electronics, A.K. Babu Khanna Publishing House
2. Automotive Electrical Equipment: PL Kohli
3. Modern Electrical Equipment: AW Judge
4. Automotive Electrical Equipment: WH Crouse
Two and Three Wheeler

UNIT-I: The Power Unit
Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams, scavenging process

UNIT-II: Fuel and Ignition Systems
Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, Starting system - Kick starter system – Self-starter system, recent technologies

UNIT-III: Chassis and Sub-Systems
Main frame for two and three wheelers, its types, Chassis and different drive systems for twowheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear control sin two wheelers, Front and rear suspension systems, Shock absorbers, Panel meters and controls on handle bar, Freewheeling devices

UNIT-IV: Brakes and Wheels
Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links layouts.
Brake actuation mechanism, Spoked wheel, cast wheel, Disc wheel & its merits and demerits, Tyres and tubes Construction & its Types, Steering geometry

UNIT-V: Two & Three Wheelers – Case Study
Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer, Servicing and maintenance, recent developments

Reference Books:
1. Two and three wheeler technology, dhruv u. Panchal
Modern Electric and Hybrid Vehicles

UNIT-I: Introduction
Introduction to electric and hybrid electric vehicles, History of hybrid and electric vehicles, Social and environmental importance of electric and hybrid electric vehicles, Electrical basics, Motor and generator basics.

UNIT-II: Electric and Hybrid Electric Drive Trains
Basic concept of electric and hybrid traction, Introduction to various electric and hybrid electric drive train topologies, Advantages and disadvantages.

UNIT-III: Power Flow
Power flow control in electric and hybrid electric drive train topologies.

UNIT-IV: Electric Drive Components
Introduction to electric drive components used in electric and hybrid vehicles, Electric motor requirements, Direct Current (DC) motors (Brushed and Brushless), Power converters, Drive controllers.

UNIT-V: Regenerative Braking System (RBS)
Introduction and need of Regenerative Braking System, Advantages and disadvantages of RBS, Working of RBS, Concept of Regenerative Braking using Piezoelectric material, Using shock absorbers as vibration energy harvesters.

Reference Books:
1. Electric & Hybrid Vehicles, A.K. Babu, Khanna Publishing House
3. Electric and Hybrid Vehicles: Design Fundamentals: Iqbal Husain
Metrology and Measuring Instruments lab

1. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Study and sketch of various types of comparators and use them for comparing length of given piece.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. To test the squareness of a component with auto-collimeter.
7. To measure the pitch, angle and form of thread of a screw.
8. To measure the geometry of a gear having involute profile.
9. To measure the straightness of the edge of a component with the help of autocollimeter.
10. To measure the length, breadth, thickness, depth, height with micrometer.
11. To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
13. Calibration of height gauge/depth gauge.
15. Checking of accuracy of snap gauge with slop gauge.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of areas by polar planimeter.
18. Use of feeler, wire, radius and fillet gauges measurement of standard parameters.

Electric and Hybrid Vehicles Lab

1. Understand working of different configurations of electric vehicles
2. Understand hybrid vehicle configuration and its components, performance analysis
3. Understand the properties of batteries and its types
4. Understand of electric vehicle drive systems.
5. Understand of hybrid electric vehicles.
6. Understand Auxiliary systems including charging, starter motor, on board power supply, lighting and environmental sensing and conducting repairs. Repair & Replacement of Electric/ Hybrid Vehicle body
7. Repair & Replacement of Electric Vehicle Drive Train
Level 5 (Semester II)

Total Quality Management

1. Introduction, Basic concepts of total quality management

Introduction to Quality, Dimensions of Quality, Quality Planning, Concept and definition of quality cost, Determinants of Quality, Optimum cost of performance, Principles of TQM, Pillars of TQM, Introduction to leadership and Leadership roles, Quality council and Quality statement, Strategic Planning Process, Deming philosophy

2. Continuous process improvement

Input/output process Model, Juran trilogy, PDCA Cycle, 5–‘S’ Housekeeping principle, Kaizen Seven tools of Quality (Q-7 tools), Check Sheet, Histogram, Cause and effect diagram, Pereto diagram, Stratification analysis, Scatter diagram, Control charts, Control chart for variables & process capability, Control chart for attributes

3. Management planning tools & Bench marking

Affinity diagram, Relationship diagram, Tree diagram, Matrix diagram, Matrix data analysis, Arrow Diagram, Process decision programme chart (PDPC), Concept of bench marking, Reason to bench marking, Bench marking process, Types of bench marking, Benefits of bench marking

4. Just in time (JIT)

JIT philosophy, Three elements of JIT, Principles of JIT Manufacturing, JIT Manufacturing building blocks, JIT benefits, Kanban & 2 Bin Systems

5. Total productive maintenance (TPM)

Concept of Total Productive Maintenance, Types of maintenance, OEE (Overall Equipment Efficiency), Stages in TPM implementation, Pillars of TPM, Difficulties faced in TPM implementation.

Reference Books:

UNIT-I: Frame and Body
Function and construction of frame, Cross-section of frames, Unitized construction (monocoque) types of bodies, Terms - Turning radius, lock-to-lock angle, centre point steering, positive steering, gradeability, Idea of Safety features in a modern car.

UNIT-II: Suspension System
Function, Types - conventional and independent, Spring types - coil, leaf - elliptical, semielliptical; helper springs, transverse springs, Spring camber; spring material, Torsion bar, stabiliser bar, Shock absorbers- telescopc and gas,Maruti suspension system and shockers, Anti-roll bars, Nitrox suspension.

UNIT-III: Steering System and Front Axle
Principle - Ackermann and Davis, Function, requirements, Steering gear box – types, Construction and working details of worm and sector, rack and pinion, worm and wheel, worm and recalculating ball type, Tractor steering, Power steering, Electronic Steering, Front axle - rigid front axle, Stub axle, Elliot and reverse elliot type, Lemoine and reverse lemoine type, Tractor front axle, Maruti steering system, Wheel alignment - castor angle, camber angle, K.P.I., Toe-in, toe out, General values of these.

UNIT-IV: Braking System
Braking terms - braking efficiency, stopping distance, stopping time, weight transfer during braking, leading/trailing shoe of brake, Determination of braking torque, Effect of braking on steering, Types of braking systems- constructional details and working of mechanical brakes, hydraulic brakes, parking brake, vacuum, pneumatic, air-hydraulic brakes; tractor brakes, Drum and disc brakes, Master cylinder, tandem master cylinder, wheel cylinder, Brake lining and brake fluid, Brake defects, their causes and remedies, Anti-Lock Braking System (ABS) & Electronic Brake Distribution (EBD).

UNIT-V: Automobile Pollution and Its Control
Effects and extent of pollution caused due to stationary and automobile engines, Harmful products and their causes in petrol & diesel engines, Measures to control exhaust emissions from two-stroke engines, four-stroke engines, and diesel engines, Turbocharger, Products which cause de-activation of catalysts in catalytic converters, Unleaded petrol, Emission measuring instruments for petrol and diesel engines. Limits specified in Motor Vehicles Act. Recent trends in Automobile Pollution Control-Exhaust Gas Recirculation, Air Injection, Reactor System, Positive Crankcase Ventilation, and Evaporative Emission Control System.

Reference Books:
**Material Science & Materials**

**UNIT-I: General:**
Brief introduction to the subject and its scope in engineering field, classification of materials of industrial importance. Their chemical thermal, electrical, magnetic, mechanical and technological properties and their selection criteria for use in industry.

**Structure of Metals and their Deformation:**
Structure of metals and its relation to their physical, mechanical and technological properties, Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections, Deformation of metals, effects of cold and hot working operations over them. Recovery re-crystallization and grain growth, solid solutions, alloys and inter metallic compounds, effect of grain size on properties of metals. PROPERTIES AND USAGE OF: (1) Metals: (a) Ferrous Metals (b) Non Ferrous Metals (2) Non-metallic Materials.

**UNIT-II: Metals-Ferrous Metals**
1. Classification of iron and steel. (b) Cast iron types as per I.S. - White, malleable, Grey (c) Steels: Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Availability of steel in market, Its forms and specifications (d) Alloy Steel: Effect of alloying various elements, viz Cr, Hi, Co, V, W, Mo, Si, and Mn, on mechanical properties of steel, Common alloy steels, viz, Ni-steel, Ni-Cr-steel, Tungsten steel, Cobalt steel, Stainless Steel, Tool steel - High Carbon Steel, High Speed steel, Tungsten Carbide, Silicon manganese steel, Spring Steel, Heat Resisting alloy Steels etc.

**UNIT-III: NON-METALLIC MATERIALS**
Introduction to Plastic and Other Synthetic Materials: Plastics- Important sources-Natural and Synthetic, Classification, thermo-set and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms of Plasctics
Heat Insulating Materials: Classification of Heat Insulating material, properties and uses of China clay, Cork, Slag wool, Glass Wool, Thermocole, Puff, Properties and uses of asbestos as filler material.
Hardware: General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. Pipes and their uses. General sheets specification (I.S.) and uses, Method of storage of G.I. sheets, M.S. sheets, General specification of pipe fitting

**UNIT-IV: Identification and Testing of Metal Alloys:**
Selection, specification forms and availability of materials.

**Heat Treatment of Metals:**
Elementary concept, purpose, Iron-carbon equilibrium diagram T.T.T. and 'S' curve in steels and its significance, Hardening, Tempering, Annealing, Normalising and case hardening

**Reference Books:**
1. MATERIAL SCIENCE: RS Khurmi& RS Shedha
2. Materials Science and Engineering, William Callister
Rapid Prototyping & Reverse Engineering

UNIT-I: Introduction:
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT-II: CAD Modelling and Data Processing for RP:
CAD model preparation, Data Requirements, different types of Data formats, Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

UNIT-III: RP Systems:

UNIT-IV: Rapid Tooling:
Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

UNIT-V: RP Applications:
Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Reference Books:
1. Reverse Engineering by Kiran J. Fernandes (Editor), Vinesh Raja (Editor)

Project

On the basis of learning in the vocational diploma, a project to be taken up by the student strengthening his/ her vocational skills
Engineering Graphics

1. Introduction

Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale.

2. Orthographic Projections

Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes

3. Orthographic Projections of Plane Surfaces (First Angle Projection Only)

Introduction, Definitions–projections of plane surfaces–triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only.

4. Projections of Solids (First Angle Projection Only)

Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

5. Sections and Development of Lateral Surfaces of Solids

Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

6. Isometric Projection (Using Isometric Scale Only)

Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of Tetrahedron, hexahedron (cube), right regular prisms, pyramids, cylinders, cones, spheres, cut Spheres.

Reference Books:
Mechanical Workshop Practice

1. SHEET METAL WORKING AND SOLDERING:
   a. (EX-1) Cutting, shearing and bending of sheet.
   b. (EX-2) To prepare a soap case by the metal sheet
   c. (EX-3) To make a funnel with thin sheet and to solder the seam of the same
   d. (EX-4) To make a cylinder and to solder the same

2. FITTING SHOP WORK:
   a. (EX-1) Hack sawing and chipping of M.S. flat
   b. (EX-2) Filing and squaring of chipped M.S. job
   c. (EX-3) Filing on square of rectangular M.S. Plate
   d. (EX-4) Drill a hole in MS Block & tapping the same
   e. (EX-5) Making a Bolt & Nut by Tap & Die set.

3. SMITHY SHOP WORK:
   a. (EX-1) To prepare square angular piece by M.S. rod
   b. (EX-2) To make square or hexagonal head bolt
   c. (EX-3) To make a screw driver with metallic handle
   d. (EX-4) To make ring with hook

4. Tin Smithy, Soldering, Brazing
   a. (EX-1) To prepare different types of joint such as lap joint single seam, double seam & cap joint-hem & wired edge.
   b. (EX-2) Utility article-waste paper basket or paper tray
   c. (EX-3) Study & sketch stakes / anvils.

5. WELDING SHOP WORK:
   a. (EX-1) Welding practice gas & electric arc welding
   b. (EX-2) Welding for lap joint after preparing the edge
   c. (EX-3) Welding Butt joint after preparing the edge
   d. (EX-4) Gas Cutting
   e. (EX-5) 'T' joint welding after preparation of edge.

Reference Books:
2. Elements of Workshop Technology Vol. I: BS Raghuwanshi

Level 6 (Semester I)
UNIT-I: STARTING SYSTEM

UNIT-II: IGNITION SYSTEM OF SPARK-IGNITED ENGINES
Types of ignition systems- battery and coil, magneto ignition systems, Ignition circuit, Details of the ignition system-ignition coil, distributor, condenser, contact breaker points, rotor, distributor cap, distributor drive, Firing order, Ignition timing, Ignition advance and retard, need, and factors it depends upon, Methods for obtaining advance and retard vacuum and mechanical, Optical sensor for spark timing.

UNIT-III: Spark plugs-constructional details; types used in automobiles, conditions of working of spark plugs, Glow plugs of diesel engines, Magneto-rotating armature and rotating magnet types, Electronic ignition of cars & motor-cycles (CDI), Idea of Distributor-less Direct ignition system.

UNIT-IV: LIGHTING SYSTEM
Requirements of automobile lighting, Head lamp - mounting and construction; Plastic headlamp Lens, sealed beam assembly, Asymmetrical head light, dipper and full beam, care of headlamp, Lens cleaners, Dynamic headlight beam control, Advanced Front lighting system (AFS) Types of bulbs, Reflector optics. Light sources – tungsten light Sources, tungsten halogen light sources, halogen infra-red reflective light sources, HID light sources (Xenon and bi-xenon), LED light sources, Blue vision head lamp, Auxiliary lights, Brake light, Fog light, Flasher unit, warning lights and panel lights.

UNIT-V: ACCESSORIES
Fuel and oil pressure gauge, cooling water temperature gauge, electrical speedometer, ampere meter, wind-screen wiper, electrical horn and relay, cigarette lighter, Odometer, wind-shield washing equipment, engine rpm meter, glow plug indicator, cluster assembly, Radio and television Interference suppressors, electrical switches. Central locking of doors, power winding of window panes, car heaters AC, blower and air flow controls, Rear defogger.

Reference Books:
1. Automotive Engines, A.K. Babu, Khanna Publishing House
2. Automotive ElectricalEquipment,Kohli
UNIT-I: Drafting of sectional views of the following assemblies: (a) Cylinder block and crankcase of 2-wheeler, (b) Poppet valve assembly of a 4-stroke engine, (c) Piston assembly, (d) Connecting rod assembly, (e) Spark plug, (f) Injector.

UNIT-II: Free hand line diagram of the following systems: (a) Fuel system of petrol engine (b) Fuel system of diesel engine (c) Cooling system of a multi-cylinder engine (d) Lubricating system of a multi-cylinder engine (e) Steering system of Maruti (f) Suspension systems of Maruti (g) Hydraulic Braking System of Maruti Zen (h) Air Hydraulic Braking System of TATA (i) Block diagram of Electronic Fuel Injection (EFI) system (j) Block diagram of Common Rail Direct Injection (CRDI) system (k) Oxygen sensor (l) Fuel injector of EFI.

UNIT-III: Drafting of sectional views of the following assemblies (1) Master cylinder (2) Wheel cylinder (3) Universal joint

UNIT-IV: Sketch layouts of (a) Depot (b) F.I. pump reconditioning shop (c) Electrical Workshop.

UNIT-V: Design of the following components of an automobile engine (1) Piston assembly (2) Connecting rod assembly (3) Crank shaft (4) Flywheel

Reference Books:
1. Automobile Drawing: RB Gupta
Automobile Engines

(B) Air standard cycles: Otto cycle, Diesel cycle, Air standard efficiency of Otto and Diesel cycle, Effect of compression ratio on efficiency, Simple numerical problem, Graphical representation of ideal and actual cycle, Comparison between actual and ideal cycles, Reasons for variation, Mean effective pressure, Work done during the cycle.

UNIT-II: (A) I.C. Engines’ operation: Working of two stroke cycle and four stroke cycle petrol and diesel engines. Valve timing diagrams. Port timing diagrams, Classification of I.C. Engines. (B) Reciprocating Engine Details: Construction, function, material and manufacturing process of: (a) Cylinder Block- 2-stroke air cooled and 4-stroke water cooled cylinder liner (wet and dry), cylinder head, gaskets, Different cylinder arrangements. Cylinder wear, Forms of combustion chamber in petrol engine, Location of spark plug, Combustion chamber in Diesel engines, Turbulence in Combustion chambers.

UNIT-III: Engines Details (continued) (b) Piston-plain, split skirt, auto-thermic, cam-ground, Anodising and Tinning of piston, Piston clearance (c) Piston rings-different types (d) Piston pin; different methods of fitting piston pin (e) Valves: Poppet, Rotary, reed, Poppet Valve arrangement, Overhead and side valve operating mechanism, Valve clearance, Hydraulic tappet. Sodium cooled valves. Valve seat inserts (f) Connecting rod, Section of connecting rod, Bearing metal for big and small end of connecting rod (g) Crank shaft, Left hand, right hand crankshaft, Balancing of crank shaft (General idea about static and dynamic balancing, problems excluding, Main bearings Crankshaft end play. Vibration damper. Flywheel (h) Camshaft, Camshaft drive timing gears (i) Inlet and exhaust manifold, Mufflers, Exhaust pipe (j) Variable Valve Timing (VVT).


UNIT-V: Supercharging and scavenging. Necessity of supercharging, Rotary compressors, Turbocharger requirement, Effect of supercharging on power output, mechanical losses, fuel consumption, detonation, Limitations of supercharging, Methods and classification of scavenging process, Performance of different scavenging systems. (B) Engine specifications, specifications of engines of Indian vehicles - four wheelers, three wheelers and two wheelers.

Reference Books:
1. Automotive Engines, A.K. Babu, Khanna Publishing House
2. Thermal Engineering I & II: Sarao, Gambhir & Aggarwal
3. Automobile Engineering II: Kirpal Singh
4. Basic Automobile Engineering: CP Nakra
5. Automobile Engineering: RB Gupta
Mass Production Devices

UNIT-I: Tool holders:
Tool holders for turning and milling carbide inserts-types, ISO-designation and applications, Tool holding and tool mounting systems for conventional milling and drilling machine tools.

UNIT-II: Locating and clamping devices:
Concept, meaning and definitions of location and clamping, Use of locating and clamping principles in day-to-day supervision on shop floor, Degree of freedom-concept and importance, 3-2-1 principle of location, Locators-Types, Sketches with nomenclature, Working, Applications, Fool proofing and ejecting

UNIT-III: Clamping devices:
Types, Sketches with nomenclature, Working, Applications

UNIT-IV: Jigs and fixtures:
Concept, meaning, differences and benefits of jigs and fixtures, Types, sketches with nomenclature, working and applications of jigs, Types, sketches with nomenclature, working and applications of fixtures,

UNIT-V: Design of Jigs and Fixtures:
Steps in designing jigs and fixture for given simple component

Reference Books:
1. Mass Production, Products from Phaidon Design Classics

Automobile Workshop - I


UNIT-II: Wheel Balance: Reasons of wheel imbalance, Effect of wheel imbalance on stability of vehicle. Static and dynamic balancing, Wheel balancing by the application of weights, Wheel Alignment: Meaning of wheel alignment, Various angles-camber, caster, KPI & toe - and their effect on steering stability, General values of popular Indian vehicles, Wheel alignment on computerized wheel aligner

UNIT-III: Measurement of Exhaust Pollution by various analyzers such as Four Gas Analyser, Smoke meter, Noxanalyser

UNIT-IV: Use of Headlight aligner, Wheel aligner, automotive oscilloscope
UNIT-V: Servicing: Meaning and scope of servicing, Items attended to in servicing of a vehicle.
Servicing a vehicle, Focusing and alignment of head lights

Reference Books:
1. Engine Service: Gary Lewis
2. Various Car’s Manuals

Tool & Die Making Lab
1. Manufacture of Box Jig and Angle plate jig
2. Manufacture of “V” Block angle grinding Fixtures and profile milling fixture
3. Manufacture of simple Blanking & piercing Tool
4. Manufacture of Progressive tool for producing a Cycle chain link
5. Manufacture of Press tools like Combination tool & Compound tool
6. Manufacture of Draw tool
7. Trial out On Fly press and power press the Produced components such as V, U, Cycle link, Cup, Washer and Cycle bell cup
8. Manufacture of simple V and U bending tool
9. Maintenance of Jig & fixture and press tool
Level 6 (Semester II)
Automobile Engine Systems


UNIT-II: COOLING SYSTEM: Necessity of cooling of I.C. engines, Methods of cooling-air cooling, water cooling, liquid cooling, Shape of cooling fins, Field of application of air cooling, Water cooling system - Thermo siphon system, pump system, thermostat system of cooling, Thermostat – types, Radiators-different types, their construction and function, Pressurized cooling system; radiator pressure-cap, surge tank, Cooling water temperature gauge, Antifreeze and anti-corrosive additive, Coolants, Flushing of cooling system.


UNIT-III: FUEL SYSTEM OF DIESEL ENGINES: Fuel supply system, Filters (primary and secondary) positioning of filters, Feed pump, Solid and air injection system, Fuel injection pump, different types-plunger, distributor pump, their construction and working, Injectors, Governors, Types of governing, Combustion process in diesel engine, Diesel knock, Electronically Controlled Diesel Injection Pump, Common Rail Direct Injection, Piezoelectric effect and its use in CRDI.

UNIT-IV: FUEL SYSTEM OF PETROL ENGINES: Gravity feed system used in 2-wheelerS, Fuel supply circuit of 4-wheelers, Mechanical and electrical fuel pump, Electric fuel gauge, Petrol fuel filter, Air/fuel ratio, Variation of air/fuel ratio with speed, Air cleaners (wet & dry), Cyclone filter, CARBURETOR - Function and principle of working of simple carburetor, Carburetor controls - throttle, choke, Types of Carburetors - fixed jet carburetor (Solex type) and constant vacuum carburetors used in YAMAHA motorcycle, Twin-barrel carburetors, Classification of carburetors, Disadvantages of carburetors, Phenomenon of combustion and detonation, Pre-ignition.


Reference Books:
1. Automotive Engines, A.K. Babu, Khanna Publishing House
Automotive Refrigeration & Air-conditioning

UNIT-I: Refrigeration Fundamentals:
Introduction to refrigeration and vapour compression system, cycle diagram (Carnot cycle, Reverse Carnot cycle, Simple vapour compression cycle, bell Coleman cycle), effects of various operating parameters on performance of A/C System, Vapour absorption refrigeration system (No numerical), Applications of refrigeration and air conditioning.

UNIT-II: Refrigerants and Air conditioning Components:

UNIT-III: Air distribution system:
Psychrometry: Psychometric properties, tables, charts, Psychometric processes, Processes, Combinations and Calculations, ADP, Coil Condition line, Sensible heat factor, Bypass factor.

UNIT-IV: Load analysis and control devices:
Load Analysis, Outside and inside design consideration, Factors forming the load on refrigeration and air conditioning systems, Cooling and heating load calculations, Load calculations for automobiles, Effect of air conditioning load on engine performance, Air conditioning electrical and electronic control, pressure switching devices, sensors and actuators.

UNIT-V: Diagnostics, Trouble Shooting, Service and Repair:
Initial vehicle inspection, temperature measurements, pressure gauge reading and cycle testing, leak detection and detectors, Sight glass, Refrigerant safety/handling, refrigerant recovery; recycle and charging, system oil, system flushing, odour removal, retrofitting, Removing and replacing components, Compressor service.

Reference Books:
1. Refrigeration & Air Conditioning, Sadhu Singh, Khanna Publishing House
Vehicle Performance & Testing UNIT-I:

Vehicle Performance Parameters:

UNIT-II: Drive train and Component testing:
Vehicular transmission performance: comparison of automotive clutches, Epicyclic transmission, torque converter, final drive and differential, testing of vehicle components: clutch, gear box (for noise and shifting force), brake testing, wheels and tyre testing – tyre wear pattern identification and causes.

UNIT-III: Vehicle testing:
Vehicle Testing - Road test, free acceleration test, coast down test, passer by noise test, road load data acquisition for vehicle. Test tracks: Proving ground testing, high speed track, pavement track, corrugated track, mud track, steering pad, gradient track, deep wading through shallow water. Laboratory testing: Testing on chassis dynamometer, transition testing (Euro III onwards), accelerated testing, virtual testing, evaporative emission testing, oil consumption testing, endurance test, high speed performance test. Collisions and Crash Testing: Crash testing: Human testing, dummies, crashworthiness, pole crash testing, rear crash testing, vehicle to vehicle impact, side impact testing, crash test sensors, sensor mounting, crash test data acquisition, braking distance test.

UNIT-IV: Comfort, Convenience and Safety:
Seats: types of seats, driving controls accessibility, and driver seat anthropometry. Steering: steering column angle, collapsible steering, and power steering. Adaptive cruise control, navigation system, adaptive noise control, driver information system, Safety: Motor vehicle safety standards, active safety, passive safety, bio-mechanics Structural safety, energy absorption, ergonomic consideration in safety.

UNIT-V: Noise Vibration and EMI:
Noise and vibration: Mechanism of noise generation, engine noise and vibration, causes and remedies on road shocks, wind noise and measurement. Automobile testing instrumentation: Sensors types and selection, instrumentation for functional tests, model test and full scale testing.

Reference Books:
1. Road Vehicle Performance: Methods of Measurement and Calculation, George Gordon Lucas
2. The Engineering Principles of Vehicle Performance Testing, Frederick James Furrer
Electrical & Hybrid Vehicles – II

UNIT-I: Hybrid Architecture and Power

Plant Specifications:
Series configuration locomotive drives- series parallel switching- load tracking architecture, Pre transmission parallel and combined configurations Mild hybrid- power assist- dual mode- power split- power split with shift- Continuously Variable transmission (CVT) wheel motors, Grade and cruise targets- launching and boosting- braking and energy recuperation- drive cycle implications.

UNIT-II: Sizing the Drive System and Energy Storage Technology:
Matching electric drive and ICE; sizing the propulsion motor; sizing power electronics. Battery basics; lead acid battery; different types of batteries; battery parameters

UNIT-III: Fuel Cells:

UNIT-IV: Energy Storage:
Battery based energy storage: Battery basics, Lead acid (Pb-Acid) battery, Nickel-Cadmium (NiCd) battery, Nickel-Metal-Hydride (NiMH) battery, Lithium-ion (Li-ion) battery, Lithium-polymer (Li-poly) battery, Ultra capacitors.

UNIT-V: Nonelectric Hybrid Systems:
Short term storage systems flywheel accumulators, continuously variable transmissions hydraulic accumulator’s hydraulic pumps/motors- pneumatic hybrid engine systems operation modes.

Reference Books:
1. Electric & Hybrid Vehicles, A.K. Babu, Khanna Publishing House
2. Electric and Hybrid Vehicles, Tom Denton
Automotive RAC Lab

1. Test on vapor compression test rig.
2. Test on air conditioning test rig.
3. Study of various methods of transport refrigeration systems.
4. Study and demonstration on car and bus air conditioning system.
5. Study of latest trends in automotive refrigeration systems.
6. Study and demonstration of controls in refrigeration.
7. Study of different components with the help of cut sections/models/charts- Compressor, Condenser, Evaporators, Expansion device, Blower fans, Hating systems etc.
8. Study of installation/operations/maintenance practices for refrigeration systems.
9. Study of leak testing and leak detection methods.
10. Visit to maintenance shop of automotive air conditioning and writing report on it.

Vehicle Performance & Testing Lab

1. Estimation of power requirement for vehicle propulsion by taking actual vehicle example.
2. Perform coast down test to find vehicle inertia.
3. On road fuel consumption test at different speeds.
4. Brake efficiency measurement
5. Pass- by noise test.
6. Free acceleration test.
7. Vibration measurement in passenger compartment
8. Laboratory testing of vehicle on chassis dynamometer for performance
9. Laboratory testing of vehicle on chassis dynamometer for emission.
10. Report based on visit to vehicle testing and research organization.
11. On road emission testing of petrol and diesel vehicles for PUC/RTO
Level 7 (Semester I)

Automotive System Design

UNIT-I: Design of Clutches & Gearbox:
Design requirements of friction clutches, selection criterion, torque transmission capacity, lining materials, Design of single plate clutch, mutilate clutch and centrifugal clutch. Selection of gear ratios and final drive ratio, numerical on 3-speed and 4-speed gearbox.

UNIT-II: Design of Propeller Shafts and Axles:
Design of propeller shafts for bending, torsion and rigidity, Design of universal joints and slip joints, final drive, Design of live and dead axles.

UNIT-III: Brake Systems:
Design of hydraulic braking system, internal expanding shoe brake and disc brake, design of master and wheel cylinder and piping design.

UNIT-IV: Design of Suspension and Steering System:
General design considerations of suspension system, design of helical and leaf springs for automobile suspension system, design considerations of Belleville springs, elastomeric springs, design considerations of steering system and vehicle frame design.

UNIT-V: Statistical Consideration in Design and Optimization:
Ergonomics and aesthetic design, statistics in design, design for natural tolerances, statistical analysis, and mechanical reliability, introduction to design optimization of mechanical elements, adequate and optimum design, methods of optimization, Johnson’s method of optimum design-simple problems in optimum design like axially loaded members.

Reference Books:
**UNIT-I**

**Objective of Facility Design:** Types of layout problems, the layout function, organization of layout. Analysis and Design of Material Flow: Systems approach to flow cycle, process charts, flow process charts, Quantitative analysis of material flow; optimal material flow configuration. Space and Area Allocation for Production and Physical Plant Services;

**UNIT-II**

**Computerized handling of layout algorithms:** Algorithms for computerized Layout Planning, Construction and Development type of computerized Layout Planning Techniques i.e. CRAFT, ALDEP, CORELAP etc.;

**UNIT-III**

**Product handling:** Design of system configurations conforming to various kinds of product features and layout characteristics; Design concepts of common handling and transfer equipment; Different types of conveyors, elevators, fork lifters;

**UNIT-IV**

Design concept of warehouse facilities commensurate with adopted kind of handling and transfer devices; Automated Handling of materials, Automated Transfer lines, AGVS, Use of Robots in Product handling, automated packaging devices.

**UNIT-V**

Application of pneumatic and hydraulic system in transportation and handling of products, Design of integrated plant layout for product handling systems

**Reference Books:**
1. Plant Layout and Materials Handling, R. B. Choudhary, G. R. N. Tagore
2. Plant Layout And Material Handling (Paperback, G.K. Agarwal)
UNIT-I: INSPECTION: Inspection and its objective, Types of inspection, Inspection standards, Duties of inspection foreman, QUALITY CONTROL: Concept of quality control, elements of quality control, quality control groups, objectives of quality control, Statistical quality control, objectives of S.Q.C. Inspection by variables & attributes, Frequency distribution, mean, median & mode, standard deviation, X-R charts, P-Charts, C-Charts and acceptance sampling. (i) I.S.O. 9000 (ii) KAIZEN (iii) Six Sigma (iv) 5S (v) TQM system, concept & brief idea only


UNIT-III: CPM & PERT: Introduction to CPM, language of CPM net work. Diagram map for CPM chart, arrow diagram method of CPM, Programme Evaluation & Review Technique (PERT) Activity event net work (simple manual cases only), Project scheduling with CPM & PERT.


UNIT-V: MATERIAL HANDLING: Material Handling & material handling equipment, factors in material handling problems, cost reduction through improved material handling, Reduction in time of material handling, Material handling equipment-Idea about lifting lowering devices, Transportation devices, combination devices, Maintenance of material handling equipment.


Reference Books:
1. Industrial Safety, S.C. Sharma, Khanna Publishing House
2. Industrial Engineering Safety and Pollution, Sanjai Kumar Gupta
UNIT-I: Introduction CIM and CAD & Analysis:

UNIT-II: Computer aided Manufacturing CAM:

UNIT-III: CNC Machine and Components:

UNIT-IV: Part Programming:

UNIT-V: FMS, Integrated Material Handling and Robot:

Reference Books:
1. Engineering AutoCAD, Pradeep Jain & A.P. Gautam, Khanna Publishing House
CAD Lab & CAM Lab

1. Introduction and different features of the CAD Software.
2. 2-D Drafting.
3. 3-D Modeling.
4. 3-D Advanced Modeling.
5. Assembly modeling.
6. Feature Modification and Manipulation
7. Detailing.
10. To prepare part programming for plain turning operation.
11. To prepare part programming for turning operation in absolute mode.
12. To prepare part program in inch mode for plain turning operation.
13. To prepare part program for taper turning operation.
14. To prepare part program for turning operations using turning cycle.
15. To prepare part program for threading operation.
16. To prepare part program for slot milling operation.
17. To prepare part program for gear cutting operation.
18. To prepare part program for gear cutting using mill cycle.
19. To prepare part program for drilling operation

Design of Automotive Systems Lab

1. Design of automotive clutch assembly and component drawing using any drafting software (Two full imperial sheets along with design calculations report) consists of:
   - Functional design of clutch
   - Design of clutch shaft, hub and flange
   - Design of damper springs
   - Design of sectors, rivets etc.
   - Design of pressure plate assembly
   - Design for linkage mechanism
   - Details and assembly drawing
   - Details and assembly drawing
2. Design of automotive gear box along with reverse gear (Two full imperial sheets along with design calculations report) consists of:
   - Calculation of gear ratios
   - Determination of number of teeth on gear pair
   - Determination of gear reductions
   - Design of gear pairs
   - Design of shafts
   - Selection of bearings
   - Details and assembly drawing
3. Design of suspension spring and its analysis using any analysis software.
Level 7 (Semester II)

Vehicle Safety

UNIT-I: Introduction to vehicle safety, Basic concepts of vehicle safety, Risk evaluation and communication Human error control, Universal design, The distracted driver, Crash Testing


UNIT-IV: Antilock braking system, Traction control system, Electronic Stability Program, Low tire pressure warning system, Collision avoidance systems

UNIT-V: Automotive Industry Standards, Transport Engineering Standards, Indian road congress Standards

Reference Books:
1. Automotive Vehicle Safety, Book by Barbara J. Peters and George A. Peters
2. Vehicle Safety Communications Book by Luca Delgrossi and Tao Zhang
Agile and Lean Manufacturing

UNIT-I: Introduction
Introduction to Just in time production, Toyota production system, Introduction to lean manufacturing (LM), history of LM, advantages of LM over mass production

UNIT-II: Waste Identification
Types of wastes, lean manufacturing principles; Value, value stream, flow, pull and perfection

UNIT-III: Value stream mapping
Introduction to value stream mapping, types of value stream mapping, value added activities, necessary non value added activities, non-value added activities

UNIT-IV: Lean manufacturing tools
Introduction to 5S, Kanban, kaizen, work standardization, Statistical process control, automation and other lean tools

UNIT-V: Agile manufacturing
Introduction to agile manufacturing, advantages of agile manufacturing, differences with lean manufacturing.

Reference Books:
1. Lean and Agile Manufacturing, Devadasan S.R
2. Agile and Lean Program Management, Johanna Rothman
Process Planning and Control

UNIT-I: Introduction, components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Selection of forecasting technique.

UNIT-II: Capacity Planning-
Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.

UNIT-III: Facility Location-
Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, Fixed position, combination and cellular layouts; Designing product and process layout, line balancing.

UNIT-IV: Production Control-
Capacity control and priority control, production control functions; Routing, scheduling, dispatching, expediting and follow up, Techniques of production control in job shop production, batch production and mass production systems

UNIT-V: Sequencing-
Priority rules, sequencing methods, sequence jobs through two work centers, scheduling services, application of CPM and PERT techniques.

Reference Books:
1. Process of Planning and Control, Chakrapani Srinivasa

Project

On the basis of learning in the Bachelor of Vocational, a project to be taken up by the student strengthening his/her vocational skills
DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc Automobile Servicing (AS)
Branch Code: 102

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
## Evaluation Scheme
### B. Voc Automobile Servicing

### NSFQ Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT</td>
<td>TE PE</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BASV511</td>
<td>Motor Vehicle Technology -I</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV512</td>
<td>Manufacturing Technology</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BASV513</td>
<td>Automobile Electrical Equipment</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASV514</td>
<td>Two and Three Wheeler</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BASP511</td>
<td>Mechanical Workshop Practice lab</td>
<td>30 20 30</td>
<td>30 50</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>BASP512</td>
<td>Basic Electricity and Electronics lab</td>
<td>30 20 30</td>
<td>30 50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BASP513</td>
<td>Language Lab</td>
<td>30 20 30</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>BAST511</td>
<td>Automotive Service Technician Level 5 (ASC/Q 1403)</td>
<td>150 400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST512</td>
<td>Spare Parts Operations Executive Level 5 (ASC/Q 1502)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST513</td>
<td>Industrial Engineer (Layout Design) (ASC/Q6401)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST514</td>
<td>Equipment Designer L5 (ASC/Q 6405)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST515</td>
<td>Tool Designer (ASC/Q4001)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total** 610 500 24

### NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT</td>
<td>TE PE</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BASV521</td>
<td>Modern Electric &amp; Hybrid Vehicles</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV522</td>
<td>Motor Vehicle Technology -II</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BASV523</td>
<td>Material Science and Materials</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASV524</td>
<td>Garage Organization &amp; Transport Management</td>
<td>30 10 5 5 20</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BASV525</td>
<td>Project</td>
<td>30 20 30</td>
<td>30 50</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>BASP521</td>
<td>Electric &amp; Hybrid Vehicles Lab</td>
<td>30 20 30</td>
<td>30 50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BASP522</td>
<td>IT Tool Lab</td>
<td>30 20 30</td>
<td>30 50</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>BASP523</td>
<td>Equipment Designer L5 (ASC/Q 6405)</td>
<td>150 400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST521</td>
<td>Spare Parts Operations Executive Level 5 (ASC/Q 1502)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST522</td>
<td>Industrial Engineer (Layout Design) (ASC/Q6401)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST523</td>
<td>Automotive Service Technician Level 5 (ASC/Q 1403)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST524</td>
<td>Tool Designer (ASC/Q4001)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total** 500 24

---

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council

2 | B. Voc - Automobile Servicing(AS)  | Branch Code:102
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BASV631</td>
<td>Automobile Electrical System</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV632</td>
<td>Automobile Drawing &amp; Design</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BASV633</td>
<td>Automobile Engine Systems</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASV634</td>
<td>Auto Body Repair, Denting &amp; Painting</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BASP631</td>
<td>Automobile Workshop - I</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BASP632</td>
<td>Auto Body Repair, Denting &amp; Painting Workshop</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>BAST631</td>
<td>Automotive Service Technician Level 6 (ASC/Q1404)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST632</td>
<td>Automation Specialist (ASC/Q6807)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST633</td>
<td>Assembly Line Machine Setter (ASC/Q3603)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST634</td>
<td>Process Design Engineer (ASC/Q6404)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NSFQ Level 6 SEMESTER- IV**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BASV641</td>
<td>Automobile Engine Systems</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV642</td>
<td>Automotive Refrigeration and Air Conditioning</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BASV643</td>
<td>Vehicle Performance and Testing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASV644</td>
<td>Electric and Hybrid Vehicles-II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BASP641</td>
<td>Automotive RAC Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BASP642</td>
<td>Vehicle Performance and Testing Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>BAST641</td>
<td>Quality Controller (ASC/Q1605)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST642</td>
<td>Automation Specialist (ASC/Q6807)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST643</td>
<td>Assembly Line Machine Setter (ASC/Q3603)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST644</td>
<td>Process Design Engineer (ASC/Q6404)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council

B. Voc - Automobile Servicing (AS) Branch Code: 102
### NSFQ Level 7 SEMESTER- V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BASV751</td>
<td>Automotive System Design</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV752</td>
<td>Alternative Fuel &amp; Emission Control</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BASV753</td>
<td>Automobile Maintenance Service &amp; Repairs - I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASV754</td>
<td>Auto NVH</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BASP751</td>
<td>Automobile Workshop - II</td>
<td>30</td>
<td>20 30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BASP752</td>
<td>Design of Automotive Systems Lab</td>
<td>30</td>
<td>20 30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BAST751</td>
<td>Spare Parts Operations In charge (ASC/Q1503)</td>
<td></td>
<td></td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BAST752</td>
<td>Body Shop In-Charge (ASC/Q1413)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST753</td>
<td>Service Supervisor (ASC/Q1412)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST754</td>
<td>Testing Manager (ASC/Q8405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>610</td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BASV761</td>
<td>Automobile Maintenance Service &amp; Repairs - II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BASV762</td>
<td>Off-road Vehicles</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BKVH763</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BASP761</td>
<td>Automobile Workshop - I</td>
<td>180</td>
<td>150</td>
<td>150 6</td>
<td>500</td>
<td>24</td>
</tr>
<tr>
<td>5</td>
<td>BAST761</td>
<td>Product Design Manager L7 (ASC/Q8103)</td>
<td></td>
<td></td>
<td>Any one Training (other than 5th sem)400 hrs/ 8 weeks</td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BAST762</td>
<td>Body Shop In-Charge (ASC/Q1413)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST763</td>
<td>Service Supervisor (ASC/Q1412)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BAST764</td>
<td>Testing Manager (ASC/Q8405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>670</td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
Level 5 (Semester I)
Motor Vehicle Technology – 1

Unit1: Introduction & Chassis Layout

General study of the motor vehicle with functions of its main components and assemblies (engine excluded), Development of a Tractor and its basic function and H.P. requirements, Conventional layout of chassis Front wheel drive, four wheel drive, rear engine vehicle, their advantages and disadvantages, Layout of Maruti car chassis and tractor chassis, Definitions of items-wheel track, wheel base, front and rear overhang, kerb weight, ground clearance.

Unit2: Clutch System

Layout of conventional transmission system, Maruti car transmission system, Tractor transmission system, clutch - necessity, functions, requirements, types, Constructional details and working of single plate, multiple plate, diaphragm clutches, fluid coupling, Centrifugal and semi-centrifugal clutch, Tractor clutch, Clutch pedal free play. Torque transmitted by clutch. Simple numerical problems. Clutch defects, probable causes, remedies.

Unit3: Gear Box

Function and necessity, Construction and working details of sliding mesh, constant mesh, synchromesh gear boxes; epicyclic gear box - its applications and advantages. Over drive, Torque convertor, Maruti-800 car gear box, tractor gear box and P.T.O. shaft, 4 wheel drive auxiliary gear box. Gear ratio

Unit4: Final Drive

Torque tube drive, Hotchkiss drive, Universal joints, constant velocity joints, slip joints, Propeller shaft. Differential, slip differential, double reduction differential, final drive ratio. Tractor final drive construction and working, Rear axles-Fully floating, semi-floating, three quarter floating, Tractor axles

Unit5: Wheels and Tyres

Road-wheels - Rim types and sizes, Tyres-conventional, radial, Tubeless tyre its advantages, Tyre sizes, wheels-front and rear, Tyre retreading, Tyre wear, wheel balancing, Tyre pressure, Advantages of filling nitrogen in tyres.

Reference Books:
Manufacturing Technology

UNIT1

(A) General Introduction: (a) Scope of subject "Workshop Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).

GENERAL PROCESS: Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility viz., Rolling, Forging, Drawing, Extruding, Spinning, Pressing, Punching, Blanking, Welding, Soldering, Brazing, Metal cutting processes-turning, Drilling, Boring, Shaping, Grinding, Riveting, Elementary idea of machines used for the above processes.

UNIT2

WELDING:
(a) Welding Arcs: Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes.
(b) Introduction to various welding processes with procedure equipment and applications such as (i) Electric arc welding and Gas welding (ii) Resistance welding. (iii) Thermit welding (iv) Carbon arc gauging. (v) Metal-Inert-Gas welding (MIG) (vi) Tungsten Inert Gas welding (TIG)

WELDING OF SPECIAL MATERIALS: (a) Welding of carbon steel, Low alloy steel and stainless steel, equipment, filler rods, weldability, procedures and precautions. (b) Welding of Grey Cast Iron (c) Welding of Aluminium (d) Welding of Plastics.

UNIT 3

Carpentry: (a) Fundamental of wood working operations (b) Common Carpentry Tools-Their classification, size, specification (name of the parts and use only): (i) Marking and measuring tools (ii) Holding and supporting tools: (iii) Cutting and Sawing Tools: (iv) Drilling and Boring Tools (v) Striking Tools-Mallet and Claw hammer (vi) Turning Tools & Equipment (vii) Miscellaneous Tools

PATTERN & MOULDING: The pattern materials used, Types of pattern allowances and pattern layout, Colour scheme patterns defects, Types of cores and their utility. Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding

UNIT4

Moulding and Pouring: Classification of mould materials according to characteristics, Types of sands and their importance test, parting powders and liquids, Sand mixing preparation, Moulding defects

MELTING AND POURING: Brief idea of refractory material and fluxes, Fuels and metallic materials used in foundry. Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces,
their construction and operation, metals and alloys. Additions to molten metal, Closing and pouring of the moulds, Coring-up, venting and closing, use of ladles, spur and risers, Defects due to closing and spurring, Basic idea of fettling operations. Surface treatment, Salvaging of castings, Factors determining soundness of casting.

FOUNDERY PRACTICE: Elementary idea of special casting processes-Shell mould casting, die casing, investment mould casting, centrifugal and continuous casting full mould casting. Elementary idea of mechanisation of foundries

UNIT5

POWDER METALLURGY: Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing, Self-lubricated bearings. Advantages of the process and its limitations (Elementary concept only)

TESTING OF WELDS & RELEVANT WELDING CODES: (a) Destructive methods-Tensile Test, Hardness Test, Fracture Test, Impact Test (b) Non destructive methods-visual, Liquid Penetrant Testing, Magnetic particles Testing, Radiographic Testing.


Reference Books:


Automobile Electrical Equipment

**Unit 1: Automobile Wiring Systems & Cables**

Earth-return and insulated-return systems; 6 Volt, 12 Volt and 24 Volt systems Positive and negative earthing. Cables-starting systems cables, general purpose cables and hightension cables; specifications and colour codes. Diagram of a typical wiring systemWiring harness, cable connectors, circuit breakers, plastic fibre-optic wires, printed circuits Fuses in circuits.

**Unit 2: Storage Battery**

Principle of lead-acid cells; constructional details of battery plates, separator, container, terminal, vent plug, grouping compound. Electrolyte: specific gravity of electrolyte and its variation with temperature. Effect of charging and discharging of specific gravity, Capacity of battery Efficiency of battery, Methods of charging of battery, Internal circuit of battery charger, Care and maintenance of batteries, Checking for cell voltage and specific gravity of electrolyte, Battery tests- high discharge test, cranking motor test, open-circuit voltage test, cadmium test, life test, Battery failures, Maintenance-free batteries, VRLA batteries, Traction battery, Alkaline type batteries, Fuel cell and its types, Battery Life enhancer.

**UNIT 3: Dynamo**

Principle of generation of D.C. Constructional details of a Dynamo, Armature reaction, Principle of commutation, Construction of commutator. Types of wound field generator series, shunt and compound wound, Other types of D.C. generators-four brush & four pole, interlope, split field and bucking field, Dyna- Starter, Generator drive.

**UNIT 4: Alternator**

Principle of generation of A.C. Constructional details of an alternator, Working of alternators Advantages over dynamo, Types of alternators, Charging of battery with an alternator, Regulator for alternators.

**UNIT 5: Regulators**

Constant current and constant voltage systems, Double-contact and compensated voltage control regulators. Current-and-voltage regulator, Cut-out

**Reference Books:**

1. Automotive Electricals and Electronics, A.K. Babu, Khanna Publishing House
2. Automotive Electrical Equipment: PL Kohli
3. Modern Electrical Equipment: AW Judge
4. Automotive Electrical Equipment: WH Crouse
Two and Three Wheeler

Unit I: The Power Unit

Two stroke and four stroke SI & CI engine Construction and Working, merits and demerits, Symmetrical and unsymmetrical valve & port timing diagrams, scavenging process

Unit II: Fuel and Ignition Systems

Fuel system – Different circuits in two wheeler fuel systems, fuel injection system. Lubrication system, Ignition systems - Magneto coil and battery coil spark ignition system, Electronic ignition System, and starting system - Kick starter system – Self starter system, recent technologies

Unit III: Chassis and Sub-Systems

Main frame for two and three wheelers, its types, Chassis and different drive systems for two wheelers, Single, multiple plates and centrifugal clutches, Gear box and its and various gear controls in two wheelers. Front and rear suspension systems, Shock absorbers, Panel meters and controls on handle bar, Freewheeling devices

Unit IV: Brakes and Wheels

Drum brakes & Disc brakes Construction and Working and its Types, Front and Rear brake links layouts. Brake actuation mechanism. Spoked wheel, cast wheel, Disc wheel & its merits and demerits. Tyres and tubes Construction & its Types. Steering geometry

Unit V: Two & Three Wheelers – Case Study

Case study of Sports bike, Motor cycles, Scooters and Mopeds - Auto rickshaws, Pick up van, Delivery van and Trailer, Servicing and maintenance, recent developments.

Reference Books:

Two and three wheeler technology, dhruv u. Panchal
Mechanical Workshop Practice Lab

1. SHEET METAL WORKING AND SOLDERING:
   (EX-1) Cutting, shearing and bending of sheet.
   (EX-2) To prepare a soap case by the metal sheet
   (EX-3) To make a funnel with thin sheet and to solder the seam of the same
   (EX-4) To make a cylinder and to solder the same

2. FITTING SHOP WORK:
   (EX-1) Hack sawing and chipping of M.S. flat
   (EX-2) Filing and squaring of chipped M.S. job
   (EX-3) Filing on square of rectangular M.S. Plate

3. SMITHY SHOP WORK:
   (EX-1) To prepare square angular piece by M.S. rod
   (EX-2) To Braze M.S. flat/Tipped tool on M.S. shank
   (EX-3) To make a screw driver with metallic handle

4. Tin Smithy, Soldering, Brazing
   (EX-1) To prepare different types of joint such as lap joint single seam, double seam & cap joint-hem & wired edge.
   (EX-2) Utility article-waste paper basket or paper tray
   (EX-3) Study & sketch stakes / anvils.

5. WELDING SHOP WORK:
   (EX-1) Welding practice gas & electric
   (EX-2) Welding for lap joint after preparing the edge
   (EX-3) Welding Butt joint after preparing the edge
   (EX-4) Gas Cutting
   (EX-5) 'T’ joint welding after preparation of edge.

6. Measurement of angle with the help of sin bar /Vernier Bevel protractor
7. To measure the pitch, angle and form of thread of screw.
8. To measure length, breadth, Thickness and depth height with micrometer height gauge and Vernier Calipers.
9. Calibration of Vernier Calipers/micrometersHeight gauge/depth gauge.
10. Use of feeler, wire radius and fillet gauge measurement of standard parameters.

Reference Books:

2. Elements of workshop Technology Vol. I: BS Raghuwanshi
Basic Electricity & Electronics - Lab

1. Study of series resistive circuits.
2. Study of parallel resistive circuits.
4. Preparation of Electrolyte for lead acid battery and its charging and measurement of Specific gravity with the help of hydrometer.
5. Charging and Discharging of a capacitor.
6. Verification of magnetic field of solenoid with Iron core and Air core.
7. Verification of Torque development in a current carrying coil in magnetic field.
8. Study of R.L.C. series circuit and measurement of power and power factor.
9. Study of current and voltage measurement using Ammeter and Voltmeter.
10. Study of current and voltage measurement using Galvanometer.
11. Study of current, voltage and resistance measurement using of Multi-meter
13. Study of working of single layer PCB manufacturing.
15. Study and interpreting circuit diagram and to check the continuity of connections.

Instrument Required:

1. Trainer kit for measuring TCR
2. Lead acid battery
3. Hydrometer
4. Trainer kit for measuring power and power factor in RLC circuits
5. Ammeter
6. Voltmeter
7. Multi-meter
8. Galvanometer
9. Energy Meter
10. PCB Manufacturing Facility
Unit 1:
Introduction
Introduction to electric and hybrid electric vehicles, History of hybrid and electric vehicles, Social and environmental importance of electric and hybrid electric vehicles, Electrical basics, Motor and generator basics

Unit 2:
Electric and Hybrid Electric Drive Trains
Basic concept of electric and hybrid traction, Introduction to various electric and hybrid electric drive train topologies, Advantages and disadvantages

Unit 3:
Power Flow
Power flow control in electric and hybrid electric drive train topologies.

Unit 4:
Electric Drive Components
Introduction to electric drive components used in electric and hybrid vehicles, Electric motor requirements, Direct Current (DC) motors (Brushed and Brushless), Power converters, Drive controllers.

Unit 5:
Regenerative Braking System (RBS)
Introduction and need of Regenerative Braking System, Advantages and disadvantages of RBS, Working of RBS, Concept of Regenerative Braking using Piezoelectric material, Using shock absorbers as vibration energy harvesters.

Reference Books:
1. Electric & Hybrid Vehicles, A.K. Babu, Khanna Publishing House
3. Electric and Hybrid Vehicles: Design Fundamentals: Iqbal Husain
Motor Vehicle Technology - II

Unit 1:
Frame and Body
Function and construction of frame, Cross-section of frames, Unitized construction (monocoque) types of bodies, Terms - Turning radius, lock-to-lock angle, centre point steering, positive steering, grade ability, Idea of Safety features in a modern car.

Unit 2:
Suspension System
Function, Types - conventional and independent, Spring types - coil, leaf - elliptical, semielliptical; helper springs, transverse springs, Spring camber; spring material, Torsion bar, stabiliser bar, Shock absorbers- telescopic and gas, Maruti suspension system and shockers. Anti-roll bars, Nitrox suspension.

Unit 3:
Steering System And Front Axle
Principle - Ackermann and Davis, Function, requirements, Steering gear box – types, Construction and working details of worm and sector, rack and pinion, worm and wheel, worm and recirculating ball type. Tractor steering, Power steering, Electronic Steering, Front axle - rigid front axle, Stub axle, Elliot and reverse elliot type, Lemoine and reverse lemoine type, Tractor front axle, Maruti steering system. Wheel alignment - castor angle, camber angle, K.P.I., Toe-in, toe out. General values of these.

Unit 4:
Braking System
Braking terms - braking efficiency, stopping distance, stopping time, weight transfer during braking, leading/trailing shoe of brake. Determination of braking torque, Effect of braking on steering, Types of braking systems- constructional details and working of mechanical brakes, hydraulic brakes, parking brake, vacuum, pneumatic, air-hydraulic brakes; tractor brakes, Drum and disc brakes, Master cylinder, tandem master cylinder, wheel cylinder, Brake lining and brake fluid, Brake defects, their causes and remedies, Anti Lock Braking System (ABS) & Electronic Brake Distribution (EBD).

Unit 5:
Automobile Pollution And Its Control
Effects and extent of pollution caused due to stationary and automobile engines, Harmful products and their causes in petrol & diesel engines, Measures to control exhaust emissions from two-stroke engines, four-stroke engines, and diesel engines, Turbocharger, Products which cause de-activation of catalysts in catalytic converters, Unleaded petrol, Emission measuring instruments for petrol and diesel engines. Limits specified in Motor Vehicles Act. Recent trends in Automobile Pollution Control-Exhaust Gas Recirculation, Air Injection, Reactor System, Positive Crankcase Ventilation, Evaporative Emission Control System.

Reference Books:
Unit 1 General:
Brief introduction to the subject and its scope in engineering field, classification of materials of industrial importance, Their chemical thermal, electrical, magnetic, mechanical and technological properties and their selection criteria for use in industry.

Structure of Metals and their Deformation:
Structure of metals and its relation to their physical, mechanical and technological properties, Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections, Deformation of metals, effects of cold and hot working operations over them. Recovery re-crystallization and grain growth, solid solutions, alloys and inter metallic compounds, effect of grain size on properties of metals. PROPERTIES AND USAGE OF: (1) Metals: (a) Ferrous Metals (b) Non Ferrous Metals (2) Non-metallic Materials.

Unit 2
Metals-Ferrous Metals
(a) Classification of iron and steel. (b) Cast iron types as per I.S. - White, malleable, Grey (c) Steels: Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Availability of steel in market, Its forms and specifications (d) Alloy Steel: Effect of alloying various elements, viz Cr, Hi, Co, V,W, Mo, Si, and Mn, on mechanical properties of steel, Common alloy steels, viz, Ni-steel, Ni-Cr-steel, Tungsten steel, Cobalt steel, Stainless Steel, Tool steel - High Carbon Steel, High Speed steel, Tungsten Carbide, Silicon manganese steel, Spring Steel, Heat Resisting alloy Steels etc.

UNIT 3:
NON-METALIC MATERIALS

UNIT 4
Identification and Testing of Metal Alloys:
Selection, specification forms and availability of materials.

Heat Treatment of Metals:
Elementary concept, purpose, Iron-carbon equilibrium diagram, T.T.T. and 'S' curve in steels and its significance, Hardening, Tempering, Annealing, Normalising and case hardening

Reference Books:
1. MATERIAL SCIENCE: RS Khurmi& RS Shedha
2. Material Science and engineering V Raghavan

Garage Organization & Transport Management
Unit 1:

**Layout of garage and tools & equipment required**
Location of modern automobile garage, Layout of a fully equipped modern garage, Major equipment used in repair, testing, and reconditioning of automobiles, Service Station equipment (compressor, washer, hydraulic ramp and other lifting devices etc.) Denting and painting tools and equipment, Layout of fuel filling station-cum-service station. Workshop safety.

Unit 2:

**Garage Procedure**

Unit 3:

**Store Organisation**

Unit 4:

**Fleet Management**
Types of vehicles in a fleet - goods vehicles, tankers and carriers, delivery vans, fire fighting vehicles, break-down service vehicles, buses and luxury vehicles. Layout of a fleet maintenance depot, Duties of driver, conductor and mechanic, Scheduling the maintenance of a fleet. Estimating the operating cost of transport vehicles

Unit 5:

**Motor Vehicle Act**
Definition of vehicles, testing and certifying procedures, Registration of vehicles, Permits for passenger and goods vehicles, Licensing, Transfer of ownership. Essentials of driving and traffic regulations; signals and traffic signs

**Reference Books:**
1. Fleet Maintenance & Management: AW Clair
2. Motor Vehicle Act and Transport Management V.S.Khilery
Project

On the basis of learning and skill acquired in the academic year, a project to be taken up by the student strengthening his/ her vocational skills

Electric and Hybrid Vehicles Lab

1. Understand working of different configurations of electric vehicles
2. Understand hybrid vehicle configuration and its components, performance analysis
3. Understand the properties of batteries and its types
4. Understand of electric vehicle drive systems.
5. Understand of hybrid electric vehicles.
6. Understand Auxiliary systems including charging, starter motor, on board power supply, lighting and environmental sensing and conducting repairs. Repair & Replacement of Electric/ Hybrid Vehicle body
7. Repair & Replacement of Electric Vehicle Drive Train

IT Tools Lab.

1. Spreadsheets, Word, Presentation
2. Multimedia Design
3. Troubleshooting
4. Project / Practical File
5. Viva Voce
Level 6 (SEMESTER- III)

Automobile Electrical System

UNIT 1:
Starting System

UNIT 2:
Ignition System Of Spark-Ignited Engines
Types of ignition systems- battery-and-coil, magneto ignition systems, Ignition circuit, Details of the ignition system-ignition coil, distributor, condenser, contact breaker points, rotor, distributor cap, distributor drive. Firing order, Ignition timing. Ignition advance and retard, need, and factors it depends upon, Methods for obtaining advance and retard-vacuum and mechanical, Optical sensor for spark timing.

UNIT 3
Spark plugs-constructional details; types used in automobiles, conditions of working of spark plugs, Glow plugs of diesel engines.Magneto-rotating armature and rotating magnet types, Electronic ignition of cars & motor-cycles (CDI), Idea of Distributor-less Direct ignition system.

UNIT 4:
Lighting System

UNIT 5:
Accessories
Fuel and oil pressure gauge, cooling water temperature gauge, electrical speedometer, amperemeter, wind-screen wiper, electrical horn and relay, cigarette lighter, Odometer, wind-shield washing equipment, engine rpm meter, glow plug indicator, cluster assembly, Radio and television Interference suppressors, electrical switches. Central locking of doors, power winding of window panes, car heaters AC, blower and air flow controls, Rear defogger.

Reference Books:
1. Automotive Electricals and Electronics, A.K. Babu, Khanna Publishing House
2. Automotive Electrical Equipment: PL Kohli
3. Modern Electrical Equipment: AW Judge
4. Automotive Electrical Equipment: WH Crouse
Automobile Drawing & Design

Unit 1
Drafting of sectional views of the following assemblies: (a) Cylinder block and crankcase of 2-wheeler, (b) Poppet valve assembly of a 4-stroke engine, (c) Piston assembly, (d) Connecting rod assembly, (e) Spark plug, (f) Injector.

Unit 2
Free hand line diagram of the following systems: (a) Fuel system of petrol engine (b) Fuel system of diesel engine (c) Cooling system of a multi-cylinder engine (d) Lubricating system of a multi-cylinder engine (e) Steering system of Maruti (f) Suspension systems of Maruti (g) Hydraulic Braking System of Maruti Zen (h) Air Hydraulic Braking System of TATA (i) Block diagram of Electronic Fuel Injection (EFI) system (j) Block diagram of Common Rail Direct Injection (CRDI) system (k) Oxygen sensor (l) Fuel injector of EFI.

Unit 3
Drafting of sectional views of the following assemblies
   (1) Master cylinder (2) Wheel cylinder (3) Universal joint

Unit 4
Sketch layouts of (a) Depot (b) F.I. pump reconditioning shop (c) Electrical Workshop.

Unit 5
Design of the following components of an automobile engine
   (1) Piston assembly (2) Connecting rod assembly (3) Crank shaft (4) Flywheel

Reference Books:
Automobile Drawing: RB Gupta
Automobile Engine System

UNIT1
(B) Air standard cycles: Otto cycle, Diesel cycle, Air standard efficiency of Otto and Diesel cycle, Effect of compression ratio on efficiency, Simple numerical problems, Graphical representation of ideal and actual cycle, Comparison between actual and ideal cycles, Reasons for variation. Mean effective pressure, Work done during the cycle.

UNIT2
(B) Reciprocating Engine Details: Construction, function, material and manufacturing process of: (a) Cylinder Block- 2-stroke air cooled and 4-stroke water cooled cylinder liner (wet and dry), cylinder head, gaskets, Different cylinder arrangements. Cylinder wear, Forms of combustion chamber in petrol engine Location of spark plug Combustion chamber in Diesel engines, Turbulence in Combustion chambers.

UNIT3:
Engines Details (CONTINUED)
(b) Piston-plain, split skirt, auto-thermic, cam-ground, Anodising and Tinning of piston, Piston clearance (c) Piston rings-different types (d) Piston pin; different methods of fitting piston pin (e) Valves: Poppet, Rotary, reed, Poppet Valve arrangement, Overhead and side valve operating mechanism, Valve clearance Hydraulic tappet. Sodium cooled valves. Valve seat inserts (f) Connecting rod, Section of connecting rod Bearing metal for big and small end of connecting rod (g) Crank shaft, Left hand, right hand crankshaft, Balancing of crank shaft (General idea about static and dynamic balancing, problems excluding).Main bearings, Crankshaft end play, Vibration damper. Flywheel (h) Camshaft, Camshaft drive timing gears (i) Inlet and exhaust manifold, Mufflers, Exhaust pipe (j) Variable Valve Timing (VVT).

UNIT4
(A) Rotary Engine. Principle and operation, Engine cooling, Advantages and limitations.
UNIT5

(A) Supercharging and scavenging. Necessity of supercharging, Rotary compressors, Turbocharger requirement, Effect of supercharging on power output, mechanical losses, fuel consumption, detonation, Limitations of supercharging, Methods and classification of scavenging process, Performance of different scavenging systems.
(B) Engine specifications, specifications of engines of Indian vehicles - four wheelers, three wheelers and two wheelers.

Reference Books:
1. Automotive Engines, A.K. Babu, Khanna Publishing House
2. Thermal Engineering I & II: Sarao, Gambhir&Aggarwal
3. Automobile Engineering II: Kirpal Singh
4. Basic Automobile Engineering: CP Nakra
5. Automobile Engineering: RB Gupta
Auto Body Repair, Denting & Painting

Safety precautions and first aid, Proper use, care and maintenance of tools and equipments
Introduction on types, function of body and panels, Procedure for inspection, removing and refitting of body components panels, doors and other body parts, Arc welding-basic electricity and welding power source. Electrodes types, description and specification.arc welding procedure Gas welding-gas welding, brazing and soldering procedures Description of gas cutting, Resistance welding-resistance welding, process-spot, seam and butt welding Details of MIG welding, Method of fixation of wind screen, glass Procedure for cut open, beat out, dents, stripping of old paints, sanding at different stages, smooth surface preparation at different stages, putty application &primer application at different stages of affected area(chronological order for repair of auto body)fitment of repaired part and aligning to the original shape Personal safety – three key areas of risk eyes, skin and inhalation Details of personal protective, equipments-RPE,PPE Details of ingredients of paint, Procedure of refinishing process, Selection of consumable for doing painting work Procedure for doing painting(in chronological order),selection of materials, tools and equipments application of body filler for surface preparation, sanding on the affected area for smooth surface preparation, primer coating on the affected area, preparing affected surfaces for base coating, applying Base coat painting, clear coat painting for metallic paints, rubbing and polishing,
Application of paint production, treatment/anti rust treatment Procedure for inspection of painting, work and fixing the wind screen glass Details of spray gun-types-standard air, gap design-different sizes of nozzles, Details of different types sanding - 15 equipments Different types of sand paper-grades, Possible defects in painting, objects, causes and its cure.

Reference Books:
Automotive Body Repair & Painting Manual, John Harold Haynes
Automobile Workshop -1

UNIT 1

Engine tuning: Meaning and scope of engine tuning. Necessity of engine tuning, Service data of
Maruti: Alto, WagonR, Swift (Petrol & Diesel); Hyundai: Santro, Ford: Figo; Volkswagen: Polo;
Chevrolet: Spark. Engine analysis and tuning with the help of diagnostic computer, Diesel engine
injection timing checking

UNIT 2

Wheel Balance: Reasons of wheel imbalance, Effect of wheel imbalance on stability of vehicle. Static
and dynamic balancing, Wheel balancing by the application of weights, Wheel Alignment: Meaning of
wheel alignment, Various angles-camber, caster, KPI & toe - and their effect on steering stability,
General values of popular Indian vehicles, Wheel alignment on computerised wheel aligner

UNIT 3

Measurement of Exhaust Pollution by various analysers such as Four Gas Analyser, Smoke meter,
Noxanalyser

UNIT 4

Use of Headlight aligner, Wheel aligner, automotive oscilloscope

UNIT 5

Servicing: Meaning and scope of servicing, Items attended to in servicing of a vehicle. Servicing a
vehicle, Focussing and alignment of head lights

Reference Books:
1. Engine Service: Gary Lewis
2. Various Car’s Manuals
AUTO BODY REPAIR Practice health & safety-familiarize, select, proper use, maintain and store – tools, equipments, Consumables clothing safety Simple basic practices on computer reading, service manuals, collision repair manuals and colour matching guide, Identification of different types of body, chassis and drive lines, Identification of location of parts and panels, Practice on operating the air compressor, Practice on periodical maintenance of air compressor Inspect and decide whether it can be repaired or replaced Remove and refit body panels, doors, floors, wheel boxes and fenders Practice on removing and refitting wind shield glasses Practice on arc welding on vehicle body Practice on gas welding, gas brazing, gas soldering and gas cutting on vehicle body Practice on resistance, spot, seam and butt welding on vehicle body Practice on MIG welding Safety precautions and first aid. Proper use, care and maintenance of tools and equipments, Introduction on types, function of body and panels Procedure for inspection, removing and refitting of body components panels, doors and other body parts Arc welding-basic electricity and welding power source. Electrodes types, description and specification, Arc welding procedure Gas welding-gas welding, brazing and soldering procedures Description of gas cutting Resistance welding-resistance welding process-spot, seam and butt welding Details of MIG welding Method of fixation of wind screen glass Procedure for cut open, beat out dents, stripping of old paints, sanding at different stages, smooth surface preparation at different stages, putty application & primer application at different stages of affected area(chronological order for repair of auto body)fitment of repaired part and aligning to the original shape, Practice on plasma welding, Practice on minor repair of auto body cut open, beat out, strip out old paint, make smooth surface by using different grades of sanders, apply putty on affected area and applying primer(repair damaged body which is ready for final paint) Apply base coat painting, Fit check the repaired components for alignment

AUTO BODY PAINTING Practice health & safety-familiarize, select, proper use, maintain and store – tools, equipments, Consumables clothing safety, Practice on removing paint from the damaged area Practice on mixing and applying body filler Practice on sanding(block) Practice on mixing and applying putty Practice on applying primer Practice on feather edge sanding and masking Base coat application Surface cleaning and degreasing Second and third coat application Preheating the vehicle and cooling Cutting, scuffing, rubbing and polishing

Reference Books:
Automotive Body Repair & Painting Manual, John Harold Haynes
UNIT 1
IGNITION SYSTEM: Idea of Battery-and-coil ignition circuit and its working, Compression ignition of diesel engines.
Properties and functions of a good lubricating oil, Additives, Gradation of lubricating oil due to viscosity. SAE numbers, Service rating, 2T and Super 2T oils for use in 2-s engines.

UNIT 2
COOLING SYSTEM: Necessity of cooling of I.C. engines, Methods of cooling-air cooling, water cooling, liquid cooling, Shape of cooling fins Field of application of air cooling.
Water cooling system - Thermo siphon system, pump system, thermostat system of cooling Thermostat - types Radiators-different types, their construction and function Pressurized cooling system; radiator pressure-cap, surge tank Cooling water temperature gauge Anti-freeze and anti-corrosive additives Coolants Flushing of cooling system.

UNIT 3
FUEL SYSTEM OF DIESEL ENGINES: Fuel supply system, Filters (primary and secondary); positioning of filters, Feed pump Solid and air injection system Fuel injection pump, different types- plunger, distributor pump, their construction and working, Injectors Governors Types of governing Combustion process in diesel engine, Diesel knock, Electronically Controlled Diesel Injection Pump Common Rail Direct Injection Piezoelectric effect and its use in CRDI.

UNIT 4
CARBURETOR - Function and principle of working of simple carburetor. Carburetor controls- throttle, choke. Types of Carburetors- fixed jet carburetor (Solex type) and constant vacuum carburetors used
in YAMAHA motorcycle, Twin-barrel carburetors, Classification of carburetors, Disadvantages of carburetors Phenomenon of combustion and detonation Pre-ignition.

UNIT 5


Reference Books:
Automotive Engines, A.K. Babu, Khanna Publishing House
Automotive Refrigeration & Air-conditioning

Unit-I: Refrigeration Fundamentals: Introduction to refrigeration and vapour compression system, cycle diagram (Carnot cycle, Reverse Carnot cycle, Simple vapour compression cycle, bell Coleman cycle), effects of various operating parameters on performance of A/C System, Vapour absorption refrigeration system (No numerical), Applications of refrigeration and air conditioning.

Unit-II: Refrigerants and Air Conditioning Components: Environmental concerns/Legislation for automotive A/C systems, types and properties of refrigerants, refrigerant oils, refrigerant piping. Future refrigerants, Air conditioning components: Compressors, Condensers, flow control devices, evaporators – Design guidelines, types, sizing and their installation. Accumulators, receiver driers and desiccants, Refrigerant charge capacity determination

Unit-III: Air distribution system: Comfort conditions, Air management and heater systems, air distribution modes (Fresh/Recirculation, Face, Foot, Defrost, and Demist), A/C ducts and air filters. Blower fans, Temperature control systems (manual/semautomatic, automatic). Vehicle operation modes and Cool-down performance

Psychrometry: Psychometric properties, tables, charts, Psychometric processes, Processes, Combinations and Calculations, ADP, Coil Condition line, Sensible heat factor, Bypass factor.

Unit-IV: Load analysis and control devices: Load Analysis, Outside and inside design consideration, Factors forming the load on refrigeration and air conditioning systems, Cooling and heating load calculations, Load calculations for automobiles, Effect of air conditioning load on engine performance, Air conditioning electrical and electronic control, pressure switching devices, sensors and actuators.

Unit-V: Diagnostics, Trouble Shooting, Service and Repair: Initial vehicle inspection, temperature measurements, pressure gauge reading and cycle testing, leak detection and detectors, Sight glass. Refrigerant safety/handling, refrigerant recovery; recycle and charging, system oil, system flushing, odour removal, retrofitting. Removing and replacing components, Compressor service.

Reference Books:
Refrigeration & Air Conditioning, Sadhu Singh, Khanna Publishing House
Vehicle Performance & Testing


Unit-II: Drive train and Component testing: Vehicular transmission performance: comparison of automotive clutches, Epicyclic transmission, torque converter, final drive and differential, testing of vehicle components: clutch, gear box (for noise and shifting force), brake testing, wheels and tyre testing – tyre wear pattern identification and causes.

Unit-III: Vehicle testing: Vehicle Testing - Road test, free acceleration test, coast down test, passer by noise test, road load data acquisition for vehicle. Test tracks: Proving ground testing, high speed track, pavement track, corrugated track, mud track, steering pad, gradient track, deep wading through shallow water. Laboratory testing: Testing on chassis dynamometer, transition testing (Euro III onwards), accelerated testing, virtual testing, evaporative emission testing, oil consumption testing, endurance test, high speed performance test.

Collisions and Crash Testing: Crash testing: Human testing, dummies, crashworthiness, pole crash testing, rear crash testing, vehicle to vehicle impact, side impact testing, crash test sensors, sensor mounting, crash test data acquisition, braking distance test.

Unit-IV: Comfort, Convenience and Safety: Seats: types of seats, driving controls accessibility, and driver seat anthropometry. Steering: steering column angle, collapsible steering, and power steering. Adaptive cruise control, navigation system, adaptive noise control, driver information system. Safety: Motor vehicle safety standards, active safety, passive safety, bio-mechanics Structural safety, energy absorption, ergonomic consideration in safety.

Unit-V: Noise Vibration and EMI: Noise and vibration: Mechanism of noise generation, engine noise and vibration, causes and remedies on road shocks, wind noise and measurement. Automobile testing instrumentation: Sensors types and selection, instrumentation for functional tests, model test and full scale testing.

Reference Books:
Road Vehicle Performance: Methods of Measurement and Calculation, George Gordon Lucas
Electrical & Hybrid Vehicles – II

Unit -I: Hybrid Architecture and Power Plant Specifications: Series configuration locomotive drives-series parallel switching- load tracking architecture. Pre transmission parallel and combined configurations Mild hybrid- power assist- dual mode- power split- power split with shift- Continuously Variable transmission (CVT)- wheel motors. Grade and cruise targets- launching and boosting- braking and energy recuperation- drive cycle implications.

Unit -II: Sizing the Drive System and Energy Storage Technology: Matching electric drive and ICE; sizing the propulsion motor; sizing power electronics. Battery basics; lead acid battery; different types of batteries; battery parameters


Unit IV: Energy Storage: Battery based energy storage: Battery basics, Lead acid (Pb-Acid) battery, Nickel-Cadmium (NiCd) battery, Nickel-Metal-Hydride (NiMH) battery, Lithium-ion (Li-ion) battery, Lithium-polymer (Li-poly) battery, Ultra capacitors.

Unit -V: Nonelectric Hybrid Systems: Short term storage systems flywheel accumulators, continuously variable transmissions hydraulic accumulators hydraulic pumps/motors- pneumatic hybrid engine systems operation modes.

Reference Books:
1. Electric & Hybrid Vehicles, A.K.Babu, Khanna Publishing House

Automotive RAC Lab.
1. Test on vapor compression test rig.
2. Test on air conditioning test rig.
3. Study of various methods of transport refrigeration systems.
4. Study and demonstration on car and bus air conditioning system.
5. Study of latest trends in automotive refrigeration systems.
6. Study and demonstration of controls in refrigeration.
7. Study of different components with the help of cut sections/models/charts- Compressor, Condenser, Evaporators, Expansion device, Blower fans, Hating systems etc.
8. Study of installation/operations/maintenance practices for refrigeration systems.
9. Study of leak testing and leak detection methods.
10. Visit to maintenance shop of automotive air conditioning and writing report on it.

Vehicle Performance & Testing Lab
1. Estimation of power requirement for vehicle propulsion by taking actual vehicle example.
2. Perform coast down test to find vehicle inertia.
3. On road fuel consumption test at different speeds.
4. Brake efficiency measurement
5. Pass- by noise test.
6. Free acceleration test.
7. Vibration measurement in passenger compartment
8. Laboratory testing of vehicle on chassis dynamometer for performance
9. Laboratory testing of vehicle on chassis dynamometer for emission.
10. Report based on visit to vehicle testing and research organization.
11. On road emission testing of petrol and diesel vehicles for PUC/RTO.
Level 7 (Semester V)

Automotive System Design

Unit-I:
Design of Clutches & Gearbox:
Design requirements of friction clutches, selection criterion, torque transmission capacity, lining materials, Design of single plate clutch, multi-plate clutch and centrifugal clutch. Selection of gear ratios and final drive ratio, numerical on 3-speed and 4-speed gearbox.

Unit-II:
Design of Propeller Shafts and Axles:
Design of propeller shafts for bending, torsion and rigidity, Design of universal joints and slip joints, final drive, Design of live and dead axles.

Unit-III:
Brake Systems:
Design of hydraulic braking system, internal expanding shoe brake and disc brake, design of master and wheel cylinder and piping design.

Unit-IV:
Design of Suspension and Steering System:
General design considerations of suspension system, design of helical and leaf springs for automobile suspension system, design considerations of belleville springs, elastomeric springs, design considerations of steering system and vehicle frame design.

Unit-V:
Statistical Consideration in Design and Optimization:
Ergonomics and aesthetic design, statistics in design, design for natural tolerances, statistical analysis, and mechanical reliability, introduction to design optimization of mechanical elements, adequate and optimum design, methods of optimization, johnson’s method of optimum design-simple problems in optimum design like axially loaded members.

Reference Books:
1. Automotive Systems Engineering, Hermann Winner, Markus Maurer
2. Automotive Mechanics – SIEWilliam Crouse
Alternative Fuel and Emission Control

Unit-I: Conventional Fuels and Need for alternative fuels: Estimate of petroleum reserve and availability - comparative properties of fuels- diesel and gasoline, quality rating of SI and CI engine fuels, fuel additives for SI and CI engines, thermodynamics of fuel combustion - introduction to chemical thermodynamics, chemical reaction - fuels and combustion, enthalpy of formation and enthalpy of combustion, first law analysis of reacting systems, adiabatic flame temperature, need for alternative fuels, applications, types etc.

Unit-II: Alternative Fuels: Gaseous Fuels and Bio-fuel: Introduction to CNG, LPG, ethanol, vegetable oils, bio-diesel, biogas, Hydrogen and HCNG. Study of availability, manufacture, properties, storage, handling and dispensing, safety aspects, engine/vehicle modifications required and effects of design parameters performance and durability

Synthetic Fuels Introduction to Syngas, DME, P-Series, GTL, BTL, study of production, advantages, disadvantages, need, types, properties, storage and handling, dispensing and safety, discussion on air and water vehicles.

Unit-III: Emission Control (SI Engine): Emission formation in S.I. engines - Hydrocarbons, carbon monoxide, oxides of nitrogen, poly-nuclear aromatic hydrocarbon, effects of design and operating variables on emission formation in spark ignition engines, controlling of pollutant formation in engines exhaust after treatment, charcoal canister control for evaporative emission control, emissions and drivability, positive crank case ventilation system for ubhc emission reduction.

Unit-IV: Emission Measurement and Control (CI Engine): Chemical delay, intermediate compound formation, pollutant formation on incomplete combustion, effect of design and operating variables on pollutant formation, controlling of emissions, emissions and drivability, exhaust gas recirculation, exhaust after treatment – doc, dpf, scr and Int. Measurement and test procedure (ndir analyzers, fid, chemiluminescenox analyzer, oxygen analyzer, smoke measurement, constant volume sampling, particulate emission measurement, orsat apparatus.)

Unit-V: Health effects of Emissions from Automobiles: Emission effects on health and environment. Emission inventory, ambient air quality monitoring, Emission Norms: As per Bharat Standard up to BS– IV.

Reference Books:
1. Electric & Hybrid Vehicles, A.K. Babu, Khanna Publishing House
2. Engine Emissions: Pollutant Formation and Advances in Control Technology B.P. Pundir
Automobile Maintenance Service & Repairs – I

Unit 1:

Workshop Equipment

Equipment for testing electrical accessories: Electric test bench, growler, coil tester, ignition and cam-dwell-angle tester; wiring harness tester. Ampere-hour battery tester, voltmeter tester, Layout of diesel injector and F.I.P. reconditioning shop, Tools and equipment required

Unit 2:

Lubrication and Maintenance Schedule

Necessity for routine maintenance, Importance of service manuals, Specification of engines- petrol and diesel vehicles
   (a) Engine (b) Clutch (c) Gear Box (d) Propeller shaft (e) Universal joints (f) Differential (g) Axles and hubs

Unit 3:

Lubrication and Maintenance Schedule

(a) Suspension system (b) Steering system (c) Tyre (d) Chassis (e) Brake-drum and disc

(f) Battery (g) Self starter (h) Dynamo

Unit 4:

Fuel System

Maintenance Schedule of diesel engine fuel injector, hot plugs, rotary and reciprocating type of fuel injection pump, fuel injection pump of single cylinder engines, hoses & pipe lines, priming unit, tanks. Electricals: Maintenance Schedule of batteries, starter motor, dynamo, ignition system, wiper motor, electrical fuel pump, alternator, horn, flasher unit.

Unit 5:

Engine Tuning

(a) Engine tuning of conventional and MPFI petrol engine. Adjustments of spark plug gap, valve tappet clearance, head bolts, Use of vacuum and compression gauge, Air cleaner cleaning, Ignition timing setting by timing light, Pollution checking, Troubleshooting

Reference Books:
Automotive NVH

Unit-I:

Introduction to NVH and Vibrations:
Noise Vibration and Harshness (NVH) and its role in automotive design and development. Physiological effects of noise and vibration, sources of vibration and noise in automobiles, Basic concepts of vibration, time period, frequency, SHM, types of vibration, Natural frequency, resonance, damping, mathematical models.

Unit-II

Vibration Control and Measurement:
Different types of dampers, vibration absorbers, centrifugal pendulum, dry friction, untuned viscous, vibration isolation, Instruments, vibrometer, velocity pick-ups, frequency measurement instrument. One applications: isolation of the engine from vehicle structure and control of torsional oscillation amplitudes in engine crankshaft.

Unit-III:

Noise Fundamentals:
Fundamentals of acoustics—general sound propagation—structure borne sound and air borne sound, plane wave propagation - wave equation, specific acoustic impedance, acoustic intensity, spherical wave propagation – acoustic near and far fields, reference quantities, the decibel scale.

Unit-IV:

Sound Analysis:
Anatomy of human ear, mechanism of hearing, loudness, weighting networks, equivalent sound level, relationship among sound power, sound intensity and sound pressure level.

Unit V:

Automotive Noise Sources and Control Techniques
Methods for control of engine noise, transmission noise, intake and exhaust noise, aerodynamic noise, tyre noise, brake noise.
Noise control strategy, noise control at source – along the path isolation, damping, balancing, resonators, absorption, barriers and enclosures.

Reference Books:
1. Automotive NVH Technology (SpringerBriefs in Applied Sciences and Technology), Fuchs, Anton, Nijman, Eugenius, Priebsch, Hans-Herwig (Eds.)
Automobile Workshop - II

1. Find the mechanical efficiency of a multi-cylinder engine by Morse Test
2. Tune a multi-cylinder petrol engine and set dwell, rpm, ignition timing, CB point gap, spark plug gap, and tappet clearance.
3. Check the condition of the given battery as regards: (i) cell voltage (ii) specific gravity (iii) ampere-hour capacity (iv) Level of electrolyte. Use battery capacity tester. Clean the battery and charge it. Prepare a maintenance schedule.
4. Dismantle study, assemble and check for proper working the following: (a) Electric horn (b) Wiper motor (c) Starter motor (d) dynamo (e) alternator.
5. Test the following on electrical test bench: (a) Dynamo (b) Starter motor (c) Alternator. Also study the working of a growler.
6. Dismantle, inspect and assemble the magneto of a 2-wheeler. Set the ignition timing using dial gauge.
7. Dismantle and assemble the given electrical fuel pump. Check it for proper working.
8. Set the cut-out and regulator of a vehicle.
10. Test a multi-cylinder F.I. pump on calibrating machine and check it for proper phasing. Set the injection timing on the engine.
11. Test a diesel fuel injector and set injection pressure. Grind needle and seat.
12. Study and sketch rotary F.I. pump.
13. Study of working of electric vehicle.
Design of Automotive Systems Lab

1. Design of automotive clutch assembly and component drawing using any drafting software (Two full imperial sheets along with design calculations report) consists of:
   • Functional design of clutch
   • Design of clutch shaft, hub and flange
   • Design of damper springs
   • Design of sectors, rivets etc.
   • Design of pressure plate assembly
   • Design for linkage mechanism
   • Details and assembly drawing
   • Details and assembly drawing

2. Design of automotive gear box along with reverse gear (Two full imperial sheets along with design calculations report) consists of:
   • Calculation of gear ratios
   • Determination of number of teeth on gear pair
   • Determination of gear reductions
   • Design of gear pairs
   • Design of shafts
   • Selection of bearings
   • Details and assembly drawing

3. Design of suspension spring and its analysis using any analysis software.
Automobile Maintenance Service & Repairs – I

Unit 1:
Workshop Equipment
Equipment for testing electrical accessories: Electric test bench, growler, coil tester, ignition and cam-dwell-angle tester; wiring harness tester. Ampere-hour battery tester, voltmeter tester, Layout of diesel injector and F.I.P. reconditioning shop, Tools and equipment required

Unit 2:
Lubrication and Maintenance Schedule
Necessity for routine maintenance, Importance of service manuals, Specification of engines- petrol and diesel vehicles (a) Engine (b) Clutch (c) Gear Box (d) Propeller shaft (e) Universal joints (f) Differential (g) Axles and hubs

Unit 3:
Lubrication and Maintenance Schedule
(a) Suspension system (b) Steering system (c) Tyre (d) Chassis (e) Brake-drum and disc (f) Battery (g) Self starter (h) Dynamo

Unit 4:
Fuel System
Maintenance Schedule of diesel engine fuel injector, hot plugs, rotary and reciprocating type of fuel injection pump, fuel injection pump of single cylinder engines, hoses & pipe lines, priming unit, tanks. Electricals: Maintenance Schedule of batteries, starter motor, dynamo, ignition system, wiper motor, electrical fuel pump, alternator, horn, flasher unit. Unit 5: Engine Tuning (a) Engine tuning of conventional and MPFI petrol engine. Adjustments of spark plug gap, valve tappet clearance, head bolts, Use of vacuum and compression gauge, Air cleaner cleaning, Ignition timing setting by timing light, Pollution checking, Troubleshooting

Reference Books:
2. Automotive Technology:Service And MaintenanceDon Knowles
Off-Road Vehicles

Unit 1:
Classification and Requirements of Off Road Vehicles
Introduction, pretest, history and overview of an off-road machines, construction layout, capacity and applications, power plants, chassis and transmission, multi-axle vehicles

Unit 2:
Earth Moving Machines
Different types of earth moving equipments and their applications. Bulldozers, cable and hydraulic dozers, Crawler track, running and steering gears, scrapers, drag and self powered types - Dump trucks and dumpers - Loaders, single bucket, multi bucket and rotary types - Power and capacity of earth moving machines.

Unit 3:
Farm Equipments & Tractors
Scrapers, elevating graders, motor graders, self powered scrapers and graders, power shovel, revolving and stripper shovels, drag lines, ditchers, capacity of shovels Tractors: General description, specification and functions, light, medium and heavy wheeled tractors, crawler tracks mounted / wheeled-bull dozers, tilt dozers and angle dozers, front end loaders, factors affecting efficiency of output of tractors, simple problems, merits and demerits

Unit 4:
Combat Vehicles and Vehicle Systems
Power take off, special implements. Special features and constructional details of tankers, gun carriers and transport vehicles Vehicle Systems: Brake system and actuation – OCDB and dry disc caliper brakes. Body hoist and bucket operational hydraulics, Hydro-pneumatic suspension cylinders, Power steering system, Kinematics for loader and bulldozer operational linkages, Safety features, safe warning system for dumper, Design aspects on dumper body, loader bucket and water tank of sprinkler

Unit 5:
Vehicle Evaluation Mobility
Soil-Vehicle Mechanics, characteristics of soils, nominal ground pressure, mean maximum pressure, the mobility index (mi), vehicle cone index (vci) and rated cone index (rci), mobility number, dynamic behavior and traction on wet soil, traction performance and factors affecting traction performance

Reference Books:
1. Off-road Vehicle Dynamics: Analysis, Modelling and Optimization Hamid, ArefMardani
2. Road and Off-Road Vehicle System, Manfred Ploechl
3. Off-Road Vehicles, Ian Graham

Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills
STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc
Production Technology (PT)
Branch Code: 103

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
# Evaluation Scheme

**B. Voc Production Technology**

## NSFQ Level 5 SEMESTER-I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total TE PE</td>
<td>Total Credit</td>
</tr>
<tr>
<td>1</td>
<td>BPTV511</td>
<td>Machine Tool Technology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>BPTV512</td>
<td>General Mechanical Engineering-I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>BPTV513</td>
<td>Production Technology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>BPTV514</td>
<td>Metrology and Measuring Instruments</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>BPTP511</td>
<td>Metrology and Measuring Instruments Lab</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>BPTP512</td>
<td>Machine Tool Technology Lab</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>BPTP513</td>
<td>Language Lab</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>BPTT511</td>
<td>Metal Arc Welding (CSC/Q0204)</td>
<td></td>
<td></td>
<td>Any one Training 400 hrs/8 weeks</td>
</tr>
<tr>
<td></td>
<td>BPTT512</td>
<td>MIG MAG or GMAW Welder (CSC/Q0209)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT513</td>
<td>Assistant TIG Welder (CSC/Q0212)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT514</td>
<td>CNC Setter Cum Operator (CSC/Q0120)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT515</td>
<td>CNC Operator – VMC (CSC/Q0116)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## NSFQ Level 5 SEMESTER-II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total TE PE</td>
<td>Total Credit</td>
</tr>
<tr>
<td>1</td>
<td>BPTV521</td>
<td>Industrial Management</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>BPTV522</td>
<td>Manufacturing Technology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>BPTV523</td>
<td>Material Science and Materials</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>BPTV524</td>
<td>General Mechanical Engineering-II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>BPTP521</td>
<td>Project</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>BPTP522</td>
<td>Basic Electricity and Electronics Lab</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>7</td>
<td>BPTP523</td>
<td>Mechanical Workshop Practice Lab</td>
<td>30</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>8</td>
<td>BPTT521</td>
<td>Metal Arc Welding (CSC/Q0204)</td>
<td></td>
<td></td>
<td>Any one Training (other than 1'sem)400 hrs/8 weeks</td>
</tr>
<tr>
<td></td>
<td>BPTT522</td>
<td>MIG MAG or GMAW Welder (CSC/Q0209)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT523</td>
<td>Assistant TIG Welder (CSC/Q0212)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT524</td>
<td>CNC Setter Cum Operator (CSC/Q0120)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT525</td>
<td>CNC Operator – VMC (CSC/Q0116)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total** | 610 | 500 | 24

---

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council

2 | B. Voc -Production Technology (PT) Branch Code:103
### NSFQ Level 6 SEMESTER- III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BPTV631</td>
<td>Metal Casting Technology</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BPTV632</td>
<td>Production Automation &amp; Computer Integrated Mfg.</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BPTV633</td>
<td>Fundamental of Mechatronics</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BPTV634</td>
<td>Machining and Machine Tools</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BPTP631</td>
<td>Metal Casting Technology Workshop</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BPTP632</td>
<td>Mechatronics Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BPTT631</td>
<td>Service Engineer – Installation (CSC/Q0501)</td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT632</td>
<td>Quality Inspector – Forged, Casted or Machined Component (CSC/Q0601)</td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT633</td>
<td>CNC Programmer (CSC/Q0401)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT634</td>
<td>Maintenance Fitter – Mechanical (CSC/Q901)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 6 SEMESTER- IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BPTV641</td>
<td>Mass Production Devices</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BPTV642</td>
<td>Agile and Lean Manufacturing</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BPTV643</td>
<td>Metal Forming Processes</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BPTV644</td>
<td>Non-Conventional Machining</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BPTP641</td>
<td>Tool and Die Making Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BPTP642</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BPTT641</td>
<td>Service Engineer – Installation (CSC/Q0501)</td>
<td>Any one Training (other than 3rd sem) 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT642</td>
<td>CNC Programmer (CSC/Q0401)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT643</td>
<td>Quality Inspector – Forged, Casted or Machined Component (CSC/Q0601)</td>
<td>Any one Training (other than 3rd sem) 400 hrs/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT644</td>
<td>CNC Setter Cum Operator – VMC (CSC/Q0123)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GV: General Vocational; VP: Vocational Practical; OJT: On Job Training; SSC: Sector Skill Council
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BPTV751</td>
<td>BPTV751</td>
<td>Reliability, Maintenance &amp; Safety Engineering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTV752</td>
<td>BPTV752</td>
<td>Plant Layout and Product Handling</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTV753</td>
<td>BPTV753</td>
<td>Product Design and Manufacturing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTV754</td>
<td>BPTV754</td>
<td>CAD &amp; CAM</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BKVH751</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTP751</td>
<td>BPTP751</td>
<td>CAD Lab</td>
<td>30</td>
<td></td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTP752</td>
<td>BPTP752</td>
<td>CAM Lab</td>
<td>30</td>
<td></td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTT751</td>
<td>BPTT751</td>
<td>Tool &amp; Die Maker (CSC/Q0306)</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT752</td>
<td>BPTT752</td>
<td>Designer – Mechanical (CSC/Q0405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT753</td>
<td>BPTT753</td>
<td>Service Engineer – Breakdown Service (CSC/Q0503)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BPTV761</td>
<td>BPTV761</td>
<td>Rapid Prototyping and Reverse Engineering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTV762</td>
<td>BPTV762</td>
<td>Production Planning and Control</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BKVH761</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>BPTP761</td>
<td>BPTP761</td>
<td>Major Project</td>
<td>180</td>
<td></td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>BPTT761</td>
<td>BPTT761</td>
<td>Tool &amp; Die Maker (CSC/Q0306)</td>
<td>Any one Training (other than 5th sem) 400 hrs/ 8 weeks</td>
<td>200</td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BPTT762</td>
<td>BPTT762</td>
<td>Designer – Mechanical (CSC/Q0405)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BPTT763</td>
<td>BPTT763</td>
<td>Service Engineer – Breakdown Service (CSC/Q0503)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total</td>
<td>670</td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
Unit 1: Centre Lathe
The centre lathe and its principle of working, Types of lathes, Lathe specification and size, Features of lathe bed, Head stock and tail stock, feed mechanism and change-gears. carriage saddle, Cross slide, Compound rest, Tool post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe doges, mandrils, Steady rest, Lathe attachments, Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, Under cutting, Relieving. Types of lathe tools and their uses, Brief description of semi-automatic lathes such as capstan and turret lathes, their advantages and disadvantages over centre lathes, types of job done on them. General and periodic maintenance of a centre lathe

Unit 2: Shaping, Planing & Slotting Machines
Working principles of planer, shaper and Slotter, Differences and similarities among them, quick return mechanism applied to the machines. Types of work done on them, types of tools used, their geometry, General and periodic maintenance of a shaper.
DRILLING & BORING MACHINES: Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.

Unit 3: Milling Machines
Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling. Negative rake milling, cutting speed and speed for different tools in up and down milling. Simple, compound and differential indexing, milling of spur gears and racks

Unit 4: Grinding Machines
Common abrasives, grinding wheel materials, Bonds, Grain and grit of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding, Types of grinding machines, precision finishing operations like honing.
BROACHING MACHINES: Types of work done on broaching machine. Simple types of broaches and their uses, Types of broaching machines

Unit 5: Jigs and Fixtures
Object of Jigs and Fixture, Difference between jigs and fixtures, Principle of location, Principle of clamping, Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs-bushes(Fixed, Liner, Renewal, and Slip). Template, Plate jigs. Channel jigs, Leaf jigs, Simple example of milling, turning, grinding, horizontal boring fixtures and broaching fixtures. Welding fixtures
COOLING PROCESS: Cooling and cutting fluids, difference between coolant and cutting fluid, function and action of cutting fluids, Requirement of good cutting fluids, their selection for different materials and operations AUTOMATION OF MACHINE TOOLS: Introduction to CNC lathe (Computer Numerical Control Lathe) and FMS (Flexible Manufacturing System) Introduction only.

Reference Books:
1. Production Technology: Jain & Gupta
2. Workshop Technology Vol. II: Hazra & Choudhary

5 | B. Voc -Production Technology (PT) Branch Code:103
General Mechanical Engineering – I

Unit 1: Strength of Materials & Power

Transmission

Stress, strain, elastic constraints, stress in circular shaft subjected to pure torsion only, Riveted and bolted joints.

Unit 2: Shear Force & Bending Moment

Elementary idea of Shear force and bending moment for concentrated, uniformly distributed loads on simply supported beam cantilever and overhanging beam, Simple Shear force and bending moment diagrams, Relationship between shear force and bending moment

Unit 3: Power Transmission: Pulleys, Gears & Shaft

Classification of Pulleys, Types of Belts, Simple calculation of pulley diameter, Classification of Gears, Simple calculation of number of teeth and speed, Power transmission by solid and hollow shaft

Unit 4: Hydraulics & Hydraulic Machines

Properties of fluids, pressure of fluid and its measurement. Flow of fluids, velocity and discharge, Bernoulli’s theorem and its application in venturimeter, flow through pipe, head loss due to friction

Unit 5: Water Turbines & Pumps

Capacity & Working of Turbines- Pelton and Reaction, reciprocating and centrifugal pump

Reference Books:

Production Technology

Unit 1
TRANSFER MACHINES: Types of productions. Types of layout, Economic justification of transfer machines, Inline transfer, drum type transfer machines. Automatic loading & Transferring methods, Machining heads, Automatic inspections, Tool servicing, Transfer press linked lines.

Unit 2

Unit 3
Surface Treatment & Finishing: Meaning of the terms surface treatment and its purpose, Elements of surface treatment cleaning protecting, Colouring, Altering surface properties.
AUTO CONTROL OF SIZE: Auto sizing, Mechanical calliper for turning operation, Pneumatic sizing of external cylindrical ground work, Pneumatic slide position measuring device, Digital slide position measuring device, Auto sizing device for centre-less grinding operation. Friction rollers, Optical measurement

Unit 4
Cutting Tools For Machining: Elements of machining process, Single point tools -Basic angles, Chip formation, Effect of manipulating factors such as velocity, size of cut, effect of tool geometry, Tool material, Cutting fluids and contamination in them, Work piece material, Tool life model, Machining economics, Specific power consumption
Basic principles of multipoint tools, Linear travel tools, Broaches, Gear shaper cutters, Axial feed rotary tools-Twist drill, Reamers, Core drills, Counter bores and counter sinks, Multiple diameter tools, Hobs, Characteristics of tools materials., Tool materials, Tool steels, High speed steel, Cast cobalt alloys. Carbides or cintered carbide, Ceramics, Carbide tools
Surface treatment of cutting tools- Its advantage, Tin coated high speed steel diamonds. Cubic boron nitrides, Specialised knowledge of steel cutting

Unit 5
Press Tools: Factors affecting press tool design, Shearing, Bending, Drawing, combination tools, Progression tools, Rubber die formatting, high energy forming, Explosive forming
SPECIFICATION OF QUALITY & RELIABILITY: Quality, Specification Designing for production Standardisation, Preferred numbers, Limits and fits, Tolerance build up, Geometric tolerances. Limit gauging

Reference Books:
(i) Production Engineering: PC Sharma
(ii) Production Technology: CK Singh

Metrology and Measuring Instruments
Unit 1

Introduction: Meaning and scope of metrology in field of engineering, Standards and types of measurements (Line and Wave, length, Primary, Secondary and Tertiary measurement concept only). Limits, Fits and Tolerances, Interchangeability, precision and accuracy, Sources of error

PRINCIPLES AND CLASSIFICATIONS OF MEASURING INSTRUMENTS:
(i) Principles of Electrical measuring Instruments.

Unit 2:
Comparators
General principles of constructions, balancing and graduation of measuring instruments, characteristics comparators, use of comparators, difference between comparators, limit gauges and measuring instruments. Classification of comparators, construction and working of dial indicator, mechanical comparator, mechanical-optical, zeissoptotest, electro limit, electromechanical electronics, pneumatic comparators, gauges, tool makers microscope.

Unit 3:
Surface Finish
Geometrical characteristics of surface roughness- Wavyness, layflaws, Effect of surface quality on its functional properties. Factor affecting the surface finish, Drafting symbols for surface roughness, Evaluation of surface finish RMS and CLS values, Methods of measuring surface roughness qualitative and quantitative methods, Comparison of surface produce by common production methods.

Unit 4
Various Types of Instruments Used For:
1. (a) Physical Measurements such as-Length, distance, height, Thickness, Gaps, Curvature, Angle, Taper, Area, Undulations, Surface finish, Thread and Gear measurement (b) Liquid Level & Viscosity-Liquid level measuring methods and devices, Viscometer - Plate and cone Viscometer, Two float viscometer, Rheo viscometer
2. Mechanical Quantities: (a) Displacement. velocity, acceleration, space troque-Use of transducers and electronic count stroboscope, vibrating reeds and technometers (b) Pressure and Vacuum - Idea of atmosphere pressure, Gauge pressure and vacuum - Use of instruments such as manometers and those use elastic elements such as diaphragm, capsule Bellows, Bourdon tube and various transducers thermo couple, vacuum gauges (c) Strain - Use of Strain gauge and load cells (d) Mechanical Power - Dynomometers - absorption and transmission type both. (Reference Only)

TEMPERATURE MEASUREMENT: Various types of thermometers, thermocouples, pyrometers (Radiation and optical type both)

Unit 5
**Inspection of Geometrical Errors:**
Construction and working of auto collimeter, checking of straightness, flatness, squareness and parallelism, circularity (By dial gauge and telerod).

Maintenance Of Measuring Instruments: Defects likely to occur in measuring instruments and their remedies. General maintenance of measuring instruments

**Reference Books:**
1. Metrology: RK Jain
2. Mechanical Measurement: RK Jain
Metrology and Measuring Instruments lab.

**Bridge Course to be merge with practical classes:**
Introduction of scale, orthographic projection, simple drawing of mechanical components, and cut sections, significance of various types of lines used in engineering drawing, representation of material, brief idea of isometric projections.

Types of thread, single start, multi start thread and their application
1. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Study and sketch of various types of comparators and use them for comparing length of given piece.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. To test the squareness of a component with auto-collimeter.
7. To measure the pitch, angle and form of thread of a screw.
8. To measure the geometry of a gear having involute profile.
9. To measure the straightness of the edge of a component with the help of auto-collimeter.
10. To measure the length, breadth, thickness, depth, height with micrometer.
11. To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
13. Calibration of height gauge/depth gauge.
15. Checking of accuracy of snap gauge with slop gauge.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of areas by polar planimeter.
18. Use of feeler, wire, radius and fillet gauges measurement of standard parameters.

**Machine Tool Technology Lab.**

(A) MACHINE SHOP
1. (a) Square thread cutting (internal and external) - 2 jobs
   (b) Multi-start thread cutting - 1 job
   (c) Eccentric Turning - 1 job
2. Making utility job - Planner, Shaper, Slotter - 1 job
3. Group work on milling machine involving up & down milling in:
   (a)Gang milling - 1 job
   (b)Spur gear cutting - 1 job
   (c)Helical gear cutting - 1 j

(B) FITTING SHOP
1. To make a cut and cup tool - 1 job
2. To make blank and pierce tool - 1 job
3. To make a male and female fitting jobs - 1 job
4. To grind a lathe/shaper/planer tool - 1 job
5. To make different types of keys - 3 jobs
6. To make complete gauge - 2 jobs
Level 5 (Semester II)
Industrial Management

Unit 1
Introduction

Growth of industry, The management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.

Unit 2
Private sector and public sector:
Public sector enterprise, merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments, viz. stores, purchase and sales departments relationship between individual departments.

Unit 3
Wages & incentives
Definition of wages, real wage and nominal wage, systems of wage payment, incentives, financial and non - financial incentives, Essentials of a good wage plan, essentials of a good incentive scheme. Introduction to elements of cost & indirect expenses, Material cost, labour cost, fixed and variable overheads, components of cost, selling price, Factory expenses, administrative expenses, selling & distribution expenses, depreciation, obsolescence, interest on capital, Idleness, Repair and maintenance.

Unit 4
Labour, industrial & tax laws:
Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee’s state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman.

Unit 5
Material management:
Introduction, Scope of Material Management selective control techniques-ABC analysis, Material handling, inventory control, Essential steps in inventory control, quality standards.

Reference Books:
1. Industrial Engineering and Management, S.C. Sharma, Khanna Publishing House
2. Industrial Safety, S.C. Sharma, Khanna Publishing House
3. Industrial Engineering & Management: Banga, Sharma & Agrawal
4. Industrial Engineering Safety & Pollution (Hindi): HemendraDutt
Manufacturing Technology

Unit 1
(A) General Introduction: (a) Scope of subject "Workshop Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).
GENERAL PROCESS: Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility viz., Rolling, Forging, Drawing, Extruding, Spinning, Pressing, Punching, Blanking, Welding, Soldering, Brazing, Metal cutting processes-turning, Drilling, Boring, Shaping, Grinding, Riveting, Elementary idea of machines used for the above processes.

Unit 2
WELDING:
(a) Welding Arcs: Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes.
(b) Introduction to various welding processes with procedure equipment and applications such as (i) Electric arc welding and Gas welding (ii) Resistance welding. (iii) Thermit welding (iv) Carbon arc gauging. (v) Metal-Inert-Gas welding (MIG) (vi) Tungsten Inert Gas welding (TIG)
WELDING OF SPECIAL MATERIALS: (a) Welding of carbon steel, Low alloy steel and stainless steel, equipment, filler rods, weldability, procedures and precautions. (b) Welding of Grey Cast Iron (c) Welding of Aluminium (d) Welding of Plastics.

Unit 3
Carpentry: (a) Fundamental of wood working operations (b) Common Carpentry Tools-Their classification, size, specification (name of the parts and use only): (i) Marking and measuring tools (ii) Holding and supporting tools: (iii) Cutting and Sawing Tools: (iv) Drilling and Boring Tools (v) Striking Tools-Mallet and Claw hammer (vi) Turning Tools & Equipment (vii) Miscellaneous Tools
PATTERN & MOULDING: The pattern materials used, Types of pattern allowances and pattern layout, Colour scheme patterns defects, Types of cores and their utility.
Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding

Unit 4
Moulding and Pouring: Classification of mould materials according to characteristics, Types of sands and their importance test, parting powders and liquids, Sand mixing preparation, Moulding defects
MELTING AND POURING: Brief idea of refractory material and fluxes, Fuels and metallic materials used in foundry. Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, their construction and operation, metals and alloys. Additions to molten metal, Closing and pouring of the moulds, Coring-up, venting and closing, use of ladles, spur and risers, Defects due to closing and spurring, Basic idea of fettling operations. Surface treatment, Salvaging of castings, Factors determining soundness of casting.
FOUNDRY PRACTICE: Elementary idea of special casting processes-Shell mould casting, die casing, investment mould casting, centrifugal and continuous casting full mould casting. Elementary idea of mechanization of foundries

Unit 5

POWDER METALLURGY: Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing, Self-lubricated bearings. Advantages of the process and its limitations (Elementary concept only)


Reference Books:

Material Science & Materials

Unit 1

General:
Brief introduction to the subject and its scope in engineering field, classification of materials of industrial importance. Their chemical thermal, electrical, magnetic, mechanical and technological properties and their selection criteria for use in industry.

STRUCTURE OF METALS AND THEIR DEFORMATION:
Structure of metals and its relation to their physical, mechanical and technological properties, Elementary idea of arrangement of atoms in metals, molecular structures, crystal structures and crystal imperfections, Deformation of metals, effects of cold and hot working operations over them. Recovery re-crystallization and grain growth, solid solutions, alloys and inter metallic compounds, effect of grain size on properties of metals. PROPERTIES AND USAGE OF: (1) Metals: (a) Ferrous Metals (b) Non Ferrous Metals (2) Non-metallic Materials.

Unit 2:
Metals-Ferrous Metals
1. Classification of iron and steel. (b) Cast iron types as per I.S. - White, malleable, Grey (c) Steels: Classification of steels according to carbon content and according to use as per I.S. Mechanical properties of various steels and their uses. Availability of steel in market, its forms and specifications (d) Alloy Steel: Effect of alloying various elements, viz Cr, Hi, Co, V, W, Mo, Si, and Mn, on mechanical properties of steel, Common alloy steels, viz, Ni-steel, Ni-Cr-steel, Tungsten steel, Cobalt steel, Stainless Steel, Tool steel - High Carbon Steel, High Speed steel, Tungsten Carbide, Silicon manganese steel, Spring Steel, Heat Resisting alloy Steels etc.

Unit 3:
Non-Metallic Materials
Introduction to Plastic and Other Synthetic Materials: Plastics- Important sources-Natural and Synthetic, Classification, thermo-set and thermoplastic, Various trade names, Important Properties and engineering use of plastics. Market forms of Plastics
Heat Insulating Materials: Classification of Heat Insulating material, properties and uses of China clay, Cork, Slag wool, Glass Wool, Thermocole, Puff, Properties and uses of asbestos as filler material.
Hardware: General specification, uses and methods of storage of G.I. and C.I. steel, Copper, A.C. pressure conduits, R.C.C. spun, P.V.C. Pipes and their uses. General sheets specification (I.S.) and uses, Method of storage of G.I. sheets, M.S. sheets, General specification of pipe fitting

Unit 4
IDENTIFICATION AND TESTING OF METAL ALLOYS: Selection, specification forms and availability of materials.

Reference Books:
Material Science: RS Khurmi& RS Shedha
General Mechanical Engineering - II

Unit 1:
Basics of Thermodynamics
Basic definition of heat, work, Thermodynamic process, parameters of working body and their units, Equation of state, Universal gas constant, Relation between heat capacity and temperature. Determination of quantity of heat

Unit 2:
Laws of Thermodynamics
Elementary concept of laws of thermodynamics, first law and second law, Graphical representation of process, The work of expansion and compression of a gas, Change in the state of ideal gas-Isochoric, Isothermal and Adiabatic process, Carnot-cycle

Unit 3:
IC Engines
External & internal combustion engines, working of diesel and petrol engine, horse power of IC engines,

Unit 4:
Steam Generators & Condensers
Construction and working of Babcock & Wilcox boiler, Cochran boiler, Steam condenser & its types

Unit 5: Steam & Gas Turbines
Steam turbine, classification and principle of operation, gas turbine

Reference Books:
3. General Mechanical Engineering: Jk Kapoor
4. Mechanical Engineering: Khurmi& Gupta

Project

On the basis of learning and skill acquired in the academic year, a project to be taken up by the student strengthening his/ her vocational skills
Basic Electricity & Electronics - Lab

Bridge course:
Introduction to current, voltage, resistance, capacitance, impedance, diode, zener diode, transistors, amplifiers, electric cells

1. Study of series resistive circuits.
2. Study of parallel resistive circuits.
4. Preparation of Electrolyte for lead acid battery and its charging and measurement of Specific gravity with the help of hydrometer.
5. Charging and Discharging of a capacitor.
6. Verification of magnetic field of solenoid with Iron core and Air core.
7. Verification of Torque development in a current carrying coil in magnetic field.
8. Study of R.L.C. series circuit and measurement of power and power factor.
9. Study of current and voltage measurement using Ammeter and Voltmeter.
10. Study of current and voltage measurement using Galvanometer.
11. Study of current, voltage and resistance measurement using of Multi-meter
13. Study of working of single layer PCB manufacturing.
15. Study and interpreting circuit diagram and to check the continuity of connections.

Instrument Required:

1. Trainer kit for measuring TCR
2. Lead acid battery
3. Hydrometer
4. Trainer kit for measuring power and power factor in RLC circuits
5. Ammeter
6. Voltmeter
7. Multi-meter
8. Galvanometer
9. Energy Meter
10. PCB Manufacturing Facility
Mechanical Workshop Practice

1. SHEET METAL WORKING AND SOLDERING:
   a. (EX-1) Cutting, shearing and bending of sheet.
   b. (EX-2) To prepare a soap case by the metal sheet
   c. (EX-3) To make a funnel with thin sheet and to solder the seam of the same
   d. (EX-4) To make a cylinder and to solder the same

2. FITTING SHOP WORK:
   a. (EX-1) Hack sawing and chipping of M.S. flat
   b. (EX-2) Filing and squaring of chipped M.S. job
   c. (EX-3) Filing on square of rectangular M.S. Plate
   d. (EX-4) Drill a hole in MS Block & tapping the same
   e. (EX-5) Making a Bolt & Nut by Tap & Die set.

3. SMITHY SHOP WORK:
   a. (EX-1) To prepare square angular piece by M.S. rod
   b. (EX-2) To make square or hexagonal head bolt
   c. (EX-3) To make a screw driver with metallic handle
   d. (EX-4) To make ring with hook

4. Tin Smithy, Soldering, Brazing
   a. (EX-1) To prepare different types of joint such as lap joint single seam, double seam & cap joint-hem & wired edge.
   b. (EX-2) Utility article-waste paper basket or paper tray
   c. (EX-3) Study & sketch stakes / anvils.

5. WELDING SHOP WORK:
   a. (EX-1) Welding practice gas & electric arc welding
   b. (EX-2) Welding for lap joint after preparing the edge
   c. (EX-3) Welding Butt joint after preparing the edge
   d. (EX-4) Gas Cutting
   e. (EX-5) 'T' joint welding after preparation of edge.

Reference Books:

2. Elements of Workshop Technology Vol. I: BS Raghuwanshi
Unit 1

Introduction
Design advantages of casting, Advantages of casting process, Metallurgical advantage. Technology of pattern making requirement, Pattern material, wood & wood product, plaster, Plastics and rubbers, Polyesters resins waxes, Machines and tools for pattern making machine for wood pattern making, Machines for metal pattern making, Allowance and other Technological considerations – contraction allowance, Machining allowance, Draft or taper allowance, Rapping and shake allowance, Distortion allowance, Core Prints, Core boxes, Use of loose pieces

Unit 2

Technology of moulding and core making
Moulding sands, Principal ingredients of moulding sands, Specification and testing of moulding sands, Classification of Moulding sands, Additives to moulding and Core making sands, Mould Dressings. Sand Conditioning, Sand Preparation equipment.

Unit 3

Moulding processes
Types of sand moulding, Tools for hand moulding, Characteristics of cores and core sands, Types of cores, Use of chaplets, Machine moulding, Core making machines, Processes based on organic binders.

Unit 4

Technology of metal casting processes
Permanent mould casting, Types of die casting machines, Centrifugal casting, continues casting, Electro slag casting, Gating system, Riser of casting, Economic considerations, Melting equipments for foundries, Defects in castings.

Unit 5

Modernization & Mechanization of foundries
Need, Area for mechanization, Material handling, Pollution control in foundries, Pollutants in a foundry, Plant layout for foundries, steps in planning a foundry layout.

Reference Books:
1. Evolution of Metal Casting Technologies, Khan, Muhammad Azhar Ali, Sheikh, Anwar Khalil, Al-Shaer, Bilal Suleiman
2. Foundry technology, Peter R. Beeley
Production Automation & Computer Integrating Manufacturing

UNIT 1

UNIT 2
Production Concept:
Such as Manufacturing Lead Time (MLT), Production rate, Components of Operation Time, Production Capacity (PC), Utilisation and availability, Work in Process (WIP), Time in Plant (Tip), WIP Ratio, Tip ratio, their meaning and significance. Simple numerical problems Automation Strategies and Their Effect - Specification of operation, Combined operations, Simultaneous operations, Integration operations, Increase flexibility, Improved material handling and storage, on-line inspection, process control and optimization, Plant operation control, computer integrated manufacturing. PRODUCTION ECONOMICS: Methods evaluation investment alternatives, Constraints in manufacturing, Break Even Analysis, Unit Cost of Production, Cost of manufacturing, lead time and work in process.

UNIT 3
Assembly System and Line Balancing:
The assembly process, Assembly system, Manual assembly lines, Line balancing problems, Computerised line, balancing methods, Other ways to improve the line balancing, flexible manual assembly line AUTOMATED ASSEMBLY SYSTEMS: Design for automated assembly, Types of automated assembly systems, Parts feeding devices, analysis of multi-station Assembly machines, Analysis of single station assembly machines

UNIT 4:
Numerical Control Production System
Numerical controlling, Coordinate system, and Machine motions, Types of N.C. systems, Machine tool applications, Economics of NCS

UNIT 5

Reference Books:
1. Numerical Control Machines: NK Mehta
Fundamentals of Mechatronics

Unit 1.
Introduction: Introduction to Mechatronics, systems, measurement systems, control systems, the Mechatronics approach. Introduction to Transducers: Sensors and transducers, operating characteristics of transducers, measurement of displacement, velocity, pressure, flow, and temperature.

Unit 2.
Signal conditioning: Signal conditioning- their features and various blocks, the operational amplifiers, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing. Data Presentation Systems: Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition system, Telemetry- electrical, optical and pneumatic methods of telemetry.

Unit 3.
Introduction to process control systems: Importance of process control, analog and digital processing, Supervisory digital control, direct digital control. Controller Characteristics: Process characteristics, control system parameters, Discontinuous controller modes (two position, multiple position, floating position), Continuous controller modes i.e. P, I, D, PI, PD, PID.

Unit 4.

Unit 5.

Reference Books:
1. Mechatronic Systems: Fundamentals, R. Isermann
2. Fundamentals Of Mechatronics, M. Jouaneh
Machining and Machine Tools

Unit 1
Classification of Metal Removal Process and Machines Mechanics of Metal Cutting:

Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship, introduction of mechanism of chip formation and types of chips, chip breakers, orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface, temperature, friction in metal cutting.

Unit 2
Machinability:

Concept and evaluation of machinability, tool life, mechanisms of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability, Cutting fluids, types, properties, selection and application methods, General Purpose Machine Tools: tooling, attachments and operations performed, selection of cutting parameters, Simple calculation of time for machining.

Unit 3
Special Purpose Machine Tools:


Unit 4
Thread and Gear Manufacturing:
Casting, thread chasing, thread cutting on lathe, thread rolling, die threading and tapping, thread milling, thread grinding, Gear Manufacturing Processes: Hot rolling, stamping, powder metallurgy, extruding etc. gear generating processes, gear hobbling, gear shaping, gear finishing processes, shaving, grinding, lapping, shot blasting, phosphate coating, gear testing.

Unit 5
High Velocity Forming Methods:
(High-energy rate forming processes) Definition, Hydraulic forming, explosive forming, electro-hydraulic forming, magnetic pulse forming

Reference Books:
Metal Casting Technology Workshop

Minimum work in each section is indicated against that PATTERN MAKING: (a) Making Patterns (At least two) (i) Solid one-piece pattern (ii) Split two piece pattern (iii) Split three-piece pattern (iv) Gated pattern (b) Making Core Boxes (At least one) (i) Straight Core Box (ii) Bent Core Box.


MOULDING: (a) Making at least 3 sands moulds of different forms with different types of pattern using. (i) Floor Moulding. (ii) Two Box Moulding. (iii) Three Box (or more) Moulding. (b) At least one of the following: (i) Making and setting of cores of different types. (ii) Making one shell mould apparatus

(C) MELTING AND POURING: (Each to be demonstrated at least once in the section). (a) Demonstration of Melting of cast iron in (i) Pit Furnace. (ii) Cupola. (b) Demonstration of Melting a non-Ferrous metal in (i) Pit furnace. (ii) Tilting Furnace. (c) Pouring of metals in moulds (Ferrous and Non-Ferrous).

(D) CLEANING AND INSPECTION: (a) Shaking, cleaning and fettling of casting (At least 2 Casting) (b) (i) Inspection of cast component (visual) and preparing inspection report (At least one report). (ii) Establishing cause of Defects seen (At least one cause).

(E) CASE STUDY OF: At least 2 sand castings produced from sand preparation pattern layout to final finished casting.

Mechatronics Lab

2. Study of Speed Measurement System: (a) Magnetic Pick-up (b) Stroboscope
3. Study of Load Measurement System Load Cell
4. Measurement of temperature using thermocouple, thermistor and RTD
5. Measurement of displacement using POT, LVDT & Capacitive transducer
6. Torque measurement using torque measuring devices
7. Strain Measurement using strain gauge
8. Frequency to Voltage Converter and vice versa
9. Position and velocity measurement using encoders
10. Study on the application of data acquisition system for industrial purposes
Level 6 (Semester IV)
Mass Production Devices

Unit 1
Tool holders: Tool holders for turning and milling carbide inserts-types, ISO-designation and applications, Tool holding and tool mounting systems for conventional milling and drilling machine tools.

Unit 2
Locating and clamping devices: Concept, meaning and definitions of location and clamping, Use of locating and clamping principles in day-to-day supervision on shop floor, Degree of freedom-concept and importance, 3-2-1 principle of location, Locators-Types, Sketches with nomenclature, Working, Applications, Fool proofing and ejecting

Unit 3
Clamping devices: Types, Sketches with nomenclature, Working, Applications

Unit 4
Jigs and fixtures: Concept, meaning, differences and benefits of jigs and fixtures, Types, sketches with nomenclature, working and applications of jigs, Types, sketches with nomenclature, working and applications of fixtures

Unit 5
Design of Jigs and Fixtures: Steps in designing jigs and fixture for given simple component

Reference Books:
1. Mass Production, Phaidon
Lean and Agile Manufacturing

Unit 1
Introduction-
Introduction to Just in time production, Toyota production system, Introduction to lean manufacturing (LM), history of LM, advantages of LM over mass production

Unit 2
Waste Identification-
Types of wastes, lean manufacturing principles; Value, value stream, flow, pull and perfection

Unit 3
Value stream mapping-
Introduction to value stream mapping, types of value stream mapping, value added activities, necessary non value added activities, non-value added activities

Unit 4
Lean manufacturing tools-
Introduction to 5S, Kanban, kaizen, work standardization, Statistical process control, automation and other lean tools

Unit 5
Agile manufacturing-
Introduction to agile manufacturing, advantages of agile manufacturing, differences with lean manufacturing.

Reference Books:
1. Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities, Devadasan S.R
2. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, Andrew Stellman, Jennifer Greene
Metal Forming Processes

Unit 1
Rolling
Introduction, Types of rolling, Hot rolling, Two high reversing mill, Three high mill, Continuous mill, Roll bending

Unit 2
Forging
Introduction, Advantages of Forging, Application of Forging, Limitations of Forging, Upsetting, Hollow Forging, Impression die or closed, Methods of Forging, Drop Forging, Press Forging, Hammer and press Forging, Hot bar Forging, Upset Forging

Unit 3
Extrusion
Direct and forward, Sleeve method of direct, Indirect or backward, Impact Extrusion, Tube Extrusion, Stepped Extrusion, Combined forging and Extrusion

Unit 4
Drawing
Wire Drawing, Cupping and Bending, Tube Drawing, Spinning, Hot and cold Spinning Advantages of Metal Spinning

Unit 5
Pipe and Tube Production-
Manufacturing of seamless pipe- Butt welded pipe- Lap welded pipe

Reference Books:
2. Metal Forming Processes, G. R. Nagpal
Non-conventional Machining

Unit-I
Introduction:
Limitations of conventional manufacturing processes need of unconventional manufacturing processes and its classification.

Unit-II
Un-Conventional Machining Processes:
Principle and working and applications of unconventional machining processes such as Electric Discharge machining (EDM), Electro- Chemical machining (ECM), Ultrasonic Machining (USM), and Abrasive Jet machining (AJM)

Unit-III
Un-Conventional Welding Processes:
Principle and working and applications of unconventional welding processes such as Laser Beam Welding, Electron Beam Welding, Ultrasonic Welding, Plasma Arc Welding processes.

Unit-IV
Explosive Welding:
Cladding etc. Under water welding, Metalizing Theory, Process and applications

Unit-V
Un-conventional forming processes:
Principle and working and applications of high energy forming processes such as Explosive forming, Electromagnetic forming. Electro discharge forming Water hammer forming, Explosive Compaction

Reference Books:
1. Modern Machining Process, P.C. Pandey
2. Un-conventional machining, V.K. Jain

Tool & Die Making Lab

- Manufacture of Box Jig and Angle plate jig
- Manufacture of DzVdz Block angle grinding Fixtures and profile milling fixture
- Manufacture of simple Blanking & piercing Tool
- Manufacture of Progressive tool for producing a Cycle chain link
- Manufacture of Press tools like Combination tool & Compound tool
- Manufacture of Draw tool
- Trial out On Fly press and power press the Produced components such as V, U, Cycle link, Cup Washer and Cycle bell cup
- Manufacture of simple V and U bending tool
- Maintenance of Jig & fixture and press tool
IT Tools Lab.

1. Spreadsheets, Word, Presentation
2. Multimedia Design
3. Troubleshooting
4. Project / Practical File
5. Viva Voce

Level 7 (Semester V)
Reliability, Maintenance and Safety Engineering

Unit 1
Reliability
Definition, reliability function, Mean failure rate, mean time to failure (MTTF), mean time between failures (MTBF), hazard rate curve. Bathtub curve, Conditional Reliability

Unit 2
Constant Failure rate model
Exponential Reliability function, Failure Modes, CFR model, memory lessness, System reliability: Series, parallel, mixed & complex configuration; Reliability improvement.

Unit 3
Design for reliability
Reliability specifications and system measurements, System Effectiveness, redundancy, Classification of Redundancy, Introduction of failure mode and effect analysis (FMEA)

Unit 4
Maintainability
Analysis of Downtime, repair time distribution, stochastic point processes.

Unit 5
Safety engineering
Fundamentals of industrial safety, Safety policy and safety terminology, Different types of safety systems and equipments, Safety targets, standards, objectives

Reference Books:
2. Reliability, Maintenance and Safety Engineering, A.K. Gupta
Plant Layout & Product Handling

Objective of Facility Design: Types of layout problems, the layout function, organization of layout. Analysis and Design of Material Flow: Systems approach to flow cycle, process charts, flow process charts, Quantitative analysis of material flow; optimal material flow configuration. Space and Area Allocation for Production and Physical Plant Services; Computerized handling of layout algorithms; Algorithms for computerized Layout Planning, Construction and Development type of computerized Layout Planning Techniques i.e. CRAFT, ALDEP, CORELAP etc.;

Product handling; Design of system configurations conforming to various kinds of product features and layout characteristics; Design concepts of common handling and transfer equipment; Different types of conveyors, elevators, fork lifters;

Design concept of warehouse facilities commensurate with adopted kind of handling and transfer devices; Automated Handling of materials, Automated Transfer lines, AGVS, Use of Robots in Product handling, automated packaging devices.

Application of pneumatic and hydraulic system in transportation and handling of products, Design of integrated plant layout for product handling systems

Reference Books:
1. Plant Layout and Materials Handling, S. C. Sharma
2. Plant Layout and Materials Handling, R. B. Choudhary and G. R. N. Tagore
Product Design for Manufacturing

Unit 1
Importance of New Product
Importance of new product for growth of enterprise, Definition of product and new product, Classification of products from new product development point of view- Need based/Market pull products, Tech. push, Platform based, Process based and customized products

Unit 2
New product development process and organization
Generic product development process for Market Pull and Market Push Products, Need Identification and Analysis, Problem Formulation, establishing economic existence of need, Engineering Statement of Problem, Establishing Target Specification

Unit 3
Generation of Alternatives and Concept Selection
Introduction to Concept generation, Tools of creativity like brainstorming, Analogy, Inversion, introduction to Concept feasibility and Concept Selection, Establishing Engineering Specification of Products

Unit 4
Preliminary and Detailed Design
Preliminary design, Identification of subsystems, Subsystem specifications, detailed design of subsystems, component design

Unit 5
Assembly drawing and review
Preparation of assembly drawings, Review of product design from point of view of Manufacturing, Ergonomics and aesthetics

Reference Books:
1. Manufacturing Processes for Design Professionals, Rob Thompson
2. Product design for manufacture and assembly, Geoffrey Boothroyd
Unit 1
Introduction CIM and CAD & Analysis:

Unit 2
Computer aided Manufacturing CAM:

Unit 3
CNC Machine and Components:

Unit 4
Part Programming

Unit 5
FMS, Integrated Material Handling and Robot:

Reference Books:
1. Engineering AutoCAD, Pradeep Jain & A.P. Gautam, Khanna Publishing House
CAD Lab

1. Introduction and different features of the CAD Software.
2. 2-D Drafting.
3. 3-D Modeling.
4. 3-D Advanced Modeling.
5. Assembly modeling.
6. Feature Modification and Manipulation
7. Detailing.

CAM Lab

1. To prepare part programming for plain turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program in inch mode for plain turning operation.
4. To prepare part program for taper turning operation.
5. To prepare part program for turning operations using turning cycle.
6. To prepare part program for threading operation.
7. To prepare part program for slot milling operation.
8. To prepare part program for gear cutting operation.
9. To prepare part program for gear cutting using mill cycle.
10. To prepare part program for drilling operation
Level 7 (Semester VI)
Rapid Prototyping and Reverse Engineering

Unit 1
Introduction
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Unit 2
CAD Modelling and Data Processing for RP
CAD model preparation, Data Requirements, different types of Data formats, Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

Unit 3
RP Systems

Unit 4
Rapid Tooling:
Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Unit 5
RP Applications:
Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP

Reference Books:
1. Rapid Product Development (English, Paperback, Kimura Fumihiko
Production Planning and Control

Unit 1
Demand Forecasting
Introduction, components of forecasting demand, Approaches to forecasting: forecasts based on judgment and opinion, Selection of forecasting technique.

Unit 2
Capacity Planning
Defining and measuring capacity, determinants of effective capacity, capacity strategy, steps in capacity planning process, determining capacity requirements, Capacity alternatives, Evaluation of alternatives; Cost-Volume analysis.

Unit 3
Facility Location
Need for location decisions, factors affecting location, qualitative and quantitative techniques of location. Facilities layout: Product, Process, fixed position, combination and cellular layouts; Designing product and process layout, line balancing.

Unit 4
Production Control
Capacity control and priority control, production control functions; Routing, scheduling, Dispatching, expediting and follow up, Techniques of production control in job shop production, batch production and mass production systems

Unit 5
Sequencing
Priority rules, sequencing methods, sequencing jobs through two work centers, scheduling services, application of CPM and PERT techniques.

Reference Books:

1. Production Planning and Control, W. Bolton
2. Production Planning and Control with SAP, Jörg Thomas Dickersbach and K. Weihrauch

Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills.
DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc
Industrial Tool Manufacturing (IM)
Branch Code:104
Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
# Evaluation Scheme

## B. Voc Industrial Tool Manufacturing

### NSFQ Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BIMV511</td>
<td>Machine Tool Technology</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BIMV512</td>
<td>General Mechanical Engineering – I</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BIMV513</td>
<td>Manufacturing Technology -I</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BIMV514</td>
<td>Metrology and Measuring Instruments</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BIMP511</td>
<td>Metrology and Measuring Instruments Lab</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BIMP512</td>
<td>Machine Tool Technology Lab</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BIMP513</td>
<td>Language Lab</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BIMT511</td>
<td>Metal Arc Welding (CSC/Q0204)</td>
<td></td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT512</td>
<td>MIG MAG or GMAW Welder (CSC/Q0209)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT513</td>
<td>Assistant TIG Welder (CSC/Q0212)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT514</td>
<td>CNC Setter Cum Operator (CSC/Q0120)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT515</td>
<td>CNC Operator – VMC (CSC/Q0116)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BIMV521</td>
<td>Total Quality Management</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BIMV522</td>
<td>General Mechanical Engineering – II</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BIMV523</td>
<td>Manufacturing Technology -II</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BIMV524</td>
<td>Industrial Engineering</td>
<td>30 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BIMP521</td>
<td>Project</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BIMP522</td>
<td>Engineering Graphics</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BIMP523</td>
<td>Mechanical Workshop Practice</td>
<td>30 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BIMT521</td>
<td>Metal Arc Welding (CSC/Q0204)</td>
<td></td>
<td>Any one Training (other than 1stsem) 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT522</td>
<td>MIG MAG or GMAW Welder (CSC/Q0209)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT523</td>
<td>Assistant TIG Welder (CSC/Q0212)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT524</td>
<td>CNC Setter Cum Operator (CSC/Q0120)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT525</td>
<td>CNC Operator – VMC (CSC/Q0116)</td>
<td></td>
<td>*</td>
<td>*</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
</tr>
<tr>
<td>1</td>
<td>BIMV631</td>
<td>Tool Engineering – I</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BIMV632</td>
<td>Production Automation &amp; Computer Integrated Mfg</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BIMV633</td>
<td>Fundamentals of Mechatronics</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BIMV634</td>
<td>Machining and Machine Tools</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BIMP631</td>
<td>Tool Engineering Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BIMP632</td>
<td>Mechatronics lab – Practical</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BIMT631</td>
<td>Service Engineer – Installation (CSC/Q0501)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT632</td>
<td>Quality Inspector-Forged, Casted or Machined Component (CSC/Q0601)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT633</td>
<td>CNC Programmer (CSC/Q0401)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT634</td>
<td>Maintenance Fitter – Mechanical (CSC/Q0901)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT635</td>
<td>CNC Setter Cum Operator – VMC (CSC/Q0123)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S. No.</td>
<td>Subject Code</td>
<td>Subject</td>
<td>Total Teaching/Training Hours</td>
<td>Evaluation Scheme</td>
<td>End Semester Total</td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>---------------------------------------------</td>
<td>------------------------------</td>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
</tr>
<tr>
<td>1</td>
<td>BIMV641</td>
<td>Tool Engineering – II</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BIMV642</td>
<td>Agile and Lean Manufacturing Systems</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BIMV643</td>
<td>Metal Forming Processes</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BIMV644</td>
<td>Mass Production Devices</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BIMP641</td>
<td>Tool and Die Making Lab - Practical</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BIMP642</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BIMT641</td>
<td>Service Engineer – Installation (CSC/Q0501)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT642</td>
<td>Quality Inspector-Forged, Casted or Machined Component (CSC/Q0601)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT643</td>
<td>CNC Programmer (CSC/Q0401)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT644</td>
<td>Maintenance Fitter – Mechanical (CSC/Q0901)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>BIMT645</td>
<td>CNC Setter Cum Operator – VMC (CSC/Q0123)</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

GV: General Vocational; VP: Vocational Practical; OJT: On Job Training; SSC: Sector Skill Council
### NSFQ Level 7 SEMESTER- V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BIMV751</td>
<td>Reliability, Maintenance &amp; Safety Engineering</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BIMV752</td>
<td>Design Concepts in Engineering</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BIMV753</td>
<td>Product Design and Development</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BIMV754</td>
<td>CAD &amp; CAM</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BIMP751</td>
<td>CAD Lab</td>
<td>30 20 30</td>
<td>50 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BIMP752</td>
<td>CAM Lab</td>
<td>30 20 30</td>
<td>50 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BIMT751</td>
<td>Tool &amp; Die Maker (CSC/Q0306)</td>
<td></td>
<td>Any one Training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT752</td>
<td>Designer – Mechanical (CSC/Q0405)</td>
<td></td>
<td>400 hrs/ 8 weeks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT753</td>
<td>Service Engineer – Breakdown Service (CSC/Q0503)</td>
<td></td>
<td>150 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td>500 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BIMV761</td>
<td>Rapid Prototyping and Reverse Engineering</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BIMV762</td>
<td>Process Planning and Cost Estimation</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30 10 5 5 20 30</td>
<td>50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BIMP761</td>
<td>Major Project</td>
<td>180</td>
<td>150 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BIMT761</td>
<td>Tool &amp; Die Maker (CSC/Q0306)</td>
<td></td>
<td>Any one Training</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT762</td>
<td>Designer – Mechanical (CSC/Q0405)</td>
<td></td>
<td>(other than 5th sem)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BIMT763</td>
<td>Service Engineer – Breakdown Service (CSC/Q0503)</td>
<td></td>
<td>200 12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>670</td>
<td>500 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
Level 5 (Semester I)
Machine Tool Technology

Unit 1: Centre Lathe
The centre lathe and its principle of working, Types of lathes, Lathe specification and size, Features of lathe bed, Head stock and tail stock, Feed mechanism and change-gears. carriage saddle, Cross slide, Compound rest, Tool post, Apron mechanism, lathe accessories, Chucks, Face plate, Angle plate, Driving plate, Lathe doges, mandrils, Steady rest, Lathe attachments, Lathe operations-plane and step turning, Taper turning, Screw cutting, Drilling, Boring, reaming, Knurling, Parting off, Under cutting, Relieving, Types of lathe tools and their uses, Brief description of semi-automatic lathes such as capstan and turret lathes, their advantages and disadvantages over centre lathe, types of job done on them. General and periodic maintenance of a centre lathe.

Unit 2: Shaping, Planing & Slotting Machines
Working principles of planer, shaper and Slotter, Differences and similarities among them, quick return mechanism applied to the machines. Types of work done on them, types of tools used, their geometry, General and periodic maintenance of a shaper.
DRILLING & BORING MACHINES: Types of tools used in drilling and boring. Classification of drilling and boring machines, principle of working and constructional details of simple and radial drilling M/C and general and periodic maintenance. Operations like facing, counter boring, tapering.

Unit 3: Milling Machines
Types of milling machines, constructional features of horizontal milling M/C. general maintenance of the machine, types of milling cutters, milling operations like plane milling, space milling, angular milling form milling, straddle milling, gang milling, Negative rake milling, cutting speed and speed for different tools in up and down milling. Simple, compound and differential indexing, milling of spur gears and racks.

Unit 4: Grinding Machines
Common abrasives, grinding wheel materials, Bonds, Grain and grit of abrasive, Grain structure and shapes of common wheels, various speeds and feeds, Use of coolants, Methods of grinding, Types of grinding machines, precision finishing operations like honing.
BORACHING MACHINES: Types of work done on broaching machine. Simple types of broaches and their uses, Types of broaching machines

Unit 5: Jigs and Fixtures
Object of Jigs and Fixture, Difference between jigs and fixtures, Principle of location, Principle of clamping, Locating and clamping devices. Types of jigs -Simple open and closed (or box) jigs. Drill jigs-bushes (Fixed, Liner, Renewal, and Slip). Template, Plate jigs. Channel jigs, Leaf jigs, Simple example of milling, turning, grinding, horizontal boring fixtures and broaching fixtures, Welding fixtures
COOLING PROCESS: Cooling and cutting fluids, difference between coolant and cutting fluid, function and action of cutting fluids, Requirement of good cutting fluids, their selection for different materials and operations AUTOMATION OF MACHINE TOOLS: Introduction to CNC lathe (Computer Numerical Control Lathe) and FMS (Flexible Manufacturing System) Introduction only.

Reference Books:
1. Production Technology: Jain & Gupta
2. Workshop Technology Vol. II: Hazra & Choudhary
General Mechanical Engineering - I Unit 1:

Strength of Materials & Power Transmission

Strength, strain, elastic constraints, stress in circular shaft subjected to pure torsion only, Riveted and bolted joints.

Unit 2: Shear Force & Bending Moment

Elementary idea of Shear force and bending moment for concentrated, uniformly distributed loads on simply supported beam cantilever and overhanging beam, Simple Shear force and bending moment diagrams, Relationship between shear force and bending moment

Unit 3: Power Transmission: Pulleys, Gears & Shaft

Classification of Pulleys, Types of Belts, Simple calculation of pulley diameter, Classification of Gears, Simple calculation of number of teeth and speed, Power transmission by solid and hollow shaft

Unit 4: Hydraulics & Hydraulic Machines

Properties of fluids, pressure of fluid and its measurement. Flow of fluids, velocity and discharge, Bernoulli’s theorem and its application in venturimeter, flow through pipe, head loss due to friction

Unit 5: Water Turbines & Pumps

Capacity & Working of Turbines- Pelton and Reaction, reciprocating and centrifugal pump

Reference Books:

Manufacturing Technology –I

Unit 1

(A) General Introduction: (a) Scope of subject "Workshop Technology" in engineering (b) different shop activities and broad division of the shops on the basis of nature of work done such as (i) Wooden Fabrication-carpentry (ii) Metal Fabrication (shaping and Forming, Smithy, sheet metal and Joining-welding, Riveting, Fitting and Plumbing).
(B) Carpentry: (a) Fundamental of wood working operations (b) Common Carpentry Tools- Their classification, size, specification (name of the parts and use only): (i) Marking and measuring tools (ii) Holding and supporting tools: (iii) Cutting and Sawing Tools: (iv) Drilling and Boring Tools (v) Striking Tools-Mallet and Claw hammer (vi) Turning Tools & Equipment (vii) Miscellaneous Tools

Unit 2

(A) Joining of Timber Components for Fabrications Works: Assembly of joints (Preparation steps and tools used only) Mortise, Tenon, Rivet, Groove, Tongue, Dowel, operations in assembly-simple lap and butt, Mortise, Tenon, Dovetail, Miter &briddle joints.
(B) Metal Fabrication
(B) Metal Shaping-Smithy: (i) Operations involved (concept only) (ii) Tool and equipment used (Names, size, specification for identification only) (iii) Heating and fuel handling equipment (iv) Holding and supporting tools (v) Striking Tools (vi) Cutting tools (vii) Punching & Drifting Tools (viii) Bending Tools and figures (ix) Forming & Finishing Tools (x) Defects Occurring & its remedy

Unit 3

Sheet metal Working-Tools and operation: (1) Operations involved (Names and concept only) (2) Sheet metal joints (3) Tools and equipment used (Name, size, specifications for identification only) (4) Marking tools (5) Cutting and shearing Tools (6) Straightening tool (7) Striking Tools (8) Holding Tools (9) Supporting Tools (10) Bending tools (11) Punching-Piercing and Drafting tools (12) Burring Tools-Files (13) Defects Occurring & its remedy

Unit 4

(A) Metal Joining During Fabrication-
(a) Permanent Joining: (i) Welding methods (ii) Electric welding
(b) Soldering & Brazing: (i) Its concept, comparison with welding as joining method and classification (ii) Soldering operation (iii) Materials Used (iv) Defects Occurring & its remedy
(B) Riveting: (i) Its comparison with welding as joining method. (ii) Rivets and Materials. (iii) Operation involved (iv) Tools and equipment used (Names, Size, specification and uses)), Elementary knowledge about working of pneumatic, hydraulic and electric riveter. Temporary Joining (Fasteners & their uses), General Idea about temporary fasteners & their uses
(C) Familiarity with the Use of Various Tools Used in Mechanical Engineering Workshop (a)Marking & Measuring Tools (b) Holding Tools (c) Cutting Tools (d) Files (e) Thread Cutting Tools (h) Miscellaneous Tools
They should be shown physically to each student for familiarity.
Unit 5
(A) Protection of Fabricated Structures from Weather:
(a) Painting: Its need, Introduction to methods of painting (classification only) operations involved description steps only, surface preparation materials, tools and equipment used (name, size specification for identification), Brushes-round and flat wire brush, scraper, trowel, spray gun, compressor, defects likely to occur in painting and their remedies

(b) Varnishing & Polishing: Its need, operation involved (description of steps only), surface preparation method of old and new articles, application of polishing materials, materials used for preparation of french and sprit polish, copal varnish, defects likely to occur.

Safety of Personnel, Equipment & Tools to be observed
(B) Foundry Work:
Elementary idea of patterns, green sand moulds and moulding, tools and equipment used in green sand moulding

Reference Books:
Metrology and Measuring Instruments

Unit 1
Introduction: Meaning and scope of metrology in field of engineering, Standards and types of measurements (Line and Wave, length, Primary, Secondary and Tertiary measurement concept only). Limits, Fits and Tolerances, Interchangeability, precision and accuracy, Sources of error

PRINCIPLES AND CLASSIFICATIONS OF MEASURING INSTRUMENTS:

(i) Principles of Electrical measuring Instruments.

Unit 2:
Comparators
General principles of constructions, balancing and graduation of measuring instruments, characteristics comparators, use of comparators, difference between comparators, limit gauges and measuring instruments. Classification of comparators, construction and working of dial indicator, mechanical comparator, mechanical-optical, zeissoptotest, electro limit, electromechanical electronics, pneumatic comparators, gauges, tool makers microscope.

Unit 3:
Surface Finish
Geometrical characteristics of surface roughness- Wavyness, layflaws, Effect of surface quality on its functional properties. Factor affecting the surface finish, Drafting symbols for surface roughness, Evaluation of surface finish RMS and CLS values, Methods of measuring surface roughness qualitative and quantitative methods, Comparison of surface produce by common production methods.

Unit 4
Various Types Of Instruments Used For:
1. (a) Physical Measurements such as-Length, distance, height, Thickness, Gaps, Curvature, Angle, Taper, Area, Undulations, Surface finish, Thread and Gear measurement (b) Liquid Level & Viscosity-Liquid level measuring methods and devices, Viscometer - Plate and cone Viscometer, Two float viscometer, Rheo viscometer

2. Mechanical Quantities: (a) Displacement, velocity, acceleration, space troque-Use of transducers and electronic count stroboscope, vibrating reeds and technometers (b) Pressure and Vacuum - Idea of atmosphere pressure, Gauge pressure and vacuum - Use of instruments such as manometers and those use elastic elements such as diaphragm, capsule Bellows, Bourdon tube and various transducers thermo couple, vacuum gauges (c) Strain - Use of Strain gauge and load cells (d) Mechanical Power - Dynomometers - absorption and transmission type both. (Reference Only)
TEMPERATURE MEASUREMENT: Various types of thermometers, thermocouples, pyrometers (Radiation and optical type both)

Unit 5
Inspection of Geometrical Errors:
Construction and working of auto collimeter, checking of straightness, flatness, squareness and parallelism, circularity (By dial gauge and telerod).

MAINTENANCE OF MEASURING INSTRUMENTS: Defects likely to occur in measuring instruments and their remedies. General maintenance of measuring instruments

Reference Books:
1. Metrology: RK Jain
2. Mechanical Measurement: RK Jain
UNIT 1

UNIT 2:
COMPARATORS General principles of constructions, balancing and graduation of measuring instruments, characteristics comparators, use of comparators, difference between comparators, limit gauges and measuring instruments. Classification of comparators, construction and working of dial indicator, mechanical comparator, mechanical-optical, zeissoptotest, electro limit, electromechanical electronics, pneumatic comparators, gauges, tool makers microscope.

UNIT 3:
SURFACE FINISH Geometrical characteristics of surface roughness- Wavyness, layflaws, Effect of surface quality on its functional properties. Factor affecting the surface finish, Drafting symbols for surface roughness, Evaluation of surface finish RMS and CLS values, Methods of measuring surface roughness qualitative and quantitative methods, Comparison of surface produce by common production methods.

UNIT 4:
VARIOUS TYPES OF INSTRUMENTS USED FOR: (i) (a) Physical Measurements such as-Length, distance, height, Thickness, Gaps, Curvature, Angle, Taper, Area, Undulations, Surface finish, Thread and Gear measurement (b) Liquid Level & Viscosity-Liquid level measuring methods and devices, Viscometer - Plate and cone Viscometer, Two float viscometer, Rheo viscometer (ii) Mechanical Quantities: (a) Displacement. velocity, acceleration, space troque-Use of transducers and electronic count stroboscope, vibrating reeds and technometers (b) Pressure and Vacuum - Idea of atmosphere pressure, Gauge pressure and vacuum - Use of instruments such as manometers and those use elastic elements such as diaphragm, capsule Bellows, Bourdon tube and various transducers thermo couple, vacuum gauges (c) Strain - Use of Strain gauge and load cells (d) Mechanical Power - Dynomometers - absorption and transmission type both. (Reference Only) TEMPERATURE MEASUREMENT: Various types of thermometers, thermocouples, pyrometers (Radiation and optical type both)
UNIT 5

INSPECTION OF GEOMETRICAL ERRORS: Construction and working of autocollimator, checking of straightness, flatness, squareness and parallelism, circularity (By dial gauge and telerod).

MAINTENANCE OF MEASURING INSTRUMENTS: Defects likely to occur in measuring instruments and their remedies. General maintenance of measuring instruments

Reference Books:

1. Metrology: RK Jain
2. Mechanical Measurement: RK Jain
Metrology and Measuring Instruments lab.

1. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Study and sketch of various types of comparators and use them for comparing length of given piece.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. To test the squareness of a component with auto-collimeter.
7. To measure the pitch, angle and form of thread of a screw.
8. To measure the geometry of a gear having involute profile.
9. To measure the straightness of the edge of a component with the help of auto-collimeter.
10. To measure the length, breadth, thickness, depth, height with micrometer.
11. To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
13. Calibration of height gauge/depth gauge.
15. Checking of accuracy of snap gauge with slop gauge.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of areas by polar planimeter.
18. Use of feeler, wire, radius and fillet gauges measurement of standard parameters.

Machine Tool Technology Lab.

(A) MACHINE SHOP
1. (a) Square thread cutting (internal and external) - 2 jobs
   (b) Multi-start thread cutting - 1 job
   (c) Eccentric Turning - 1 job
2. Making utility job - Planner, Shaper, Slotter - 1 job
3. Group work on milling machine involving up & down milling in:
   (a) Gang milling - 1 job
   (b) Spur gear cutting - 1 job
   (c) Helical gear cutting - 1 job

(B) FITTING SHOP
1. To make a cut and cup tool - 1 job
2. To make blank and pierce tool - 1 job
3. To make a male and female fitting jobs - 1 job
4. To grind a lathe/shaper/planer tool - 1 job
5. To make different types of keys - 3 jobs
6. To make complete gauge - 2 jobs
Level 5 (Semester II)

Total Quality Management

1. Introduction, Basic concepts of total quality management

Introduction to Quality, Dimensions of Quality, Quality Planning, Concept and definition of quality cost, Determinants of Quality, Optimum cost of performance, Principles of TQM, Pillars of TQM, Introduction to leadership and Leadership roles, Quality council and Quality statement, Strategic Planning Process, Deming philosophy

2. Continuous process improvement

Input/output process Model, Juran trilogy, PDCA Cycle, 5–‘S’ Housekeeping principle, Kaizen Seven tools of Quality (Q-7 tools), Check Sheet, Histogram, Cause and effect diagram, Pereto diagram, Stratification analysis, Scatter diagram, Control charts, Control chart for variables & process capability, Control chart for attributes

3. Management planning tools & Bench marking

Affinity diagram, Relationship diagram, Tree diagram, Matrix diagram, Matrix data analysis, Arrow Diagram, Process decision programme chart (PDPC), Concept of bench marking, Reason to bench marking, Bench marking process, Types of bench marking, Benefits of bench marking

4. Just in time (JIT)

JIT philosophy, Three elements of JIT, Principles of JIT Manufacturing, JIT Manufacturing building blocks, JIT benefits, Kanban & 2 Bin Systems

5. Total productive maintenance (TPM)

Concept of Total Productive Maintenance, Types of maintenance, OEE (Overall Equipment Efficiency), Stages in TPM implementation, Pillars of TPM, Difficulties faced in TPM implementation.

Reference Books:

General Mechanical Engineering - II

Unit 1:
Basics of Thermodynamics
Basic definition of heat, work, Thermodynamic process, parameters of working body and their units, Equation of state, Universal gas constant, Relation between heat capacity and temperature. Determination of quantity of heat

Unit 2:
Laws of Thermodynamics
Elementary concept of laws of thermodynamics, first law and second law, Graphical representation of process, The work of expansion and compression of a gas, Change in the state of ideal gas-Isochoric, Isothermal and Adiabatic process, Carnot-cycle

Unit 3:
IC Engines
External & internal combustion engines, working of diesel and petrol engine, horse power of IC engines

Unit 4:
Steam Generators & Condensers
Construction and working of Babcock & Wilcox boiler, Cochran boiler, Steam condenser & its types

Unit 5: Steam & Gas Turbines
Steam turbine, classification and principle of operation, gas turbine

Reference Books:
3. General Mechanical Engineering: Jk Kapoor
4. Mechanical Engineering: Khurmi& Gupta
UNIT I
GENERAL PROCESS: Classification and elementary idea of metal forming processes on the basis of the properties of deformability (Plasticity), fusibility and divisibility viz., Rolling, Forging, Drawing, Extruding, Spinning, Pressing, Punching, Blanking, Welding, Soldering, Brazing, Metal cutting processes-turning, Drilling, Boring, Shaping, Grinding, Elementary idea of machines used for the above processes.
WELDING: (a) Weld edge preparation, Introduction to various welding processes with procedure equipment and applications such as (i) Electric arc welding. (ii) Resistance welding. (iii) Thermit welding (iv) Carbon arc gauging. (v) Metal-Inert-Gas welding (MIG) (vi) Tungsten Inert Gas welding (TIG) (vii) Atomic Hydrogen arc welding, (viii) Stud welding, (ix) Laser Beam, Electron Beam welding, Explosion welding (b) Welding Arcs: Definition, arc initiation, arc structures, types of arc, metal transfer characteristics and influencing parameters, weld bead geometry, various types of electrodes used in various processes.

UNIT 2
WELDING OF SPECIAL MATERIALS: (a) Welding of plastics, equipment, filler rods, weldability, procedures and precautions. (b) Welding of Grey Cast Iron, shielded metal arc gas welding procedures. (c) Welding of Aluminium, Argon arc and gas welding procedures. (d) Welding of copper, Brass and Bronze, Gas shielded metallic arc welding, TIG, Oxy-acetylene method.
TESTING OF WELDS & RELEVANT WELDING CODES: (a) Destructive methods (b) Non-destructive methods-visual, X-ray, Y-ray, Magnetic particles, fluorescent, penetrant and ultrasonic testing.

UNIT 3 & UNIT 4:
FOUNDRY PRACTICE PATTERN & MOULDING: The pattern materials used, Types of pattern allowances and pattern layout, Colour scheme patterns defects, Types of cores and their utility. Moulding and Pouring: Classification of mould materials according to characteristics, Types of sands and their importance test, parting powders and liquids, Sand mixing preparation, Moulding defects MELTING AND POURING: Brief idea of refractory material and fluxes, Fuels and metallic materials used in foundry. Melting furnaces used in foundry such as pit furnace, Tilting and cupola furnaces, their construction and operation, metals and alloys. Additions to molten metal, Closing and pouring of the moulds, Coring-up, venting and closing, use of ladles, spur and risers, Defects due to closing and spurring, Basic idea of festling operations. Surface treatment, salvaging of castings, Factors determining soundness of casting.

UNIT 5
FOUNDRY PRACTICE: Elementary idea of special casting Processes-Shell mould casting, die casing, investment mould casting, centrifugal and continuous casting full mould casting. Elementary idea of mechanisation of foundries
POWDER METALLURGY: Introduction, principle, scope and names of processes. Production of metal powders, compaction, sintering and sizing, Self-lubricated bearings. Advantages of the process and its limitations (Elementary concept only)

Reference Books:
UNIT 1
INSPECTION: Inspection and its objective, Types of inspection, Inspection standards, Duties of inspection foreman QUALITY CONTROL: Concept of quality control, Elements of quality control, quality control groups, objectives of quality control. Statistical quality control, objectives of S.Q.C. Inspection by variables & attributes, Frequency distribution, mean, median & mode, standard deviation, X-R charts, P-Charts, C-Charts and acceptance sampling (i) I.S.O. 9000 (ii) KAIZEN (iii) Six Sigma (iv) 5S (v) TQM system, concept & brief idea only.

UNIT 2:
WORK STUDY Method study-Process chart, Flow process chart, Flow diagram, Man and Machine chart, gang process chart, Work Measurement-Time study, Tools used in time study, Performance rating, Allowance and use of time standard, Time and Motion Study. Principles of human motion economy, Micro-motion study, Memo motion study, Therbligs, left hand and right hand chart.

UNIT 3:
CPM & PERT Introduction to CPM, language of CPM network, Diagram map for CPM chart, arrow diagram method of CPM, Programme Evaluation & Review Technique (PERT) Activity event network (simple manual cases only). Project scheduling with CPM & PERT

UNIT 4:

UNIT 5:
MATERIAL HANDLING Material Handling & material handling equipment, factors in material handling problems, cost reduction through improved material handling, Reduction in time of material handling, Material handling equipment-Idea about lifting lowering devices, Transportation devices, combination devices, Maintenance of material handling equipment.

Reference Books:
1. Industrial Engineering and Management, S.C. Sharma, Khanna Publishing House
2. Industrial Safety, S.C. Sharma, Khanna Publishing House
3. Industrial Engineering & Management: Banga, Sharma & Agrawal
4. Industrial Engineering Safety & Pollution (Hindi): HemendraDutt

Project
On the basis of learning in the vocational diploma, a project to be taken up by the student strengthening his/ her vocational skills

Engineering Graphics
1. Introduction
Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning line conventions and free hand practicing, AUTO CAD, layout of the software, standard tool bar/menus and description of most commonly used toolbars, navigational tools. Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Commands and creation of Lines, Co-ordinate points, axes, poly-lines, square, rectangle, polygons, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints.

2. Orthographic Projections
Introduction, Definitions - Planes of projection, reference line and conventions employed, Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes

3. Orthographic Projections of Plane Surfaces (First Angle Projection Only)
Introduction, Definitions – projections of plane surfaces – triangle, square, rectangle, rhombus, pentagon, hexagon and circle, planes in different positions by change of position method only.

4. Projections of Solids (First Angle Projection Only)
Introduction, Definitions – Projections of right regular tetrahedron, hexahedron (cube), prisms, pyramids, cylinders and cones in different positions.

5. Sections and Development of Lateral Surfaces of Solids
Introduction, Section planes, Sections, Section views, Sectional views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting with base on HP.

6. Isometric Projection (Using Isometric Scale Only)
Introduction, Isometric scale, Isometric projection of simple plane figures, Isometric projection of Tetrahedron, hexahedron (cube), right regular prisms, pyramids, cylinders, cones, spheres, cut Spheres.

Reference Books:
Mechanical Workshop Practice

1. SHEET METAL WORKING AND SOLDERING:
   a. (EX-1) Cutting, shearing and bending of sheet.
   b. (EX-2) To prepare a soap case by the metal sheet
   c. (EX-3) To make a funnel with thin sheet and to solder the seam of the same
   d. (EX-4) To make a cylinder and to solder the same

2. FITTING SHOP WORK:
   a. (EX-1) Hack sawing and chipping of M.S. flat
   b. (EX-2) Filing and squaring of chipped M.S. job
   c. (EX-3) Filing on square of rectangular M.S. Plate
   d. (EX-4) Drill a hole in MS Block & tapping the same
   e. (EX-5) Making a Bolt & Nut by Tap & Die set.

3. SMITHY SHOP WORK:
   a. (EX-1) To prepare square angular piece by M.S. rod
   b. (EX-2) To make square or hexagonal head bolt
   c. (EX-3) To make a screw driver with metallic handle
   d. (EX-4) To make ring with hook

4. Tin Smithy, Soldering, Brazing
   a. (EX-1) To prepare different types of joint such as lap joint single seam, double seam & cap joint-hem & wired edge.
   b. (EX-2) Utility article-waste paper basket or paper tray
   c. (EX-3) Study & sketch stakes / anvils.

5. WELDING SHOP WORK:
   a. (EX-1) Welding practice gas & electric arc welding
   b. (EX-2) Welding for lap joint after preparing the edge
   c. (EX-3) Welding Butt joint after preparing the edge
   d. (EX-4) Gas Cutting
   e. (EX-5) 'T' joint welding after preparation of edge.

Reference Books:

2. Elements of Workshop Technology Vol. I: BS Raghuwanshi
Level 6 (Semester III)

Tool Engineering - I

Unit 1

Introduction:
Concept, meaning and definitions of tool, tool design and tool engineering, Tools-types, classification, features & applications, Tool engineering- functions and importance to enhance productivity and quality, Importance of process planning in tool engineering, Economy-concept, meaning, importance and principles in tool engineering.

Unit 2


Unit 3

Press tools: Press working processes-types, sketches and applications, Press tools: types, working, components and their functions, Concept, meaning, definitions and calculations of press tonnage and shut height of press tool, Shear action in die cutting operation, Centre of pressure: Concept, meaning, definition, methods of finding and importance, Die clearance: Concept, meaning, definition, reasons, effects and methods of application, Scrap strip layout: - Concept, importance, method to prepare, and determining percentage stock utilization, Types, working, and applications of stock stop, pilots, strippers and knockouts, Cutting dies-types and applications.

Unit 4

Dies and moulds: Bending: Types, Parts and functions of bending die, Definition, calculations and factors affecting bend radii, bend allowance and spring back, Method to compute bending pressure, Types, sketch, working and applications of bending dies. Drawing dies-types and method to determine blank size for drawing operation, Types, sketch, working and applications of drawing dies (embossing, curling, bulging, coining, swaging and hole flanging), Forging dies- terminology, types, sketch, working and applications, Dies / Mould: Sketch, working and applications of following i. Extrusion. ii. Plastic injection. iii. Blow moulding

Reference Books:

1. Tool Engineering ,Albert A Dowd
Production Automation & Computer Integrating Manufacturing


UNIT 2 - Production Concept: Such as Manufacturing Lead Time (MLT), Production rate, Components of Operation Time, Production Capacity (PC), Utilisation and availability, Work in Process (WIP), Time in Plant (Tip), WIP Ratio, Tip ratio, their meaning and significance. Simple numerical problems Automation Strategies and Their Effect - Specification of operation, Combined operations, Simultaneous operations, Integration operations, Increase flexibility, Improved material handling and storage, on-line inspection, process control and optimization, Plant operation control, computer integrated manufacturing. PRODUCTION ECONOMICS: Methods evaluation investment alternatives, Constraints in manufacturing, Break Even Analysis, Unit Cost of Production, Cost of manufacturing, lead time and work in process.

UNIT 3 Assembly System And Line Balancing: The assembly process, Assembly system, Manual assembly lines, Line balancing problems, Computerised line, balancing methods, Other ways to improve the line balancing, flexible manual assembly line AUTOMATED ASSEMBLY SYSTEMS: Design for automated assembly, Types of automated assembly systems, Parts feeding devices, analysis of multi-station Assembly machines, Analysis of single station assembly machines

UNIT 4: Numerical Control Production System: Numerical controlling, Coordinate system, and Machine motions, Types of N.C. systems, Machine tool applications, Economics of NCS


Reference Books:

1. Numerical Control Machines: NK Mehta
Fundamentals of Mechatronics

1. **Introduction**: Introduction to mechatronics, systems, measurement systems, control systems, the mechatronics approach. Introduction to Transducers: Sensors and transducers, operating characteristics of transducers, measurement of displacement, velocity, pressure, flow, and temperature.

2. **Signal conditioning**: Signal conditioning- their features and various blocks, the operational amplifiers, Protection, Filtering, Wheatstone bridge, Digital signals, Multiplexers, Data acquisition, Digital signal processing. Data Presentation Systems: Displays, Data presentation elements, Magnetic recording, Displays, Data acquisition system, Telemetry- electrical, optical and pneumatic methods of telemetry.

3. **Introduction to process control systems**: Importance of process control, analog and digital processing, Supervisory digital control, direct digital control. Controller Characteristics: Process characteristics, control system parameters, Discontinuous controller modes (two position, multiple position, floating position), Continuous controller modes i.e. P, I, D, PI, PD, PID.


**Reference Books:**

1. **Classification of Metal Removal Process and Machines Mechanics of Metal Cutting:** Geometry of single point cutting tool and tool angles, tool nomenclature in ASA, ORS, NRS and interrelationship, introduction of mechanism of chip formation and types of chips, chip breakers, orthogonal and oblique cutting, cutting forces and power required, theories of metal cutting, thermal aspects of machining and measurement of chip tool interface temperature, friction in metal cutting.

2. **Machinability:** Concept and evaluation of machinability, tool life, mechanisms of tool failure, tool life and cutting parameters, machinability index, factors affecting machinability, Cutting fluids, types, properties, selection and application methods, General Purpose Machine Tools: tooling, attachments and operations performed, selection of cutting parameters, Simple calculation of time for machining.


4. **Thread and Gear Manufacturing:** Casting, thread chasing, thread cutting on lathe, thread rolling, die threading and tapping, thread milling, thread grinding, Gear Manufacturing Processes: Hot rolling, stamping, powder metallurgy, extruding etc. gear generating processes, gear hobbling, gear shaping, gear finishing processes, shaving, grinding, lapping, shot blasting, phosphate coating, gear testing.

5. **High Velocity Forming Methods:** (High-energy rate forming processes) Definition, Hydraulic forming, explosive forming, electro- hydraulic forming, magnetic pulse forming

**Reference Books:**

Tool Engineering Lab

1. Study of the influence of tool geometry on surface integrity
   a. With positive rake angle b. With negative rake angle
2. Effect of speed, feed, depth of cut and nose radius on surface topography of the components machined using tool inserts
3. Cutting force measurement and construction of Merchant circle diagram as a function of rake angle
4. Study of different type of chips
5. Tool tip temperature measurement during turning of heat treated and cast products
6. Machinability studies on different materials (for different conditions)
7. Machining of the heat treated samples
8. Machining of as-cast product
9. Measurement of tool wear of inserts due to machining

Mechatronics Lab

2. Study of Speed Measurement System: (a) Magnetic Pick-up (b)Stroboscope
3. Study of Load Measurement System Load Cell
4. Measurement of temperature using thermocouple, thermistor and RTD
5. Measurement of displacement using POT, LVDT & Capacitive transducer
6. Torque measurement using torque measuring devices
7. Strain Measurement using strain gauge
8. Frequency to Voltage Converter and vice versa
9. Position and velocity measurement using encoders
10. Study on the application of data acquisition system for industrial purposes
Level 6 (Semester IV)

Tool Engineering – II

Unit 1.

Tool holders: Tool holders for turning and milling carbide inserts-types, ISO-designation and applications, Tool holding and tool mounting systems for conventional milling and drilling machine tools.

Unit 2.

Locating and clamping devices: Concept, meaning and definitions of location and clamping, Use of locating and clamping principles in day-to-day supervision on shop floor, Degree of freedom-concept and importance, 3-2-1 principle of location, Locators-Types, Sketches with nomenclature, Working, Applications, Fool proofing and ejecting

Unit 3.

Clamping devices: Types, Sketches with nomenclature, Working, Applications

Unit 4.

Jigs and fixtures: Concept, meaning, differences and benefits of jigs and fixtures, Types, sketches with nomenclature, working and applications of jigs, Types, sketches with nomenclature, working and applications of fixtures.

Unit 5.

Design of Jigs and Fixtures: Steps in designing jigs and fixture for given simple component

Reference Books:

1. Tool Engineering BY Albert A Dowd
Lean and Agile Manufacturing

Unit 1.

**Introduction** - Introduction to Just in time production, Toyota production system, Introduction to lean manufacturing (LM), history of LM, advantages of LM over mass production

Unit 2.

**Waste Identification** - Types of wastes, lean manufacturing principles; Value, value stream, flow, pull and perfection

Unit 3.

**Value stream mapping** - Introduction to value stream mapping, types of value stream mapping, value added activities, necessary non value added activities, non-value added activities

Unit 4.

**Lean manufacturing tools** - Introduction to 5S, Kanban, kaizen, work standardization, Statistical process control, automation and other lean tools

Unit 5.

**Agile manufacturing** - Introduction to agile manufacturing, advantages of agile manufacturing, differences with lean manufacturing.

Reference Books:

1. Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities, Devadasan S.R
2. Learning Agile: Understanding Scrum, XP, Lean, and Kanban, Andrew Stellman, Jennifer Greene
Metal Forming Processes

Unit 1.

Rolling- Introduction, Types of rolling, Hot rolling, Two high reversing mill, Three high mill, Continuous mill, Roll bending

Unit 2.

Forging- Introduction, Advantages of Forging, Application of Forging, Limitations of Forging, Upsetting, Hollow Forging, Impression die or closed, Methods of Forging, Drop Forging, Press Forging, Hammer and press Forging, Hot bar Forging, Upset Forging

Unit 3.

Extrusion- Direct and forward, Sleeve method of direct, Indirect or backward, Impact Extrusion, Tube Extrusion, Stepped Extrusion, Combined forging and Extrusion

Unit 4.

Drawing- Wire Drawing, Cupping and Bending, Tube Drawing, Spinning, Hot and cold Spinning Advantages of Metal Spinning

Unit 5.

Pipe and Tube Production- Manufacturing of seamless pipe- Butt welded pipe- Lap welded pipe

Reference Books:

2. Metal Forming Processes, G. R. Nagpal
Mass Production Devices

Unit 1.

Introduction- Properties of tool material, types of tool material, 5 basic requirement of tool material and general consideration in tool design, Tools-types, classification, features & applications

Unit 2.


Unit 3.

Press Tools- Introduction to Press tools, Elements of press tools - punches, punch holder, knockouts, pilots stock, Types of punches, Standards die sets, Element of blanking die, Element of drawing die, Element of bending die, Working of progressive and compound dies

Unit 4.

Jig & Fixtures-I- Usefulness, Principles of Jig & Fixtures design, Principle of location, Locating and clamping devices 5. Jig & Fixtures-II- Type of jigs, Element of a fixture, Milling fixtures, Lathe fixture, Economics of jigs and fixtures

Reference Books:
  1. Mass Production, phaidon
Tool & Die Making Lab

1. Manufacture of Box Jig and Angle plate jig
2. Manufacture of “V” Block angle grinding Fixtures and profile milling fixture
3. Manufacture of simple Blanking & piercing Tool
4. Manufacture of Progressive tool for producing a Cycle chain link
5. Manufacture of Press tools like Combination tool & Compound tool
6. Manufacture of Draw tool
7. Trial out On Fly press and power press the Produced components such as V, U, Cycle link, Cup, Washer and Cycle bell cup
8. Manufacture of simple V and U bending tool
9. Maintenance of Jig& fixture and press tool

IT Tools Lab.

1. Spreadsheets, Word, Presentation
2. Multimedia Design
3. Troubleshooting
4. Project / Practical File
5. Viva Voce
Level 7 (Semester I)
Reliability, Maintenance and Safety Engineering

Unit 1

Reliability - Definition, reliability function, Mean failure rate, mean time to failure (MTTF), mean time between failures (MTBF), hazard rate curve. Bathtub curve, Conditional Reliability

Unit 2

Constant Failure rate model - Exponential Reliability function, Failure Modes, CFR model, memory lessens, System reliability: Series, parallel, mixed & complex configuration; Reliability improvement.

Unit 3

Design for reliability - Reliability specifications and system Measurements, System Effectiveness, redundancy, Classification of Redundancy. Introduction of failure mode and effect analysis (FMEA)

Unit 4

Maintainability - Analysis of Downtime, repair time distribution, stochastic point processes.

Unit 5

Safety engineering - Fundamentals of industrial safety, Safety policy and safety terminology, Different types of safety systems and equipments, Safety targets, standards, objectives.

Reference Books:
2. Reliability, Maintenance and Safety Engineering, A.K. Gupta
Design Concepts in Engineering


Reference Books:

1. Design concepts for engineers, Mark N. Horenstein
2. Concepts in Engineering Design, Sumesh Krishnan, Dr. Mukul Shukla
Product Design and Development

Unit 1.

**Importance of New Product:** Definition-importance-Development Process, Importance of new product for growth of enterprise, Definition of product and new product, Responsibility for new product development, Demands on product development team, Classification of products from new product development point of view. New product development process and organization, Generic product development process for Market Pull Products, Modification of this process for other types of products.

Unit 2.

**Need Analysis:** Problem formulation establishing economic existence of need, need identification and analysis, engineering statement of problem, establishing target specification

Unit 3.

**Generation of Alternatives and Concept Selection:** Concept generation- a creative process, Creativity, Road Elects to creative thinking Fear of criticism and Psychological set, Tools of creativity like brain storming, Analogy, Inversion etc., Creative thinking Process, Concept feasibility and Concept Selection, Establishing Engineering Specification of Products.

Unit 4.

**Preliminary and Detailed Design:** Design Review Preliminary design- Identification of subsystems, Subsystem specifications, Compatibility, Detailed design of subsystems, component design, Preparation of assembly drawings, Review of product design from point of view of Manufacturing, Ergonomics and aesthetics.

Unit 5

**Assembly drawing and review**
Preparation of assembly drawings, Review of product design from point of view of Manufacturing, Ergonomics and aesthetics

**Reference Books:**
1. Manufacturing Processes for Design Professionals, Rob Thompson
2. Product design for manufacture and assembly, Geoffrey Boothroyd
Unit 1
Introduction CIM and CAD & Analysis:

Unit 2
Computer aided Manufacturing CAM:

Unit 3
CNC Machine and Components:

Unit 4
Part Programming

Unit 5
FMS, Integrated Material Handling and Robot:

Reference Books:
1. Engineering AutoCAD, Pradeep Jain & A.P. Gautam, Khanna Publishing House
CAD Lab

1. Introduction and different features of the CAD Software.
2. 2-D Drafting.
3. 3-D Modeling.
4. 3-D Advanced Modeling.
5. Assembly modeling.
6. Feature Modification and Manipulation
7. Detailing.

CAM Lab

1. To prepare part programming for plain turning operation.
2. To prepare part programming for turning operation in absolute mode.
3. To prepare part program in inch mode for plain turning operation.
4. To prepare part program for taper turning operation.
5. To prepare part program for turning operations using turning cycle.
6. To prepare part program for threading operation.
7. To prepare part program for slot milling operation.
8. To prepare part program for gear cutting operation.
9. To prepare part program for gear cutting using mill cycle.
10. To prepare part program for drilling operation
Level 7 (Semester VI)

Rapid Prototyping and Reverse Engineering

Unit 1
Introduction
Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

Unit 2
CAD Modelling and Data Processing for RP
CAD model preparation, Data Requirements, different types of Data formats, Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

Unit 3
RP Systems

Unit 4
Rapid Tooling:
Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Unit 5
RP Applications:
Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP

Reference Books:
1. Rapid Product Development, Kimura Fumihiko
Process Planning and Cost Estimation


Unit 4. Machining Time Calculation: Selection of Cutting Speed, Feed and Depth of Cut for Turning: Machining Time Calculation for Turning Operation. Selection of Cutting Speed, Feed and Depth of Cut for Milling Operation: Machining Time Calculation for Milling Operation. Selection of Cutting Speed, Feed Depth of Cut for Drilling Operation: Machining Time Calculation for Drilling Operation

Reference Books:

Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/her vocational skills.
STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc

Refrigeration and Air conditioning (RC)

Branch Code: 105

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
## Evaluation Scheme
### B. Voc Refrigeration and Air conditioning

### NSFQ Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
<td>TE</td>
</tr>
<tr>
<td>1</td>
<td>BRCV511</td>
<td>Basics of Refrigeration</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>BRCV512</td>
<td>Basics of Air Conditioning</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BRCV513</td>
<td>Engineering Material</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>BRCV514</td>
<td>Soldering &amp; De-Soldering of Components &amp; Emergency actions</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>BRC511</td>
<td>Metrology and Measuring Instruments Lab</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>BRC512</td>
<td>Heat Transfer lab.</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>7</td>
<td>BRC513</td>
<td>Language Lab</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>BRCT511</td>
<td>Field Technician- AC (ELE/Q 3102)</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT512</td>
<td>Field Technician- Refrigeration (ELE/Q 3103)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT513</td>
<td>Field Engineer- RACW (ELE/Q3105)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>610</td>
<td></td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

### NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
<td>TE</td>
</tr>
<tr>
<td>1</td>
<td>BRCV521</td>
<td>Industrial Management</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>BRCV522</td>
<td>Total Quality Management</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BRCV523</td>
<td>Entrepreneurship</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>BRCV524</td>
<td>Refrigeration &amp; Air Conditioning Applications</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>BRC521</td>
<td>Project -1</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>BRC522</td>
<td>Basic Electrical and Electronics Lab</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>7</td>
<td>BRC523</td>
<td>IT Tools Lab</td>
<td>30</td>
<td></td>
<td>20</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>8</td>
<td>BRCT521</td>
<td>Field Technician- AC (ELE/Q 3102)</td>
<td>Any one Training (other than 1stsem) 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT522</td>
<td>Field Technician- Refrigeration (ELE/Q 3103)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT523</td>
<td>Field Engineer- RACW (ELE/Q3105)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td></td>
<td>610</td>
<td></td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
### NSFQ Level 6 SEMESTER- III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total</td>
<td>TE PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BRCV631</td>
<td>RAC Piping Systems - I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BRCV632</td>
<td>Refrigeration &amp; Air-conditioning Material -I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BRCV633</td>
<td>Refrigerants</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BRCV634</td>
<td>RAC Standards</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKV631</td>
<td>Uni. Human Values &amp; Ethics</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BRCP631</td>
<td>RAC Material Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BRCP632</td>
<td>RAC Systems Installation and its Maintenance Lab. - I</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BRCT631</td>
<td>Safety Tester – RACWO (ELE/Q3605)</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT632</td>
<td>Field Engineer – RACW (ELE/Q3105)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT633</td>
<td>Cold Storage Technician (FIC/Q7004)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
</tr>
</tbody>
</table>

### NSFQ Level 6 SEMESTER- IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT TA AT Total</td>
<td>TE PE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BRCV641</td>
<td>RAC Piping Systems - II</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BRCV642</td>
<td>Refrigeration &amp; Air-conditioning Material-II</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BRCV643</td>
<td>RAC Maintenance - I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BRCV644</td>
<td>RAC Installation Techniques - I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BRCP641</td>
<td>RAC Systems Installation and its Maintenance Lab. - II</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BRCP642</td>
<td>RAC Piping Systems Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BRCT641</td>
<td>Safety Tester – RACWO (ELE/Q3605)</td>
<td>Any one Training (other than 3rd sem) 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT642</td>
<td>Field Engineer – RACW (ELE/Q3105)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT643</td>
<td>Cold Storage Technician (FIC/Q7004)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
</tr>
</tbody>
</table>

GV: General Vocational; VP: Vocational Practical; OJT: On Job Training; SSC: Sector Skill Council
### NSFQ Level 7 SEMESTER- V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BRCV751</td>
<td>RAC Maintenance - II</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>BRCV752</td>
<td>RAC Installation Techniques - II</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BRCV753</td>
<td>Automobile Air conditioning</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>BRCV754</td>
<td>Non-conventional Refrigerating System</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>6</td>
<td>BRCP751</td>
<td>RAC Maintenance - II</td>
<td>30</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BRCP752</td>
<td>RAC Installation Techniques - II</td>
<td>30</td>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BRCT751</td>
<td>AC Specialist – Automobile (ASC/Q 1416)</td>
<td>400 hrs/ 8 weeks</td>
<td>Any one Training</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT752</td>
<td>Assembly Operator (ELE/ Q 3501)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BRCV761</td>
<td>RAC Safety</td>
<td>45</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>BRCV762</td>
<td>Process Planning and Cost Estimation</td>
<td>45</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>4</td>
<td>BRCP761</td>
<td>Major Project</td>
<td>180</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BRCT761</td>
<td>AC Specialist – Automobile (ASC/Q 1416)</td>
<td>400 hrs/ 8 weeks</td>
<td>Any one Training (other than 5thsem)</td>
<td>200</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BRCT762</td>
<td>Assembly Operator (ELE/ Q 3501)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

V: General Vocational; P: Vocational Practical; T: On Job Training; SSC: Sector Skill Council
Level 5 (Semester 1)

Bridge Course

Steam Generators: Types of steam generators - Fire tube, water tube boilers, boiler mountings and accessories, Equivalent evaporation, boiler efficiency, elements of power plant.

Reciprocating Steam Engines: Working principles, classification, a brief idea and concept only.

Steam Turbines: Classification, principle of operation of Impulse reaction steam turbines.

Steam Condensers: Principle of operation, classification, a brief concept, condenser details, applications

Air Compressors: Definition and their use, Difference between reciprocating and rotary compressors, their types and working, Inter cooling in two stage compression volumetric efficiency, Compressor lubrication. Simple numerical problems.

Basic Thermodynamics: Definition, concept of thermodynamic system and surroundings, closed system, open system, isolated system thermodynamics, definition of work, Zeroth law of thermodynamics, First law of thermodynamics for cyclic and noncyclical processes, Idea of internal energy and enthalpy, Applicability of first law on various thermodynamics processes, simple numerical problems.

Basics of Refrigeration

Unit 1
INTRODUCTION: Its meaning and application, unit of refrigeration; Various methods of refrigeration.

Unit 2
REFRIGERATION SYSTEMS: Refrigeration Cycles: Refrigeration, carnot cycle of refrigeration (ideal cycle), Bell-Coleman cycle of refrigeration, their COP and Conditions for its highest value, Temperature limitations. Representation of these cycles, in P-V, T-S and P-H diagrams and also their flow diagrams, Simple numerical problems .

Unit 3
Vapour compression system: Standard vapour compression cycle, wet and dry compression, Effect of sub cooling and super heating, Effect of temperature and pressure on COP of the cycle. Simple numerical problems with the help of P-H diagram. Concept of house hold refrigerator working on vapour compression cycle.

Unit 4
Vapour Absorption System: Cycle of operation, Construction and working of refrigerator based on this system. Simple numerical problems (Simple line diagram)

Unit 5
REFRIGERANTS: Definition, classification & properties of few important refrigerants such as Ammonia, Sulphur-Di-Oxide (SO2) Carbon-Di-Oxide (CO2) Freon -12 (F-12) F-11. Qualities of good refrigerants, secondary refrigerant .

Suggested Reading:
Refrigeration and Air Conditioning: A Sarao
Refrigeration and Air Conditioning: RS Khurmi
Basics of Air Conditioning

Unit 1
INTRODUCTION: Its meaning and general application. Psychrometry: Definition, Composition of air, Daltons law of partial pressure, Gas and Vapour mixture, Dry and Wet bulb temperature, Wet bulb depression, Dew point, Dew point depression, Saturated air,

Unit 2
Specific humidity, Degree of saturation, Relative humidity, Absolute humidity, Humid specific volume and humid specific heat, Enthalpy of moist air,

Unit 3
Use of psychometric charts and tables, Sensible heating and cooling, Humidification and dehumidification and their methods, Simple numerical problems concerning above

Unit 4
HEAT LOAD: Brief idea of various types of heat loads, Sensible and latent heat loads. Sensible hat factor

Unit 5
ROOM AIR CONDITIONING: Brief idea of room air conditioning, Window types packaged air conditioner. Central air conditioning system, Round the year air conditioning

Suggested Reading:
Refrigeration and Air Conditioning: A Sarao
Refrigeration and Air Conditioning: RS Khurmi
Engineering Material

UNIT 1
ELECTRICAL ENGINEERING MATERIALS
Conducting Materials: Properties of good conducting materials, Brief idea about conductivity & Resistivity

UNIT 2
(a) Insulating Materials: (a) Plastic insulating materials-definition and classification, thermo-setting and thermoplastic materials, their applications and commercial names & uses in industry. (b) Various insulating materials-mica asbestos, ceramic materials, glass, cotton, silk, jute, paper their properties and applications
(B) Semiconductor Materials: Characteristics and applications of semiconductor materials

UNIT 3
(A) Non-Metallic Materials-Timber. Preservation of timber, Defects of timber, Surface treatment, Plywood, Hard Board, Batten Board, Veneer board, units of purchase
(B) Miscellaneous Materials: Important properties, characteristics and use of the following materials: Abrasives, Asbestos, Celluloid, Cork, Mica, Refractory

UNIT 4: MECHANICAL ENGINEERING MATERIALS
Non-Ferrous Metals: Aluminium, Zinc, Copper, Tin, Silver, Lead - Trade names; Physical, mechanical, and electrical properties and use
(ii) Base metal with principal alloying elements - Aluminium Alloys, Copper Alloys, Nickel Alloys, Bearing Metals- Lead base alloys, Tin base alloys, (White metals or babbitt metals), Copper base alloys.

UNIT 5: Civil Engineering Materials
General idea of raw materials, properties and uses of Bricks, lime, cement
Foundation: (i) Bearing capacity of soil and its importance, need of foundation for machines (ii) Foundations for heavy, light and vibrating machines (iii) Concrete proportion, mixing w/c ratio, workability RCC and its use.

Suggested Reading:
Engineering Materials: DhanpatRai& Sons
Electrical Engineering Materials: Madan Publishers
Soldering & De-soldering Components & Emergency Actions

1. Soldering & De Soldering of Basic Components
   - Soldering Tools
   - Different types of Soldering Guns related to Temperature and wattages, types of tips
   - Solder materials and their grading
   - Soldering and De Soldering Stations and their Specifications
   - Preparing Component for Soldering
   - PCB Applications
   - Types of PCB
   - Soldering Basic Components on PCB
   - De soldering Basic Components
   - Safety precautions while Soldering & De soldering
   - Check for cold continuity of PCB
   - Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards
   - Join the broken PCB track and test
   - De soldering using Pump and wick
   - Introduction of SMD Components

2. Introduction to SMD Components
   - Identification of 2, 3, 4 terminal SMD components
   - Soldering the SMD components on the PCB
   - Make the necessary settings on SMD soldering station to solder various ICs of different packages by choosing proper clamping tools
   - Identify various connections and the setup required for SMD soldering station
   - De solder the SMD components from the given PCB
   - Make the necessary settings on SMD soldering station to de solder various ICs of different packages by choosing proper clamping tools
   - Make a panel board using different types of switches for a given application
   - Identification of crimping tools for various IC packages
   - Reliable Soldering Practices

3. Emergency actions
   - Minimum Requirements
Metrology and Measuring Instruments lab.

1. Measurement of angle with the help of sine bar/ Vernier Bevel protractor.
2. Study and sketch of various types of optical projectors.
3. Study and sketch of various types of comparators and use them for comparing length of given piece.
4. To measure the diameter of a hole with the help of precision balls.
5. To measure external and internal taper with the help of taper gauges, precision rollers.
6. To test the squareness of a component with auto-collimeter.
7. To measure the pitch, angle and form of thread of a screw.
8. To measure the geometry of a gear having involute profile.
9. To measure the straightness of the edge of a component with the help of auto-collimeter.
10. To measure the length, breadth, thickness, depth, height with micrometer.
11. To measure the length, breadth, thickness, depth, height, with height gauge and Vernier calipers.
13. Calibration of height gauge/depth gauge.
15. Checking of accuracy of snap gauge with slop gauge.
16. Checking of accuracy of a plug gauge with micrometer.
17. Measurement of areas by polar planimeter.
18. Use of feeler, wire, radius and fillet gauges measurement of standard parameters

Heat Transfer Lab.

Experiments on Conduction
1. Determination of Thermal conductivity of insulation powder
2. Determination of overall heat transfer coefficient of Composite Wall
3. Determination of overall heat transfer coefficient of Lagged Pipe
4. Determination of Thermal Conductivity of given Metal Rod

Experiments on Convection
5. Determination of heat transfer coefficient of Pin-Fin (Natural and Forced Convection)
6. Determination of heat transfer coefficient of Natural Convection

Experiments on Radiation
8. Determination of Stefan Boltzman Constant
9. Determination of Emissivity of test plate

Experiments on Applications of heat transfer and heat transfer with phase change
10. Determination of effectiveness and overall heat transfer coefficient using Parallel and Counter flow Heat Exchanger
11. Determination of heat transfer coefficient in drop and film wise condensation
12. Determination of Critical Heat flux
13. Study of heat pipe and its demonstration
Level 5 (Semester II)
Industrial Management

Unit -1. Introduction:
Growth of industry, The management of men, materials and machines, the art of management, Sources of capital- industrial individual enterprise, private partnership and private Ltd. Co., Joint Stock Co. shares, debentures, financial agencies and their role in promoting industries. Break even analysis.

Unit-2. Private sector and public sector:
Public sector enterprise, merits and demerits of public sector industry and private sector industry, Line, staff and functional organizations, reasons for the choice of various types of organization, functions of different departments, viz. stores, purchase and sales departments relationship between individual departments.

Unit-3. Wages & incentives:
Definition of wages, real wage and nominal wage, systems of wage payment, incentives, financial and non - financial incentives, Essentials of a good wage plan, essentials of a good incentive scheme. Introduction to elements of cost & indirect expenses, Material cost, labour cost, fixed and variable overheads, components of cost, selling price, Factory expenses, administrative expenses, selling & distribution expenses, depreciation, obsolescence, interest on capital, Idleness, Repair and maintenance.

Unit-4. Labour, industrial & tax laws:
Evolution of industrial law, factory act, workmen compensation act, payment of wages act, employee’s state insurance act, Industrial dispute act. Role of technician in industry: Position of technician in various engineering departments, Role of a supervisor in industry, Foremanship, duties and qualities of a good foreman.

Unit-5. Material management:
Introduction, Scope of Material Management selective control techniques-ABC analysis, Material handling, inventory control, Essential steps in inventory control, quality standards
Total Quality Management

Unit-1. Introduction, Basic concepts

of total quality management
Introduction to Quality, Dimensions of Quality, Quality Planning, Concept and definition of quality cost, Determinants of Quality, Optimum cost of performance, Principles of TQM, Pillars of TQM, Introduction to leadership and Leadership roles, Quality council and Quality statement, Strategic Planning Process, Deming philosophy

Unit-2. Continuous process improvement
Input /output process Model, Juran trilogy, PDCA Cycle, 5 –‘S’ Housekeeping principle, Kaizen Seven tools of Quality (Q-7 tools), Check Sheet, Histogram, Cause and effect diagram, Pereto diagram, Stratification analysis, Scatter diagram, Control charts, Control chart for variables & process capability, Control chart for attributes
Unit-3. Management planning tools & Bench marking
Affinity diagram, Relationship diagram, Tree diagram, Matrix diagram, Matrix data analysis, Arrow Diagram, Process decision programme chart (PDPC), Concept of bench marking, Reason to bench marking, Bench marking process, Types of bench marking, Benefits of bench marking

Unit-4. Just in time (JIT)
JIT philosophy, Three elements of JIT, Principles of JIT Manufacturing, JIT Manufacturing building blocks, JIT benefits, Kanban & Bin Systems

Unit-5. Total productive maintenance (TPM)
Concept of Total Productive Maintenance, Types of maintenance, OEE (Overall Equipment Efficiency), Stages in TPM implementation, Pillars of TPM, Difficulties faced in TPM implementation.

Entrepreneurship

Unit 1. Entrepreneurship

and entrepreneur:
Need of Employment and Opportunities, Essential Characteristics of a good Entrepreneur, Industrial Policy, Classification of industries: Micro, small scale, Medium scale, Large scale, Type of industries: Production, Job based & Service

Unit 2. Entrepreneurial Development:
Product identification/selection, Site selection, Plant layout, Institutional support needed, Pre-market survey.

Unit 3. Entrepreneurship Support System and Start-ups:
Introduction to start-up’s, Role of District Industries Centre in setting up industry, Function of NSIC, SISI, NISIET, NRDC, SSIC, SIDO, NMTC, KVIC, RSMML, Role of state finance corporation, state electricity corporations, pollution control board, BIS, I.S.O. etc.

Unit 4. Introduction to Tax System, Insurance and Acts:

Unit 5. Project Report Preparation:
Procedure of preparing a project report, Format of project report, Preparation of project report, Introduction to ISO: 9000 Series of Quality System
Refrigeration & Air Conditioning Applications

Unit I: Food Preservation
Introduction, factors contributing to food spoilage, causes of food spoilage, methods of food preservation, freezing method of food preservation, preservation of food with direct contact of liquid N2, freeze drying, preservation of different products, cold storage and commercial cabinets.

Unit II: Commercial Applications
Introduction, air-conditioning of houses, offices, hotels and restaurants, air-conditioning of departmental stores, air-conditioning of theatres and auditoriums, hospitals and medical applications

Unit III: Ice-Manufacturing
Introduction, principles of ice production, different methods of ice manufacturing, treatment of water for making ice, brines, freezing tanks, ice cans, quality of ice

Unit IV: Industrial Applications
Introduction, importance of RH in different industries, ice-cream manufacturing, refrigeration for breweries, selection of refrigerant for breweries, use of liquid N2 for fabric, quality, air conditioning in textile and photographic industries

Unit V: Transport Air Conditioning
Introduction, automobile air conditioning, railway air-conditioning, marine air conditioning, aircraft air conditioning

Recommended books:
1. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi
2. course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpatrai and sons, Delhi

Reference books:
1. Refrigeration and Air Conditioning by C.P.Arora, McGraw Hill education (India) (P) limited, New Delhi

Project -1

On the basis of learning and skill acquired in the academic year, a project to be taken up by the student strengthening his/ her vocational skills
Basic Electrical and Electronics Lab

Basic Electrical – Practicals
Verify that resistance of conductor is directly proportional to resistivity and length and inversely proportional to cross-sectional area of the conductor.
2. Verification of Ohm’s Law.
3. Verification of temperature co-efficient of resistance:
   (i) Positive for Tungsten and Nichrome and
   (ii) Negative for carbon.
5. Study of parallel resistive circuits.
7. Preparation of Electrolyte for lead acid battery and its charging and measurement of Specific gravity with the help of hydrometer.
8. To find heat efficiency of an electric kettle.
9. Charging and Discharging of a capacitor.
10. Verification of magnetic field of a Solenoid with:
    (i) Iron core and
    (ii) Air core.
12. Verification of Torque development in a current carrying coil in magnetic field.
13. Study of R.L. series circuit and measurement of power and power factor.
14. Study of R.C. series circuit and measurement of power and power factor.
15. Study of R.L.C. series circuit and measurement of power and power factor.

Basic Electronics – Practicals
1. Study of current and voltage measurement using Ammeter and Voltmeter.
2. Study of current and voltage measurement using Galvanometer.
3. Study of current, voltage and resistance measurement using Multi-meter.
5. Study of working principle of Signal Generator and measurement of amplitude, time period and frequency of signal using Oscilloscope.
7. Study of V-I Characteristic of Zener Diode. And use of Zener Diode as voltage regulator.
8. Study of Half wave rectifier with and without filter circuit.
9. Study of Full wave rectifier with and without filter circuit.
10. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.
11. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.
12. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.
13. Study of working of single layer PCB manufacturing
15. Design of 7 segment display using LED and bread board.
Instruments Required (Electrical)
- Trainer kit for verifying ohm’s law,
- Trainer kit for measuring TCR
- Lead acid battery,
- Hydrometer,
- Electric kettle
- Trainer kit for measuring power and power factor in RLC circuits

Instruments Required (Electronics)
- Ammeter
- Voltmeter,
- Multi-meter,
- Galvanometer,
- Energy Meter,
- CRO,
- Diode Trainer kit
- Zener diode Trainer kit
- Rectifier trainer kit
- Transistor characteristics trainer kit,
- PCB manufacturing Lab
- Bread board trainer kit to design 7 segment displays.
Level 6 (Semester III)

RAC Piping Systems – I

Bridge Course
Basic understanding Engineering Drawing

Unit I
Codes, Standards and Specifications: Piping codes, ASME codes and standards, ASTM Specifications,

Unit II
ASME Boiler, Pressure vessel codes, ASME B31-Code for pressure piping, mechanical strength, testing of piping system and valves, fabrications.

Unit III
Piping Components: Pipe-seamless, welded pipes, pipe sizes, dimensional specifications, material, specifications, pipe ends, pipe fittings, pipe support,

Unit IV
valves–gate valve, globe valve, check valve, ball valve, plug valve, butterfly valve, control valve, pressure relief valve, valve, codes and standard, valve size, pressure class rating.

Unit V
Viscosity, Reynolds number, friction factor, Darcy Weisback friction factor, friction factor for laminar and turbulent flows, equivalent pipe length, hydraulic radius, compressible, flow,

Recommended Books
1. Piping and Pipeline Calculations Manual by J. Phillip Ellenberger
2. The fundamentals of piping design by Peter Smith.

Reference Books:
2. ASHRAE handbook, 2002
Refrigeration & Air-conditioning Material – I

Unit I
Introduction, desired properties of ideal insulating material, factors effecting the thermal conductivity,

Unit II
types of insulating material., reflective insulating blinds, laprock – a thermal acoustic and fire insulation, natural insulator, new transparent heat insulator, heat transfer through insulation used for A.C,

Unit III
thickness of insulation, few insulated systems, low temperature insulations, importance of relative humidity for the selection of the insulations, air distribution for reducing heat lose.

Unit IV
Cables and Wiring: Cryocables, economics of cryocables, A.C. super conducting cables, liquid N2 cooled cables, Liquid H2 cooled cables, super magnet, electric generator, minimal insulated cables, installing cables

Unit V
Component Material: Refrigeration component material, duct material, material used in evaporator, material used in compressor, material used in condenser.
Refrigerants

Unit I
Introduction: Refrigerants, cooling media and liquid absorbents, azeotropic and zeotropic, numbering of refrigerants.

Unit II
Classification and Properties of Refrigerants: Requirement for refrigerant, classification-based on working principle, safety and chemical composition, desirable properties of refrigerants-thermodynamic properties, safe working properties, physical properties etc

Unit III
Choice of Refrigerant: Important refrigerants, secondary refrigerant, anti-freeze solution, selection of refrigerant for required purpose,

Unit IV
Application of Refrigerants: refrigerant oils and applications, Properties and uses of commonly used refrigerant

Unit V
Greenhouse effect, Global warming, Future Refrigerants like Hydrofluoro-Olefines

Recommended books
1. A course in Refrigeration and Air Conditioning by S.C.Arior and S.Domkundwar, Dhanpatrai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi

Reference books
2. Refrigeration and Air Conditioning by P.L.Ballaney, Khanna publishers, New Delhi

Modern Refrigeration and Air Conditioning by Andrew D. Althouse, Carl h. Turnquist and Alfred F. Bracciano, The goodheart-willcox company, INC
RAC Standards

Unit I
Introduction: Meaning of IS, need of IS, international classification of standards for refrigeration and air conditioning, various national and international standards for heating, ventilation and air conditioning

Unit II
Procedure of standard development, levels of standard, main standardization, organizations, i.e. ISO-international organization for standardization, IEC-international electro technical commission and others international and national organizations

Unit III
Existing Standards: Main technical standards relevant to HCFC phase-out and low GWP (Global Warming Potential) alternatives, ISO, IEC, ECS (European Committee for Electrical Technical Standardization)

Unit IV
Adoption of International Standards at National Level: National standardization bodies, national ozone units, accreditation bodies, national RAC associations, the process of adoption

Unit V
Use of International Standards: In designing of refrigeration and air conditioning equipment, selection of materials related to refrigeration and air conditioning, safety issues related to refrigeration and air conditioning, industrial and field applications.

Recommended books
1. International Standards in Refrigeration and Air Conditioning, UNEP (United Nations Environment Program)
2. Refrigeration and Air Conditioning data book, New Age International Publication

Reference books
1. ISHRAE standard book for Refrigeration and Air Conditioning
2. ASHRE hand book for Refrigeration and Air Conditioning
RAC Materials Lab
Any eight of the following practical should be performed and recorded in laboratory book

1. Identification of types of copper tubes (dia. 3 mm, 6 mm, 12.5mm)
2. Identification of types of brazing road and its composition
3. Identification of oil and grease removals, fire hazard of the removals
4. Familiarization of joining material, gasket, pipe joint
5. Introduction of various insulating material, properties, fire hazard, etc.
7. Pipe Bending – Introduction to tools and different bends, pipe cutting.
8. Electrical requirement – introduction and familiarization with electrical symbols, circuit diagram of the RAC system
9. Introduction to gas welding, simple gas welding, arc welding
10. Identification and testing of resistor, diodes and transistors
11. Identification of refrigerant cylinder by color coding and standing pressure – types of cylinder
12. Technique of glass wool filling method in conventional refrigerant.

RAC Systems Installation & Maintenance Lab. – I

1. Handling, use and familiarization with refrigeration tools and accessories such as: (a) Tube cutter (b) Tube bender [spring type] (c) Flaring tool (d) Swaging tool (e) Pinch off tools (f) Service valve wrench (g) Service valve (h) Adjustable wrench (i) Spanner set (j) Allen Key (k) Gauges (l) Blow lamp (m) Service cylinder (n) Gauge manifold (o) Wheel puller (p) Vacuum pump (q) Halide torch (r) Practicing of related operations.
2. Study of the following units: (a) Domestic refrigerator (b) Water cooler (c) Room Air conditioner (d) Evaporative cooler (e) Experimental ice plant.
3. Experimental ice plant.
4. Study of the following components and controls: (a) Compressor: open type and sealed types (b) Thermostatic expansion valve (c) Surface condenser (d) Different types of evaporators (e) Solenoid valve (f) Thermostat for refrigeration (g) H.P. and L.P. cut out (h) Gil safety switch (i) Strainers and driers.
Level 6 (Semester4)
RAC Piping Systems – II

Unit I
Pipe Size Calculations: Pipe sizing, pipe sizing formulae, pipeline wall thickness calculation, elements of total dynamic head–static head, pressure head, velocity head, friction head, Pump power required, Cavitations in pumps, NPSH required and NPSH available for pumps.

Unit II
Pipe Stress Analysis: Objectives and definition of stress analysis, piping loads, piping stresses-primary, secondary, pipe span, calculations flexibility analysis—expansion loops and expansion joints, concept of thermal expansion, providing flexibility in piping

Unit III
Assembly and Erection: Fabrications materials for piping systems, fabrication drawings, fabrication processes, Assembly-alignment, flanged joints, threaded joints,

Unit IV
Piping System Testing: Examinations methods, visual examination, magnetic particle examination, Liquid penetrant examination, radiographic examination, ultrasonic examinations,

Unit V
Testing–leak, test, preparation for leak test, hydrostatic leak test, pneumatic leak test, sensitive leak test, examination of welds

Recommended Books
3. Piping and Pipeline Calculations Manual by J. Phillip Ellenberger
4. The fundamentals of piping design by Peter Smith.

Reference books:
3. ASHRAE handbook, 2002
Refrigeration & Air-conditioning Material – II

Unit I
Component Material: Material used in expansion valve, different type of valve material

Unit II
Material used in cooling towers, pipeline materials, drying materials, jointing, material, synthetic repair materials.

Unit III
Oils and Lubrication: Need of lubrication, types of lubrication, properties of lubrication oils, lubrication systems

Unit IV
Selection of refrigerant lubricant, compatibility of lubricant with refrigerant fluid refrigeration oil with additives, the effect of refrigerant on lubricant density, solvent and cleaning.

Unit V
Tubing: Soft copper tubing, hard-drawn copper tubing, steel tubing, normal size copper tubing, Cutting tubing, bonding tubing, connecting tubing, flaring tubing.

Recommended books
1. A course in Refrigeration and Air Conditioning by S.C.Arora and S.Domkundwar, Dhanpatrai and sons, Delhi

Reference books
1. Modern Refrigeration and Air Conditioning by Andrew D. Althouse, Carl h. Turnquist and Alfred F. Bracciano, The goodheart-willcox company, INC
RAC Maintenance – I

Unit I
RAC Tools: Engineering hand tools: spanners, screwdrivers, pliers, hammers, brazing, welding, flaring tool, tube bender, hammer, wrenches, shock wrenches, files, hacksaws, wood saws, electrical hand drill, sheet metal snips, Allen keys pop riveter, chisels, pulley extractors, Center punch, wire brush, drill bits, oil can, knife, inspection lamp, bolt extractor

Unit II
Measuring equipment’s- steel tape measure, feeler gauge, Caliper, micrometer, engineers levels, pocket type of thermometer, sling psychomotor, system analyzers, temperature analyzers, electronic leak detector, voltmeter, clamp-on ammeter

Unit III
Specialist tools and accessories: flexible charging line, bending springs, pipe tube cutter, fin combs, soldering and brazing equipments, Vacuum pump, charging cylinders, electric test lamps, jumper lead, welding goggles

Unit IV
Pipe installation work, pumping down the system, purging the system, starting the plant

Unit V
Using a system analyzer, transferring and handling liquid refrigerant

Recommended books
1. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi

Reference books
2. Refrigeration and Air Conditioning by P.L. Ballaney, Khanna publishers, New Delhi
3. Modern Refrigeration and Air Conditioning by Andrew D. Althouse, Carl h. Turnquist and Alfred F. Bracciano, The goodheart-willcox company, INC
4. Refrigeration and Air Conditioning Technology by William C. Whitman, William M. Johnson and John A. Tomczyk, Delmar Thomson learning, USA
RAC Installation Techniques - I

Unit I
Introduction: Installation operation, adding oil, testing for leak detection

Unit II
Evacuation and dehydration, removing air, charging of the system, through suction valve, through discharge valve.

Unit III
Installation of Room Air-Conditioner: Selection of proper location, providing proper slope and provision for to drain water

Unit IV
Ventilation arrangement for window air conditioner, wiring diagram for installation for room air conditioner

Unit V
Installation of split air conditioner, providing arrangement for pipes and pipe, pipe insulations

Recommended books
1. Air conditioning: procedures and installation by V. Paul Lang, CBS publishers &distributors, Delhi
2. Refrigeration Technicians pocket book by F.H. Meredith, Butterworths

(6.VP.03) RAC System Installation & Maintenance Lab. – II

1. Leak detection in refrigeration system by different methods.
2. Air removal and charging of a refrigeration unit.
3. Testing of a refrigeration system to find out: (a) Refrigerating capacity (b) Power input (c) C.O.P.
4. Determination of psychrometric properties of air with the help of a sling psychrometer and aspiration psychrometer.
5. Determination of bye pass factor of a cooling coil.
7. Determination of cooling load for a specified situation.
8. Study of the following system by visit: (a) Ice Plant (b) Cold storage plant (c) Control air conditioning system.

SUGGESTED READING:
REFRIGERATION AND AIR CONDITIONING: A Sarao REFRIGERATION AND AIR CONDITIONING: RS Khurmi
RAC Piping Systems Lab.

List of Experiments
Any six of the following practical should be performed and recorded in laboratory book:

1. Study of piping codes, ASME codes and standards, ASTM Specifications
2. Study of Pipe-seamless, welded pipes, pipe sizes, dimensional specifications, material specifications, pipe ends
3. Study of pipe fittings—elbows, tees, flanges, butt welded end fittings, socket welded and threaded end fittings
4. Valves—gate valve, globe valve, check valve, ball valve, plug valve, butterfly valve, control valve, pressure relief valve, valve codes and standard, valve size, pressure class rating.
5. Study of pipeline wall thickness calculation
6. Study of NPSH required and NPSH available for pumps
7. Study of piping load and piping stresses
8. Study of different leak detection methods
9. Checking the performance of air ducting system
Level 7 (Semester 5)

RAC Maintenance - II

Unit I
Checking the charge, electrical circuits (servicing), evacuation of the system, installation, and location of main components, leak detection methods

Unit II
Servicing Techniques: Piping and Joining Work, Burn out repair, capillary tube cleaning

Unit III
Charging the system, compressor work expansion valve (thermostatic), servicing, hermetic compressor motors (stating problems) repairing leaks, sealed system connections.

Unit IV
Electrical Fault Finding: Compressor motor fails to start, compressor motors tries to start but does not run, compressor motor starts but does not reach running speed, thermostat failure type, pressure cut-out failure, wiring and collection faults

Unit V
Mechanical Fault Finding: Fault analysis by temperature and pressure, methods of confirming the fault, finding the fault when the compressor is not running, abnormal noise problem, domestic system faults

RAC Installation Techniques – II

Unit I
Commercial Installations of Refrigeration Systems: Ice manufacturing plant, ice bank

Unit II
Commercial Installations of Refrigeration Systems: Cold storage plant, milk dairy plant

Unit III
Commercial Installation of Air Conditioning Systems: Office air conditioning, Hotel air conditioning

Unit IV
Central air conditioning, Designs, Factors of consideration for Central AC

Unit V
Automobile air conditioning: Need, Types, Selection of AC System, Ducts
**Automobile Air Conditioning**

**Unit I**
Introduction: Methods of refrigeration. Vapour compression refrigeration system, vapour absorption refrigeration system, applications of refrigeration & air conditioning, Automobile air conditioning, air conditioning for passengers, isolated vehicles, Refrigerated transport vehicles, applications related with very low temperatures, Study of Psychometric charts: Psychometric properties, tables/charts, psychometric processes, comfort charts, factors affecting comfort, effective temperature, ventilation requirements.

**Unit II**
Refrigerants & AC Systems: Importance of Refrigerant- Classification, properties, selection criteria, commonly used refrigerants, alternative refrigerants, eco-friendly refrigerants; applications of refrigerants, refrigerants used in automobile air conditioning, Air Conditioning Systems- Classification, layouts, central / unitary air conditioning systems, System components, Switch and electrical wiring circuit.

**Unit III**
Design Automobile AC system: Load Calculations & Analysis- Design considerations for achieving desired inside/room conditions with respect to prevailing outside/environment conditions. Factors affecting/contributing towards the load on refrigeration & air conditioning systems, Cooling& heating load calculations, Load calculations for automobiles, Effect of air conditioning load on engine.

**Unit IV**
Air Distribution: Air Distribution Systems- Distribution ducting, sizing, supply / return ducts, type of grills, diffusers, ventilation, air noise level, layout of duct systems for automobiles and their impact on load calculations.
Electronic control: Air Routing & Temperature Control - Objectives of the dashboard re-circulating unit, automatic temperature control, controlling flow, control of air handling systems & air flow through - evaporator care.

**UNIT V**
AC Service & Control: Air Conditioning Service- Air conditioner maintenance & service - removing & replacing Components. Compressor service, Testing, Diagnosis & trouble shooting of air conditioning system, Refrigerant gas charging procedure &. Servicing of heater system, Air Conditioning Control - Common controls such as thermostats, humidistat, control dampers, pressure cut outs, relays.
Non-conventional Refrigerating System

1. Vapour Absorption Refrigeration System: Principle of absorption system, comparison between vapour compression system and vapor absorption system, theory of binary mixtures,
2. Aqua-ammonia vapour absorption system, theory of mixtures, temperature concentration diagram and enthalpy concentration diagram, processes used in aqua-ammonia absorption system, adiabatic mixing, separation, throttling process,
3. Vapour absorption system its components, working principle and mathematical analysis, b. Lithium-bromide- water absorption system its components, working principle, and mathematical analysis
4. Steam Jet Refrigeration System: Introduction, steam jet refrigeration system, components of steam jet refrigeration system, advantage and limitation of steam jet refrigeration system, performance of steam jet refrigeration system
5. Thermo-Electric Refrigeration System: Introduction, thermo-electric effects, Seebeck effect, Peltier effect, Thomson effect

Recommended books
1. A course in Refrigeration and Air Conditioning by S.C. Arora and S. Domkundwar, Dhanpatrai and sons, Delhi
2. Refrigeration and Air Conditioning by Manohar Prasad, New age international (P) limited, New Delhi

Automobile AC Lab.

1. To study the load requirement of AC in the vehicle.
2. To design the AC System for the automobile according to the use.
3. To select the components for Automobile AC System
4. To install the AC System in automobile
5. To diagnose the fault in Automobile AC System
6. To conduct the mechanical repair in the Automobile AC System
7. To charge the Refrigerant in the Automobile AC System
8. To test the Automobile AC System.

AC Components and Assembly Laboratory

Any five of the following practical should be performed and recorded in laboratory book
1. To study hermetically sealed compressor, condensing units, performance, volumetric efficiency, performance of the ideal compressor and power requirement
2. To study different types of condensers and condenser design
3. To study different types of evaporators and evaporator performance, pressure drop in tubes, frost.
4. To study selection of expansion valves, and capillaries for various refrigeration and airconditioning applications
5. Find out the heat rejection factor of condenser, condenser capacity, efficiency and effect of fouling factor
6. Capillary bore checking, performance test conducted by test rig (consisting of capillary tube and
thermostatic expansion valve) for finding C.O.P.
7. Familiarization of capillary selection guide
Level 7 (Semester 6)

RAC Safety

Unit I
Introduction to Industrial Safety: History and development of safety movement, need for safety, safety legislation: acts and rules, safety standards and codes, safety policy: safety organization and responsibilities and authorities of different levels, accident sequence theory, causes of accidents, accident prevention and control techniques, plant safety inspections, job safety analysis and investigation of accidents, first aid.

Unit II
Overview of Standard: ANSI/ASHRAE Standard, ANSI/ASME boiler and pressure vessel code, refrigeration, piping code, boiler and pressure vessel code, safety for refrigerant-containing components and accessories, nonelectrical, uniform mechanical code, basic national mechanical code

Unit III
Safety on the Job: Personal safety, protective clothing and equipment, harmful substances, safe work, practices, safety when working with electricity, refrigeration safety.

Unit IV
Safety for RAC Engineers: Types of accident, physical injuries from mechanical causes, use of tools and handling precautions, electrical injuries, electrical safety rules

Unit V
Injuries in RAC and Precaution: Refrigerant cylinder, corrosion, burn and other scalds, refrigerants and other gases Construction materials, fire fighting precautions, breathing, toxic gases, asphyxiation and precaution for the same.

Recommended books

Reference books
2. “Industrial refrigeration Hand Book”, Wilbert F. Stoecker

Process Planning and Cost Estimation

1. Introduction to Process Planning:

2. Process Planning activities:

3. Introduction to Cost Estimation:

4. Assembly & Installation Time Calculation:
 Time calculation: Study of RAC requirement, design of RAC System, Selection of RAC components & material, Fabrication of ducts and distribution system, installation of RAC System, Testing of RAC System.

Project

On the basis of learning in the B.Voc. Programme, i.e. Level 5 to Level 7, a project to be taken up by the student strengthening his/ her vocational skills
STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc.
Software Development (SD)
Branch Code: 106

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
## EVALUATION SCHEME
### NSFQ Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BSDV511</td>
<td>IT Foundations &amp; Programming Concepts</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BSDV512</td>
<td>Web Designing</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BSDV513</td>
<td>Programming in C</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BSDV514</td>
<td>Operating System (OS)</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BSDP511</td>
<td>Web Designing Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BSDP512</td>
<td>C Programming Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BSDP513</td>
<td>Language Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BSDT511</td>
<td>Technical Writer (SSC/Q0505)</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BSDT512</td>
<td>Infrastructure Engineer (SSC/Q0801)</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>BSDT513</td>
<td>Associate – CRM (SSC/Q2202)</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>610</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BSDV521</td>
<td>Data Structures</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BSDV522</td>
<td>Concepts of Data Mining</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BSDV523</td>
<td>OOPs with Java</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BSDV524</td>
<td>Multimedia Tools &amp; Applications</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BSDP521</td>
<td>Data Structure Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>BSDP522</td>
<td>Java Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>BSDP523</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>BSDT521</td>
<td>Web Developer (SSC/Q0503)</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BSDT522</td>
<td>Test Engineer (SSC/Q1301)</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>610</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## NSFQ Level 6 SEMESTER- III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching / Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BSDV631</td>
<td>Linux Operating System – Operations and Management</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV632</td>
<td>Software Engineering</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV633</td>
<td>Web Development using PHP</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV634</td>
<td>Windows Development Fundamental</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BKVE631</td>
<td>Uni. Human Values &amp; Ethics</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDP631</td>
<td>Web Development using PHP Lab</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDP632</td>
<td>Window Development Fundamentals Lab</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDT631</td>
<td>Junior Data Associate (SSC/Q0401)</td>
<td>Any one Training</td>
<td></td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDT632</td>
<td>IP Executive (SSC/Q6201)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDT633</td>
<td>Security Analyst (SSC/Q0901)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>

## NSFQ Level 6 SEMESTER- IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching / Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BSDV641</td>
<td>Software Testing and Project Management</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV642</td>
<td>Android Application Development</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV643</td>
<td>Window Configuration and Server Administration</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDV644</td>
<td>Management Information Systems</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDP641</td>
<td>Android Application Development Lab</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDP642</td>
<td>MIS Lab</td>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDT641</td>
<td>QA Engineer (SSC/Q1302)</td>
<td>Any one Training</td>
<td></td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BSDT642</td>
<td>Software Engineer (SSC/Q4601)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>610</strong></td>
<td></td>
<td></td>
<td><strong>500</strong></td>
<td><strong>24</strong></td>
</tr>
</tbody>
</table>
## NSFQ Level 7 SEMESTER- V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BSDV751</td>
<td>Technology Trends in IT</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BSDV752</td>
<td>Window Mobile Application Development</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BSDV753</td>
<td>Introduction to Python Programming</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BSDV754</td>
<td>Introduction to Microprocessors</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30 10 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BSDP751</td>
<td>Window Mobile Application Development Lab</td>
<td>30 20</td>
<td>30 50 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BSDP752</td>
<td>Python Programming Lab</td>
<td>30 20</td>
<td>30 50 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BSDT751</td>
<td>Management Trainee (SSC/Q6301)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BSDT752</td>
<td>Associate - Transactional F&amp;A (SSC/Q2301)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BSDT753</td>
<td>Consultant Network Security (SSC/Q0917)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>610</td>
<td>500 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BSDV761</td>
<td>Introduction to AI/ Computer Network Security</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BSDV762</td>
<td>e-Commerce / Introduction to Biometrics</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30 10 5 5 20</td>
<td>30 50 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BSDP761</td>
<td>Major Project based on AI or Computer Network Security</td>
<td>180 150</td>
<td>150 6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BSDT761</td>
<td>Master Trainer for Software Developer (SSC/Q0509)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BSDT762</td>
<td>Hardware Engineer (SSC/Q4701)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>670</td>
<td>500 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Detailed Curriculum**

**Software Requirements**

1. C Compiler (Turbo C/C++ etc)
2. WYSIWYG HTML editor (Eclipse, Netbeans etc)
3. Python
4. JDK
5. Apache Tomcat
6. PHP, WAMP/XAMPP
7. DBMS (ORACLE, MySQL etc)
8. .Net Framework
9. Android Studio

**Level 5 (Semester I)**

**IT Foundations & Programming Concepts**

**Computer characteristics:** Speed, storage, accuracy, diligence; Digital signals, Binary System, ASCII; Historic Evolution of Computers; Classification of computers: Microcomputer, Minicomputer, mainframes, Supercomputers; Personal computers: Desktop, Laptops, Palmtop, Tablet; Hardware & Software; Von Neumann model.

**Hardware:** CPU, Memory, Input devices, output devices. Memory units: RAM (SDRAM, DDR

RAM, RDRAM etc. feature wise comparison only); ROM-different types: Flash memory; Auxiliary storage: Magnetic devices, Optical Devices; Floppy, Hard disk, Memory stick, CD, DVD, CD/DVD-Writer; Input devices - keyboard, mouse, scanner, speech input devices, digital camera, Touch screen Voice Input, Joystick, Optical readers, bar code reader; Output devices: Display device, size and resolution; CRT, LCD, LED; Printers: Dot-matrix, Inkjet, Laser; Plotters, Sound cards & speaker.

**Software:** System software, Application software; concepts of files and folders, Introduction to Operating systems, Different types of operating systems: single user, multitasking, time-sharing multi-user; Booting, POST; Basic features of two GUI operating systems: Windows & Linux (Basic desk top management); Programming Languages, Compiler, Interpreter, Databases; Application software: Generic Features of Word processors, Spread sheets and Presentation software; Generic Introduction to Latex for scientific typesetting; Utilities and their use; Computer Viruses & Protection, Free software, open source.

**Computer Networks and Internet:** Connecting computers, Requirements for a network: Server, Workstation, switch, router, network operating systems; Internet: brief history, World Wide Web, Websites, URL, browsers, search engines, search tips; Internet connections: ISP, Dial-up, cable modem, WLL, DSL, leased line Wireless and Wi-Fi connectivity; email, email software features (send receive, filter, attach, forward, copy, blind copy); characteristics of web-based systems, Web pages, Web Programming Languages.


Reference Books:

1. Programming in C, R.S. Salaria, Khanna Publishing House
3. Handbook of Computer Fundamentals, N.S. Gill, Khanna Publishing House
Web Designing

UNIT-I
Introduction to HTTP, HTML, Basic HTML Tags, Body Tags, Coding Style, Modifying & formatting Text, Lists – Unordered, Ordered, Definition, Insert Links -Linking to another Document, Internal Links, Email Links, Relative and Absolute Links, Insert Images - Referencing Images, Clickable Images, Image Placement and Alignment, Image Size, Image Margins, Image Formats, Image Maps-Defining an Image Map, Advanced Coloring Body Content, Working with tables - Basic Tables, Table Attributes, Table Cell Attributes, Table Row Attributes, Tables Inside of Tables, Invisible Spacers, Working with Frame-Based Pages- Creating Windows, Single Window Frames, Creating Column Frames, Creating Row Frames, Creating Complex Frames.

UNIT-II
Cascading Style Sheet (CSS) – Introduction, creating style, using inline and external CSS, Creating Divs with ID style, Creating Tag& Class style, creating borders, Navigation links, creating effects with CSS. JavaScript – Introduction, use of JavaScript in webpages. Understand JavaScript event model, use some basic event and control webpage behavior.

UNIT-III
DESIGNING WEBSITES WITH DREAMWEAVER/EXPRESSION Web/AMAYA/COFEE CUP WYSIWYG HTML Editor - Introduction to WYSIWYG HTML editor, advantages of using HTML editors, Creating a New Site, Creating a New Page, Adding Images with Alternate Text, Inserting & Formatting Text, Aligning Images, Creating an Email Link, Linking to Other Websites, Testing & Targeting Links, Organizing Files & Folders
CREATING & INSERTING IMAGES - Optimizing Images for the Web, Saving GIFs & PNGs in Photoshop, Inserting GIFs, Adjusting Transparency Settings, Saving JPGs for the Web

UNIT-IV
DESIGNING ACCESSIBLE TABLES - Understanding Tables & Accessibility, Using Tables for Tabular Data, styling a Table, Editing Table Layouts, Adding Style to a Table Using CSS CREATING WEBSITES WITH FRAMES - Introducing Frames, creating a Frameset, Opening Pages into Frames, Controlling Scrollbars & Borders, Targeting Links in Frames CUSTOMIZING THE INTERFACE - Opening an Existing Site, Reviewing Menu Options & Preferences, Comparing the Macintosh & PC Interfaces, Previewing in Browsers & Device Central
Introduction to Responsive Web Designing – Introduction, advantages, creating and using responsive web pages.

UNIT-V

Reference Books:
1. Internet & Web Development, Soma Das Gupta, Khanna Publishing House
2. Web Designing and Development, Tanweer Alam, Khanna Publishing House
Programming in C

Introduction to ‘C’ Language - Character set, Variables and Identifiers, Built-in Data Types, Variable Definition, Arithmetic operators and Expressions, Constants and Literals, Simple assignment statement, Basic input/output statement, Simple ‘C’ programs.

Conditional Statements and Loops - Decision making within a program, Conditions, Relational Operators, Logical Connectives, if statement, if-else statement, Loops: while loop, do while, for loop, Nested loops, Infinite loops, Switch statement, structured Programming.

Arrays - One dimensional arrays: Array manipulation; Searching, Insertion, Deletion of an element from an array; Finding the largest/smallest element in an array; Two dimensional arrays, Addition/Multiplication of two matrices, Transpose of a square matrix; Null terminated strings as array of characters, Standard library string functions

Functions - Top-down approach of problem solving, Modular programming and functions, Standard Library of C functions, Prototype of a function: Formal parameter list, Return Type, Function call, Block structure, Passing arguments to a Function: call by reference, call by value, Recursive Functions, arrays as function arguments.

Storage Classes - Scope and extent, Storage Classes in a single source file: auto, extern and static, register, Storage Classes in a multiple source files: extern and static

Structures and Unions - Structure variables, initialization, structure assignment, nested structure, structures and functions, structures and arrays: arrays of structures, structures containing arrays, unions

Pointers - Address operators, pointer type declaration, pointer assignment, pointer initialization, pointer arithmetic, functions and pointers, Arrays and Pointers, pointer arrays, pointers and structures, dynamic memory allocation.

File Processing - Concept of Files, File opening in various modes and closing of a file, reading from a file, writing onto a file

Reference Books:
1. Programming in C, R.S. Salaria, Khanna Publishing House
3. Test your Skills in C, R. S. Salaria, Khanna Publishing House
**Operating System (OS)**

**System Software:** Operating System, Compiler, Interpreter and Assembler;

**Operating System:** Need for Operating System, Functions of Operating System (Processor Management, Memory Management, File Management and Device Management), Types of Operating System - Interactive (GUI based), Time Sharing, Real Time and Distributed, commonly used Operating System: UNIX, LINUX, Windows, Solaris, BOSS (Bharat Operating System Solutions); Mobile OS – Android, Symbian, IOS.

**Utility Software:** Anti-Virus, File Management tools, Compression tools and Disk Management tools (Disk Cleanup, Disk Defragmenter, Backup).

**Reference Books:**

1. Operating Systems, EktaWalia, Khanna Publishing House
Web Designing Lab

1. Generic awareness about Hyper Text s Language (HTML).
2. Designing of websites.
5. Functional knowledge of web hosting

C Programming Lab

1. Write a Program to find the area and circumference of circle
2. Write a Program to swap two numbers with or without third variable
3. Write a program to convert temperature from Fahrenheit to Celsius
4. Write a program to add two numbers
5. Write a C program to input any alphabet and check whether it is vowel or consonant.
6. Write a C program to input any character and check whether it is alphabet, digit or special character.
7. Calculator program with Basic operations using switch
8. Program to find factorial of a given number
9. Program to find sum of Fibonacci series up to N Terms.
10. Program to check whether the number is palindrome or not
11. Program to find the second largest number in an array.
12. Write a 'C' function to print reverse of a given number using return and parameter method.(call by value)
13. Write a 'C' function to calculate the sum of digits of a given number using return and parameter method.(call by value)
15. Find the repeating elements in a given array
16. C program to delete duplicate element in an array.
17. C program to find multiplication of two matrices.
18. Program to store and access “id, name and percentage” for 3 students. Structure array is used in this program to store and display records for many students. You can store “n” number of students record by declaring structure variable as ‘struct student record[n]’, where n can be 1000 or 5000 etc.
19. Program to copy one file into another.
20. Program to count number of alphabet, number, spaces, newline characters from a file.
Level 5 (Semester II)
Data Structure

UNIT I
An Overview of Computers and Programming - Simple program logic, The steps involved in the program development cycle, Pseudo code statements and flowchart symbols, Using a sentinel value to end a program, Programming and user environments, The evolution of programming models.

UNIT–II
The concept of data structure, Abstract data structure, Analysis of Algorithm, The concept of List Introduction to stack & primitive operation on stack, Stack as an abstract data type, Multiple Stack, Stacks application: Infix, post fix, Prefix and Recursion, Introduction to queues, Primitive Operations on the Queues, Queue as an abstract data type, Circular queue, Dequeue, Priority queue, Applications of queue

UNIT–III
Introduction to the Linked List of Stacks, Basic operations on linked list, Stacks and queues as a circular linked list, Header nodes, Doubly Linked List, Circular Linked List, Stacks & Queues as a Circular Linked List, Application of Linked List.

UNIT–IV
TREES - Basic Terminology, Binary Trees, Tree Representations as Array & Linked List, Basic operation on Binary tree, Traversal of binary trees: - In order, Preorder & post order, Application of Binary tree, threaded binary tree, B-tree & Height balanced tree, B+ & B* trees, 2-3 trees, Binary tree representation of trees, Counting binary trees

UNIT–V
Sequential Searching, Binary search, Insertion sort, Selection sort, Quick sort, Bubble sort, Heap sort, Comparison of sorting methods
Hash Table, Collision resolution Techniques, Introduction to graphs, Definition, Terminology, Directed, Undirected & Weighted graph, Representation of graphs, Graph Traversal-Depth first & Breadth first search, Spanning Trees, minimum spanning Tree, Shortest path algorithm

Reference Books:

1. Data Structures, R.S. Salaria, Khanna Publishing House
Concepts of Data Mining

Unit-I
Introduction to Data warehousing, needs for developing data Warehouse, Data warehouse systems and its Components, Design of Data Warehouse, Dimension and Measures, Data Marts:-Dependent Data Marts, Independents Data Marts & Distributed Data Marts, Conceptual Modeling of Data Warehouses: -Star Schema, Snow flake Schema, Fact Constellations, Multidimensional Data Model & Aggregates.

Unit-II

UNIT-III
Introduction to Data Mining, Knowledge Discovery, Data Mining Functionalities, Data Mining System categorization and its Issues. Data Processing:-Data Cleaning, Data Integration and Transformation. Data Reduction, Data Mining Statistics. Guidelines for Successful Data Mining.

Unit-IV
Association Rule Mining:-Introduction, Basic, The Task and a Naïve Algorithm, Apriori Algorithms, Improving the efficiency of the Apriori Algorithm, Apriori - Tid, Direct Hasing and Pruning (DHP), Dynamic Item set Counting (DIC), Mining Frequent Patterns without Candidate Generation (FP-Growth), Performance Evaluation of Algorithms,

Unit-V
Classification:-Introduction, Decision Tree, The Tree Induction Algorithm, Split Algorithms Basedon Information Theory, Split Algorithm Based on the Gini Index, Over fitting and Pruning, Decision Trees Rules, Naïve Bayes Method.


Reference Books:

1. Data Mining and Warehousing, Ikvinderpal Singh, Khanna Publishing House
Object Oriented Programming with JAVA

UNIT–I
C++ vs JAVA, JAVA and Internet and WWW, JAVA support systems, JAVA environment.

JAVA program structure, Tokens, Statements, JAVA virtual machine, Constant & Variables, Data Types, Declaration of Variables, Scope of Variables, Symbolic Constants, Type Casting.

Operators: Arithmetic, Relational, Logical Assignments, Increment and Decrement, Conditional, Bitwise, Special, Expressions & its evaluation.
If statement, if...else... statement, Nesting of if...else... statements, else...if Ladder, Switch, ?operators, Loops – While, Do, For, Jumps in Loops, Labelled Loops.

UNIT–II
Defining a Class, Adding Variables and Methods, Creating Objects, Accessing Class Members, Constructors, Methods Overloading, Static Members, Nesting of Methods.

Inheritance: Extending a Class, Overriding Methods, Final Variables and Methods, Final Classes, Finalize Methods, Abstract methods and Classes, Visibility Control.

UNIT–III
Arrays: One Dimensional & two Dimensional, strings, Vectors, wrapper Classes, Defining Interface Extending Interface, Implementing Interface, Accessing Interface Variable, System Packages, Using System Package, Adding a Class to a Packages, Hiding Classes.

UNIT–IV
Creating Threads, Extending the Threads Class, Stopping and Blocking a Thread, Life Cycle of a Thread, Using Thread Methods, Thread Exceptions, Thread Priority, Synchronization, Implementing the Runnable Interface.

UNIT–V
Local and Remote Applets Vs Applications, Writing Applets, Applets Life Cycle, Creating an Executable Applet, Designing a Web Page, Applet Tag, Adding Applet to HTML File, Running the Applet, Passing Parameters to Applets, Aligning the Display, HTML Tags & Applets, Getting Input from the User.

Reference Books:
1. Object Oriented Systems with Java, TanweerAlam, Khanna Publishing House
2. Core Java, TanweerAlam, Khanna Publishing House
MULTIMEDIA – TOOLS & APPLICATIONS

UNIT-I

UNIT-II
SOUND - Sound and its Attributes, Sound and Its Effects in Multimedia, Frequency, Sound Depth, Channels and its Effects on Quality and Storage, Size Estimation of Space of a Sound File, Sound Card Standard – FM Synthesis Cards, Waves Table Cards, MIDI and MP3 Files and Devices, 3D Sounds, Recording and editing sound using sound editors like Audacity, Sound forge etc.

UNIT-III

UNIT-IV
VIDEO- Basic of Video, Analog and Digital Video Type of Video, Digitization of Analog Video, Video Standard – NTSC, Pal, HDTV, Video Capturing Media /Instruments Videodisk Camcorder Compression Techniques, File Formats AVI, MJPG, MPEG, Video Editing and Movie Making Tools, converting formats of videos, recording and editing videos using video editing software like adobe premiere or Sony Vegas.

UNIT-V
ANIMATION- Concepts of animation, 2D and 3D animation, tools for creating animation, character and text animation, creating simple animation using GIF animator and flash, Morphing and Applications.

Authoring tools for Multimedia – Introduction to various types of multimedia authoring tools, CD/DVD based and web based tools, features and limitations, creating multimedia package using all components.

Reference Books:
2. Fundamentals of Multimedia, Ramesh Bangia, Khanna Publishing House
Data Structure Lab

1. Implement stack. Write functions like push, pop, Initialize, Empty or Full.
2. WAP to Convert the Infix expression into postfix using STACK.
3. WAP to Convert the Infix expression into Prefix using STACK.
4. Implement concept of queues
5. Implement circular Queue using Array.
6. WAP to implement STACK using Link List
7. WAP to implement Queue using Link List
8. Implement queues as a circular linked list.
9. Implementing doubly linked list
10. Binary search tree to sort an array

Java Lab

1. Write a Program to accept a String as a Command line argument and the program should print a Welcome message.
2. Create a class Box that uses a parameterized method to initialize the dimensions of a box. (dimensions are width, height, depth of double type). The class should have a method that can return volume. Obtain an object and print the corresponding volume in main() function.
3. Write a Program that will check whether a given String is Palindrome or not.
4. Write a Java Program for Multiplication of two matrices.
5. Write a program to check if given String is Palindrome or not.
6. Given two strings, append them together (known as “concatenation”) and return the result. However, if the concatenation creates a double-char, then omit one of the chars. If the inputs are “Mark” and “Kate” then the output should be “markate”.
7. Create an abstract class Instrument which is having the abstract function play.
Create three more sub classes from Instrument which is Piano, Flute, Guitar. Override the play method inside all three classes printing a message
- “Piano is playing tantantantan” for Piano class
- “Flute is playing toootootootoot” for Flute class
- “Guitar is playing tintinitin” for Guitar class
8. Write a program that takes as input the size of the array and the elements in the array. The program then asks the user to enter a particular index and prints the element at that index.
This program may generate Array Index Out Of Bounds Exception. Use exception handling mechanisms to handle this exception. In the catch block, print the class name of the exception thrown.
9. Create two threads and assign names ‘Scooby’ and ‘Shaggy’ to the two threads. Display both thread names.
10. Write an Applet program in Java to display “Welcome to Java”.
Level 6 (Semester III)

Linux Operating System - Operations & Management

UNIT – I
Linux introduction and file system - Basic Features, Advantages, Installing requirement, Basic Architecture of Unix/Linux system, Kernel, Shell.
Linux File system-Boot block, super block, Inode table, data blocks, How Linux access files, storage files, Linux standard directories, Commands for files and directories cd, ls, cp, md, rm, mkdir, rmdir, more, less, creating and viewing files, using cat, file comparisons, View files, disk related commands, checking disk free spaces, Partitioning the Hard drive for Linux, Installing the Linux system, System startup and shut-down.

UNIT–II
Essential Linux commands Understanding shells, Processes in Linux process fundamentals, connecting processes with pipes, redirecting input output, manual help, Background processing, managing multiple processes, changing process priority, scheduling of processes at command, batch commands, kill, ps, who, sleep, Printing commands, grape, fgrep, find, sort, Cal, banner, touch, file, file related commands- ws, sat, cut, grep, dd, etc.Mathematical commands- bc, expr, factor, units.vi, joe, vim editor

UNIT–III
Shell programming Basic of shell programming, Various types of shell, shell programming in bash, conditional and looping statements, case statements, parameter passing and arguments, Shell variables, shell keywords, Creating Shell programs for automate system tasks and report printing, use of grep in shell, awk programming.

UNIT–IV
System administration Common administrative tasks, identifying administrative files – configuration and log files, Role of system administrator, Managing user accounts- adding & deleting users, changing permissions and ownerships, Creating and managing groups, modifying group attributes, Temporary disable user’s accounts, creating and mounting file system, checking and monitoring system performance file security & Permissions, becoming super user using su. Getting system information - host name, disk partitions & sizes, users, kernel.
Backup and restore files, linuxconf. utility in GUI, reconfiguration hardware with kudzu Configure desktop-X configurator, understanding XF86config file, starting & using X desktop. KDE & Gnome graphical interfaces, changing X settings.

UNIT–V
Basic networking administration Setting up a LAN using Linux, choosing peer to peer vs client/server model, setting up an Ethernet Lan, configuring host computers, checking Ethernet connecting, connecting to internet, administration in a networked environment, common networking administrative tasks, the network file system, configuring Ethernet, initializing Ethernet Interface, ifconfig, netstat and netconfig commands a TCP/IP networks, DNS services, routing using Linux, SLIP & PPP services, UUCP. Installation & Administration of mail server, ftp server and Apache web server.
(Software Engineering)

UNIT - I
SOFTWARE PROJECT MANAGEMENT: Project Management Concepts – People Problem and Process

UNIT - II


UNIT – III

UNIT - IV


UNIT - V

Reference Books:
1. Software Engineering, N.S. Gill, Khanna Publishing House
Web Development using PHP

UNIT I
Introduction to PHP as a programming Language: - Advantages of PHP, the server side architecture Decomposed, overview of PHP, history, object oriented support, benefits in running PHP as a server side script. Installing a web server, Internet information server, and IIS installation, testing web server setup.

UNIT II
The basics of PHP: - data types, variables, constants, operators, Arrays, Conditional statements (if statement, Executing Multiple Statements, else if clause and switch statement), Iterations (for loop, while loop, controlling an array using a while loop, do while statement, for each loop and special loop key words)

UNIT III
Functions, user defined functions, functions with arguments, built in functions (print(), includer(), header(), phpinfo() ), PHP server Variables, working with date and time , performing mathematical operations , working with string functions . System Variable (GET, POST, cookies& Session, Forums)

UNIT IV
Working with forms, form elements (Text Box, Text Area, Password, Radio Button, Checkbox, The Combo Box, Hidden Field and image), adding elements to a form, uploading files to the Web Server using PHP, building a challenge and response subsystem and understanding the functionality of the FORM attribute Method Regular Expressions: - Engine, types of Regular Expressions, symbols used in Regular Expressions. Error handling in PHP: - Displaying errors, warnings, types of errors, error levels in PHP, logging Errors and Ignoring errors.

UNIT V
Data base connectivity using PHP (MySQL, ODBC, ORACLE, SQL) Performing, executing Commands, different types of Data Base Operations like Insertion, deletion, update and query on data

Reference Books:
1. Mastering PHP, WebTech Solutions, Khanna Publishing House
2. Learning PHP, Ramesh Bangia, Khanna Publishing House
Window Development Fundamentals

1. Programming web applications
2. Working with data and services
3. Troubleshooting and debugging web applications
4. Working with client-side scripting
5. Configuring and deploying web applications
6. Understanding core programming
7. Understanding object-oriented programming
8. Understanding general software development
9. Understanding web applications
10. Understanding desktop applications
11. Understanding databases

Reference Books:
1. Internet and Web Development, Soma Das Gupta, Khanna Publishing House
Web Development using PHP Lab

1. Write a program to display “Hello World”.
2. Write a program to print an array of Strings.
3. Write a program to print each element of an array using foreach().
4. Write a program to find number of elements in an array.
5. Write a program to sort elements in an array in ascending order.
6. Write a program to find the sum of elements in an array.
7. Write a program to find the product of elements in an array.
8. Write a program to split a string as array elements based on delimiter.
9. Write a program to combine the array elements into a string with given delimiter.
10. Write a program to join the array elements into a string.
11. Write a program to merge two arrays into a new array.
12. Write a program to remove the duplicated values from an array.
13. Write a programs to create simple Login and Logout using sessions.
14. Write a program to Upload a file to the Server.
15. Write a program to connect to the server and selecting database.
16. Write a program to Insert records to the table in Database.
17. Write a program to fetch records from the table in Database.
18. Write a program to Store and Read an image in Database.
19. Write a program to create a simple Registration form.
20. A simple CRUD operations using PHP and Mysql.

Window Development Fundamentals Lab

1. Client-side scripting Programs
2. Deploying web applications
3. Basic object-oriented programs
4. Understanding desktop applications
5. Basic SQL Queries
Level 6 (Semester IV)

Software Testing & Project Management

UNIT - I
Testing basics and Development Models: Principals and context of testing in software production, Usability and Accessibility Testing, Phases of Software Project, Process models to represents different phases, Software Quality Control and its relation with testing, validating and verification, Software Development life cycle models, various development models.
White Box Testing: White Box Testing - Static Testing, Structural Testing-Unit code functional testing, Code coverage testing, code complexity testing,
Black Box Testing- What? Why and when to do Black box testing, Requirements based testing, Positive and Negative Testing, Boundary value testing, Decision Tables, Equivalence Partitioning, State Based or Graph Based Testing, Compatibility Testing, User Documentation Testing, Domain Testing.

UNIT - II
Integration Testing: Introduction and types of integration testing, Scenario testing, defect bash.
System and Acceptance Testing- Overview, functional and non-functional testing, Acceptance testing.
Overview of some software testing tools: WinRunner, LoadRunner, Test Director.
(Some practical should be conducted using these tools)

UNIT- III
Performance Testing- Introduction, factors related to performance testing, methodology for performing testing, Regression Testing,
Ad hoc Testing- Overview, Buddy & pair testing, Exploratory testing, Interactive testing, Agile and extreme testing. Testing of Object Oriented Testing – Introduction, Differences in OO testing.

UNIT – IV
Software Project Management: Overview, Software Project Management Framework, Software Development life cycle,
Software Project Scope: Need to scope a software project, scope management process, communication techniques and tools, communication methodology
UNIT – V
Software Project Estimation: Work Breakdown structure (WBS), steps in WBS, Measuring efforts for a project, techniques for estimation – SLOC, FP, COCOMO and Delphi methods.
Project Scheduling: Scheduling and its need, scheduling basics, Gannt Chart, Network scheduling techniques, Pert and CPM.Using a Project Management Tool: Introduction to MS Project 2000, Managing tasks in MS Project 2000, Tracing a project plan, creating and displaying project information reports.
Android Application Development

UNIT-I

UNIT-II
Designing User Interface Using Views – Basic Views- TextView, Button, Image Button, Check Box, Toggle Button, Radio Button etc., Progress Bar View and Auto Complete Text View, Time Picker and Date Picker View, List View, Image View, Image Switcher and Grid View, Digital Clock & Analog Clock Views Notification and Toast, Parameters , on Intents, Pending intents, Status bar notifications Toast notifications.

UNIT-III
Menus, Localization, Options menu, Context menu Dialogs-Alert dialog, Custom dialog, Dialog as Activity Orientation and Movement- Pitch, roll and yaw, Natural device orientation, Reference frame remapping SMS - Sending and Receiving Working with Media –Playing audio and video, Recording audio and video.

UNIT-IV
Location and Maps - Google maps, Using GPS to find current location. Working with data storage - Shared preferences, Preferences activity, Files access, Using External storage, SQLite database Animation-View animation, Drawable animation Working with Sensors - Finding sensors, Accelerometers, Gyroscopes, Other types Working with Camera – Controlling the camera, Preview and overlays, Taking pictures

UNIT-V
Content providers- Content provider introduction, Query providers Network Communication - Web Services, HTTP Client, XML and JSON, Using e-mails. Services - Service lifecycle, Foreground service, Creating own services Publishing and Distributing Your App -Preparing for publishing, Google Play requirements, Signing and preparing the graphics, Publishing to the Android Market, Monetization, Tips on becoming a top app, Google analytics

Reference Books:
Learning Android, Ramesh Bangia, Khanna Publishing House
Windows Configuration and Server Administration

**Understanding Windows Programming Basics:** Identify Windows application types, Implement user interface design.

**Creating Windows Forms Applications:** Create and handle events, Understand Windows Forms inheritance, understand how to create new controls and extend existing controls, Validate and implement user input, Debug a Windows-based application.

**Creating Windows Services Applications:** Create a Windows Services application, Install a Windows Services application.

**Accessing Data in a Windows Forms Application:** Understand data access methods for a Windows Application, Understand data bound controls.

**Deploying a Windows Application:** Understand windows application deployment methods, integrating data.

**Network basics:** Type of Networks, Topologies, Transmission media, Install UTP (Straight, Cross, Rollover Cables), IP Addressing, Subnetting, OSI Model, TCP/IP Model, Wireless Network, Network Devices.

**Installation:** Installation Server, Drivers, Working with windows server Devices, Troubleshooting Devices & Drivers, Managing system updates.

**Working With Disk Storage:** Type of Disk Storage, Type of volumes, Implementing fault tolerance, Use disk management tools, Disk Quota, Troubleshooting disk management, Shadow copy.

**Domain Controller:** Install Active Directory, Manage Active Directory Component, Working with OU Structure, Working with Domain User account, Working with Domain Groups, Troubleshooting Active Directory.

**Domain Name Services (DNS):** Define Name resolution, Install DNS, Configure DNS Client, Manage and Troubleshoot DNS.

**Dynamic Host Configuration Protocol:** Configure DNS Server, Working With Super Scope, Configure DHCP Client, Manage and Troubleshoot DHCP Server.

**Backup and Restore:** Requirement for Backup and Recovery AD, Issue for AD Backup and Recovery, Steps for Backup and Recovery AD.
Management Information System

Unit I
An introduction to information systems, Information systems in organizations, Information Technology Concepts, The IS Revolution; Information requirement for the different levels of management, transaction processing system, Management information system, Decision support system. Strategic Role of Information Systems. Business Processes; Information management, and Decision Making. Computers and Information Processing;

Unit II
Transaction processing system; hardware and software requirements, tools used, case studies, merits and demerits of transaction processing system.

Unit III
Managerial control, Information and tools required, difference between transactional system and managerial system. Frequency of taking outputs, Need for interconnected system, common database, Redundancy control, case studies. Decision support system, concept and tools, case studies, virtual organizations, strategic decisions-unstructured approach, cost and values of unstructured information.

Unit IV
Optimization techniques, difference between optimization tools and DSS tools expert system, difference between expert system and management information system. Role of chief Information officer.

Android Application Development Lab

1. Write a simple Application which will print “Hello World!”
2. Write a simple Application that uses UI Layout and Control.
3. Write a simple Application that makes use of Style & Themes.
4. Write a simple Application that uses Event Handling.
5. Write a simple Application that uses Alarm, Notification.
6. Make a location based app.
7. Write a program that shows the use animation.
8. Write a program that shows the use of Image Effects.
9. Write a program that shows the use Image Switcher.
10. Write a program that shows the use of database.

MIS Lab

Experiments to be covered based on the theory covered in class
Level 7 (Semester V)
Technology Trends in IT

Unit-I
Internet of Things (IoT) – Definition of IoT, History of IoT, IoT vs. similar concepts, Application/Segment overview, Technology overview

Unit-II
Big Data Analytics: Concepts, examples of big data analytics, benefits of big data analytics, Technologies, and Applications, requirements for being successful with big data analytics

Unit-III
Cloud Computing – Introduction, Why cloud services are popular, advantages, Characteristics, Service models, Deployment of cloud services, Potential privacy risks

Unit-IV

Unit-V
Wearable Technologies – Introduction, Applications of Wearable Technology, Challenges to Wearable Technology, various Wearable devices.

Reference Books:
2. Internet of Things, Jeeva Jose, Khanna Publishing House
4. Data Sciences and Analytics, V.K. Jain, Khanna Publishing House

Windows Mobile Application Development

Unit-I
INTRODUCTION TO WINDOWS 8 APPLICATION DEVELOPMENT - brief history of windows application development, History of APIs and Tools, Operating System Input Methods

The Windows Charm Bar, Start Button, Search Button, Share Button, Devices Button, Settings Button, Windows Desktop, Switching between Desktop Programs
GETTING TO KNOW DEVELOPMENT ENVIRONMENT - Introducing the Toolset, Visual Studio IDE:

Creating a New Project, Lighting Up Your Applications with Expression Blend

UNIT-II

CREATING WINDOWS 8 STYLE APPLICATIONS WITH HTML5, CSS, AND JAVASCRIPT - HTML5 and CSS on the Web, HTML5 Technologies, HTML5 Applications on Windows Runtime, The Windows Library for JavaScript (WinJS), Creating Windows 8 Style Applications with JavaScript, Accessing the Filesystem, Managing Data, Respecting the User’s Device

UNIT-III
USING XAML TO CREATE WINDOWS 8 STYLE USER INTERFACES - Describing the User Interface Using XAML, Using Namespaces, Understanding the Layout Management System, Reusable Resources in XAML, Basic Controls in Windows 8 Style Applications: Controls with Simply Accessing the Internet: e Values, Content Controls, Working with Data: Data Binding Dependency Properties and Notifications, Binding Modes and Directions

WORKING WITH XAML CONTROLS - Using Animations in Application, Designing the Visual Look of a Control, Working with Complex Controls: Getting to Know the List View Base Controls, Using the Grid View Control, Binding to Data, Grouping Data, Defining Visual Groups

BUILDING WINDOWS 8 STYLE APPLICATIONS - The Lifecycle of a Windows 8 Application, Deploying Windows 8 Apps, Commanding Surfaces, Persisting Application Data, Applications and the Start Screen

UNIT-IV
CREATING MULTI-PAGE APPLICATIONS - Navigation Basics, working with Pages, Using the Split Application and Grid Application Templates

BUILDING CONNECTED APPLICATIONS - Integrating with the Operating System and Other Apps: Picker Unified Design to Access Data, Understanding the Concept of Contracts, Accessing the Internet: Detecting the Changes of Internet Connectivity, Using Feeds, Accessing Windows Live


UNIT-V
ADVANCED PROGRAMMING CONCEPTS - Building Solutions with Multiple Languages: Hybrid Solutions, Background Tasks: Understanding Background Tasks, How Background Tasks Work,
Cancelling Background Tasks, Implementing Background Tasks, creating a Simple Background Task, Managing Task Progress and Cancelation, Input Devices

TESTING AND DEBUGGING WINDOWS 8 APPLICATIONS - The Quality of Software, Becoming Familiar with Debugging, Controlling the Program Flow in Debug Mode, Monitoring and Editing Variables, Changing the Code While Debugging, Windows 8 Style Application-Specific Scenarios, Introduction to Software Testing, Introduction to Unit Testing, Unit Testing Windows 8 Style Applications


Introduction to Python Programming

- Familiarization with the basics of Python programming: a simple “hello world” program, process of writing a program, running it, and print statements; simple data-types: integer, float, string

- Introduce the notion of a variable, and methods to manipulate it (concept of L-value and R-value even if not taught explicitly)

- Knowledge of data types and operators: accepting input from the console, assignment statement, expressions, operators and their precedence.

- Conditional statements: if, if-else, if-elif-else; simple programs: e.g.: absolute value, sort numbers, and divisibility.

- Notion of iterative computation and control flow: for, while, flowcharts, decision trees

- and pseudo code; write a lot of programs: interest calculation, primarily testing, and factorials.

- Idea of debugging: errors and exceptions; debugging: pdb, break points.

- Lists, tuples and dictionary: finding the maximum, minimum, mean; linear search on list/tuple of numbers, and counting the frequency of elements in a list using a dictionary. Introduce the notion of accessing elements in a collection using numbers and names.

- Sorting algorithm: bubble and insertion sort; count the number of operations while sorting.
• Strings: compare, concat, substring; notion of states and transitions using state transition diagrams.

Reference Books:

1. Introduction to Computing and Problem Solving With Python, Jeeva Jose, Khanna Publishing House
2. Taming Python by Programming, Jeeva Jose, Khanna Publishing House

Introduction to Microprocessors

Digital Design and VHDL
Introduction
Combinational Logic
Structural Modeling
Sequential Logic
Finite State Machines
Parameterized Modules
Testbenches

Arithmetic Logic Unit (ALU)
1. Introduction
2. Arithmetic Circuits
3. ALU
4. Number Systems

Microprocessor I: Instruction Data Set. Machine Language
1. Introduction
2. Assembly Language
3. Machine Language
4. Programming
5. Addressing Modes
6. Lights, Camera, Action: Compiling, Assembling, and Loading
7. Odds and Ends

Microprocessor II: Control and Datapath Design. Single-Cycle Processor
1. Introduction
2. Performance Analysis
3. Single-Cycle Processor

Microprocessor III: Control and Datapath Design. Multi-cycle Processor
1. Introduction
2. Performance Analysis
3. Multicycle Processor
4. Pipelined Processor
Memory systems and I/O.
Introduction
Memory System
Caches
Virtual Memory
Memory-Mapped I/O
Memory map
I/O Devices
Buses and organization

Reference Books:
Windows Mobile Application Development Lab
1. Working with J2ME Features
2. Threads & High level UI
3. Developing networked applications using the wireless toolkit
4. Authentication with a webserver
5. Study Windows API’s. Find out their relationship with MFC classes. Appreciate how they are helpful in finding complexities of windows programming.

Python Programming Lab
1. Python Program to Print Hello world!
2. Python Program to Add Two Numbers
3. Python Program to Check if a Number is Odd or Even
4. Python Program to Solve Quadratic Equation
5. Python Program to Check Armstrong Number
6. Python Program to Find the Sum of Natural Numbers
7. Write a Python program to get unique values from a list
8. Python Program to Illustrate Different Tuple Operations
9. Python Program to Check Whether a String is Palindrome or Not
10. Write a Python program to remove duplicates from Dictionary
11. 1. Write a Python program to sort a list alphabetically in adictionary
2. 2. Python Program to Illustrate Different Set Operations (Union, Intersection, Difference and Symmetric Difference)
3. Python Program to illustrate the concept of Binary Relations in Set.
14. Python Program to Generate a Random Number
15. 5. Python Program to Convert Decimal to Binary, Octal and Hexadecimal
16. 6. Python Program to Find HCF or GCD
17. Given two integers x and n, compute $x^n$.
18. Python Program to Find Factors of Number
19. Python Program to Make a Simple Calculator
20. Python Program to Find Factorial of Number Using Recursion
Level 7 (Semester VI)
Introduction to AI

UNIT – I
Overview of A.I: Introduction to AI, Importance of AI, AI and its related field, AI techniques, Criteria for success. Problems, problem space and search: Defining the problem as a state space search, Production system and its characteristics, Issues in the design of the search problem Heuristic search techniques: Generate and test, hill climbing, best first search technique, problem reduction, constraint satisfaction

UNIT - II
Knowledge Representation: Definition and importance of knowledge, Knowledge representation, Various approaches used in knowledge representation, Issues in knowledge representation. Using Predicate Logic: Representing Simple Facts in logic, Representing instances and is-a relationship, Computable function and predicate.

UNIT - III

UNIT - IV

Reference Books:
1. Artificial Intelligence, Munish Chandra Trivedi, Khanna Publishing House

OR

Computer Network Security

UNIT-I

UNIT-II
Ethernet Networking: Half and Full-Duplex Ethernet, Ethernet at the Data Link Layer, Ethernet at the Physical Layer. Switching Technologies: layer-2 switching, address learning in layer-2 switches,
network loop problems in layer-2 switched networks, Spanning-Tree Protocol, LAN switch types and working with layer-2 switches, Wireless LAN

UNIT- III

UNIT- IV

Reference Books:
1. Information & Computer Security, Sarika Gupta, Khanna Publishing House
e-Commerce

Unit I

Unit II
Internet and E-Business: Introduction to Internet and its application, Intranet and Extranets. World Wide Web, Internet Architectures, Internet Applications, Business Applications on Internet, E-Shopping, Electronic Data Interchange, Components of Electronic Data Interchange, Creating Web Pages using HTML.

Unit III

Unit IV
Applications in E-commerce: E-commerce Applications in Manufacturing, Wholesale, Retail and Service Sector.

Reference Books:
1. E-Commerce, Sarika Gupta, Khanna Publishing House

OR
Introduction to Biometrics

Unit I
Concepts - biometric recognition, biometrics, requirements for biometrics
Biometric systems, their modes and architectures, Biometric system errors and evaluation,
Software Development

Unit II
Overview, comparison and evaluation of various biometrics
Unimodal biometric systems, their advantages, disadvantages and limits
Multimodal biometric systems, their modes of operation, levels of fusion

Unit III
Biometric pattern recognition methods
Privacy protection and social acceptance
Biometric standardization, data formats
Design and implementation of biometric systems, applications of biometric systems, biometric databases, security of biometric systems
DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc.
Graphics & Multimedia (GM)
Branch code: 107

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
# EVALUATION SCHEME

**Graphics & Multimedia**

## Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV511</td>
<td>Web Applications</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV512</td>
<td>Communication Skill-I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BGMV513</td>
<td>Graphic Design (Basic Sketching and Human Anatomy in Drawing)</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMV514</td>
<td>Illustration And Photo-Editing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>BGMP511</td>
<td>Web Applications –Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>BGMP512</td>
<td>Illustration And Photo-Editing –Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BGMP513</td>
<td>Language Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BGMT511</td>
<td>Character Designer MES/Q0502</td>
<td>Any one Training 400 hrs / 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>BGMT512</td>
<td>Storyboard Artist MES/Q0507</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BGMT513</td>
<td>Editor MES/Q1401</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Total** | 610 | | 500 | 24 |

## NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV521</td>
<td>Pre-Production</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV522</td>
<td>Audio Editing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BGMV523</td>
<td>Video Editing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMV524</td>
<td>Communication Skill- II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>BGMP521</td>
<td>Audio Editing-Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>BGMP522</td>
<td>Video Editing-Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BGMP523</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BGMT521</td>
<td>Any one of the QP’s can be opted as offered in Semester I</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
</tbody>
</table>

**Total** | 610 | | 500 | 24 |
### NSFQ Level 6 SEMESTER- III

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV631</td>
<td></td>
<td>Principles of Animation and Techniques of Animation</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV632</td>
<td></td>
<td>Basic of 3-D Modelling</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BGMV633</td>
<td></td>
<td>Texture and Lighting</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMV634</td>
<td></td>
<td>Communication Skill-III</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td></td>
<td>Human Values and Professional Ethics</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>BGMP631</td>
<td></td>
<td>Digital Animation with Flash - Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BGMP632</td>
<td></td>
<td>Maya – Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BGMT631</td>
<td></td>
<td>Modeller MES/Q2501</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BGMT632</td>
<td></td>
<td>Animator MES/Q0701</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BGMT633</td>
<td></td>
<td>Rendering Artist MES/Q3503</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### NSFQ Level 6 SEMESTER- IV

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV641</td>
<td></td>
<td>3 D Animation</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV642</td>
<td></td>
<td>Introduction to 3 D Motion Graphics &amp; VFX</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BGMV643</td>
<td></td>
<td>Introduction to Rendering</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMV644</td>
<td></td>
<td>Communication Skill-IV</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>BKVE641</td>
<td></td>
<td>Environment and Ecology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>6</td>
<td>BGMP641</td>
<td></td>
<td>3 D Animation Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BGMP642</td>
<td></td>
<td>Rendering-Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BGMT641</td>
<td></td>
<td>Any one of the QP’s can be opted as offered in Semester III</td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
<td>24</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### NSFQ Level 7 SEMESTER- V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV751</td>
<td>Digital Compositing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV752</td>
<td>3D Texturing</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BGMV753</td>
<td>Basic of Accounts-I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMV754</td>
<td>Computer Graphics</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td><strong>Constitution of India, Law and</strong> Engineering</td>
<td>30</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BGMP751</td>
<td>Digital Compositing-Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>7</td>
<td>BGMP752</td>
<td>3D Texturing-Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>BGMT751</td>
<td>Compositor MES/Q3505</td>
<td></td>
<td></td>
<td>Any one Training 400 hrs/ 8 weeks</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td>BGMT752</td>
<td>Texturing Artist MES/Q2503</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BGMT753</td>
<td>Rigging Artist MES/Q2502</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>610</td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>

### NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BGMV761</td>
<td>Muscle System</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>BGMV762</td>
<td>Rigging</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td><strong>Indian Tradition, Culture and Society</strong></td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50</td>
</tr>
<tr>
<td>4</td>
<td>BGMP761</td>
<td>Major Project</td>
<td>180</td>
<td>30</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>5</td>
<td>BGMT761</td>
<td>Any one of the QP's can be opted as offered in Semester V</td>
<td>Any one Training 400 hrs/ 6 weeks</td>
<td>200</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>670</td>
<td></td>
<td></td>
<td>500</td>
</tr>
</tbody>
</table>
Detailed Curriculum

Software Requirements to run the B. Voc (Graphics and Multimedia)
1. Adobe Illustrator (Vector graphic design software)
2. Adobe Photoshop
3. Sound Forge
4. Adobe Premiere Pro
5. Autodesk 3DS Max
6. Autodesk Maya
7. ZBrush

Level 5 (Semester I)
Web Applications

Bridge Course

Introduction to Database Management
Introduction to database concepts and its need
Database Terminology: Data, Record/Tuple, Table, Database, field/attribute

Networking And Open Standards
Computer Networking: Evolution of Networking: ARPANET, WWW, Internet
Network Topologies: Bus, Star, Tree
Types of Network: PAN, LAN, WAN, MAN

Web Page Development
Review of HTML/DHTML, JavaScript covered in Class XI
Installation and Managing WEB-Server: IIS/XAMPP/LAMP

Movie Editing Tools.
1. Familiarization of interface components.
2. Importing pictures.
3. Importing Audio and Video Files.
4. Splitting and Joining Movie Clips.
5. Adding Titles and publishing.
10. Java Script review.
11. Functions – user defined.
12. String Object.
15. Events.
17. Advanced Features of Web Design.
20. SEO - Search Engine Optimization.
22. Publishing webpages or websites-I.

Reference Books:
1. Internet & Web Development, Soma Das Gupta, Khanna Publishing House

Communication Skill -I

*Communication Process:* The magic of effective communication; Building self-esteem and overcoming fears; Concept, nature and significance of communication process; Meaning, types and models of communication; Verbal and non-verbal communication; Linguistic and non-linguistic barriers to communication and reasons behind communication gap/ miscommunication.

*Structural and Functional Grammar:* Sentence structure, modifiers, connecting words and verbals; phrases and clauses; Case: subjective case, possessive case; objective case; Correct usage of nouns, pronouns and antecedents, adjectives, adverbs and articles;

Reference Books:
1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House

Graphic Design(Basic Sketching and Human Anatomy in Drawing)

Bridge Course

Design Processes and Practices

Role of Design in Society, Functions of Design, Implications and Impact of Graphic Design. Role of Graphic Designer, Contemporary Graphic Design in India, Graphic Design Processes

Methodology of Graphic Design

Principles and Elements of Design
Sketching and Drawing, Introduction to Drawing: an aid in visual representation, Types of drawing
Drawing from memory and imagination
Drawing from observation
Drawing from Dimensional information, Virtues of drawing, Colour, Colours theories, Colour wheel, Colour Harmonies or Colour Schemes, Colour Symbolism

Media and Design

Digital Imaging and Printing, Types of Digital Images, Digital image Editing, Digital Printing
Advertising Design, What is Media Planning, Campaign Design, Kinds of Campaign, Planning a Campaign Research & Data Collection

Unit I:
Orientation into visual art form. The Basics of traditional 2D animation, Introduction to the skill required thereof, beginning life drawing, Use of simple shapes. How to draw sketches with the help of basic shapes. Learning to draw lines, circles, ovals, scribbles, zigzag (random) patterns etc. Background elements, trees, mountains, clouds, water bodies, meadows, perspective drawing Lights and shadows day night scenes, layers (concept and implementation) layout design and staging. An intro on how to make drawings for animation, shapes and forms, about 2D and 3D drawings, Caricaturing-fundamentals, Exaggeration, Attitude, Silhouettes, Boundary breaking exercises and warm-ups.

Unit II:
HUMAN ANATOMY: Structure of man, proportion of body parts, drawing from basic form, Line of action, balance Rhythm, turnings, twisting, drawing plane surfaces, torso, face, eyes, nose, ears, mouth, hand and feet.
FEMALE ANATOMY: Proportion and construction of female body, twisting of female body, chest, torso, face, parts of face, hands, hands in action, feet and gestures, curves, curls, rhythm and twist.
CHILD ANATOMY: Understanding child’s figure, proportion and construction of child body, face, chubbiness, hand, feet and gestures.
ANIMAL ANATOMY: Animals from basic forms, understanding motion and grace of animals, turning animals to character, face, legs, tails, perspectives.
CARTOON ANATOMY: Understanding cartoon characters, drawing from basic shapes, line of action, distortion of proportion, cartoon faces, eyes, mouths, hairs, nose, hands, feet, gestures and poses.

Reference Books:
1. Internet and Web Technology, Soma Das Gupta, Khanna Publishing House
Illustrations and Photo Editing

UNIT – I
Introduction to Adobe Illustrator: Introduction to Adobe Illustrator, work area and workspaces and tools. Opening files, importing art work, viewing art work, rulers and grids, Drawing in Illustrator, drawing lines and shapes, pencil tool, pen tool, editing drawing, tracing, symbols, colouring, applying colours, swatches, adjusting colour and colour settings.

UNIT – II
Painting with Illustrator, fills, strokes, brushes, transparency, blending, gradient, meshes and color blending. Selecting, transformation, scaling, grouping, reshaping, cutting, blending of object, creating 3D object, text and typing, special effects, filters, shadows, glow, feathering graphic styles.

UNIT – III
Photoshop and its interface, Navigation and All tools, Working with basic selections, advanced selections-1(on the basis of channels, color range, extract, filter etc), Exercises on selections, Quick Masks, Layer Mask, Vector Mask, Layers & Layer Blending Modes, Play with Photoshop, Filter Gallery, Exercises, Bring some object and try to make it in computer, Make your own cartoon character.
Color Theory, Make a perfect cropping of some images using Photoshop, Prepare a cut-out of some images using Photoshop, Place nice background for those images, Prepare nice background using gradient tool, Scan various images, Color adjustment of those images (PHOTO RETOUCHING).

UNIT – IV
Make Nature scene (winter) digital painting, Make Nature scene (summer) digital painting. Make digital painting (Use brush, pencil, smudge etc), Make something like modern art keeping in mind color combination, make a collage of Indian art and culture. Make a collage of wildlife animals, Make a portrait of celebrity (Digital painting).Convert a B&W image into color (Use variation), "Choose a theme (Music, Festivals, Sports, Dance) and Design 5-8 graphics on them.", Color Modes, Color Corrections, Advanced color correction techniques (levels, Curves, Hue, Saturation etc), Design that Ad from your own style. Design motifs tribe art, Make an animal character, "Plan a story of that character & Make its backgrounds in three/four frames", Make posters on nature/earth, Matte Painting- Composition, Creating images for the web: Exporting images from Photoshop.

Reference Books:

1. Learning Illustrator, Ramesh Bangia, Khanna Publishing House
Web Applications Lab

- Movie Editing Tools
- Customizing and Embedding, Multimedia Components in Web Pages.
- Web Scripting - Java Script.

Illustration and Photo-Editing-Lab

- Script breakdown
- Storyboards
- Costume acquisition
- Sets and Properties design and sourcing
- Location recce and hire
- Location permissions and legal requirements, permissions from civic authorities
- Equipment requirements and bookings
- Travel and Transport
- Catering for crew
- Hospitality for out of town shoots
Level 5 (Semester II)
Pre-Production

- Research, brainstorming & story concept creation: Intention / purpose & audience (what you intend to say & why)
- Story structure & character development: Narrative structure and character back story
- Sequence & shot analysis: Analysis and re-creation of timing and shot composition from professionally produced film/video productions
- Storyboards: Visual design (layout/composition, style, color, lighting etc.); Language of cinema (narrative structure, shot composition, spatial/directional continuity)
- Animatics / pre-viz: Timing and transitions Audio layering (music, ambient sound, narration)
  
  Budgeting and planning: Consideration of schedules, costs and other planning issues

Audio Editing

UNIT – I
Sonic Sound Forge: Manipulating audio: Auto trim/crop, mute, DC offset, resample, reverse, smooth/enhance, Fade in/out, insert silence, bit depth converter etc, understanding various digital audio formats like .WAV, .AIFF, .MP3, swf, WMA etc, understand audio plug-in, importing and exporting into multiple audio file formats like MP3, real audio, QuickTime formats, etc.

Event tool: move, split, slip and trim multiple events, create fades, apply ASR (Attack/Sustain/Release). Understanding script editor window, Spectrum analysis tools, scrub tool etc, statistics tool (Max, RMS, DC offset, zero crossings), sampler tool etc, Audio editing: workflow, real time editing, event based editing, waveform volume and pan envelopes, Edit, record, encode and master digital audio, editing audio by drag and drop options, cross fading audio tracks, balancing sound levels, creating smooth fades etc.

UNIT – II
Understanding Multichannel audio recording, synchronize audio and video. Understanding regions and play lists, editing of fields, name markers, loops, and regions, Timing basis: absolute frames, measures and beats, Time and frames. Audio effects like: Equalizer, Volume, chorus, distortion, Delay/echo, pitch, bend/shift, reverb, vibrato, normalize etc Insert track markers, adding multiple tracks, adjusting track time, musical instrument file processing

Reference Books:
**Video Editing**

- Adobe Premiere: Concept of non-linear editing,
- The basics of editing: Overview, Importing and Exporting: various audio, video and graphics in various formats, Edit, manipulate and arrange these elements in visual timeline, understand all Tools of toolbox for editing clips. Titling and superimposing.
- Panels: Tools panel, Project,
- Monitors: Source and program, Timeline, Audio meters,
- Misc. Tasks and functions: Titles, Transitions, speed and duration, Effects, Key frames, Types of edit, Opacity, trimming,
- Adding Special effects like: Star trek transporter effect, Blur part of an image, Ghost effect, Highlight part of an image etc.

**Reference Books:**

**Communication Skill-II**

Communication Process:
Basic Communication Skills: Listening, Speaking, Reading and Writing Skills; Precise writing/abstracting/summarizing; Style of technical communication Curriculum vitae/resume writing; Innovative methods to enhance vocabulary, analogy questions.

Structural and Functional Grammar:
Agreement of verb with the subject: tense, mood, voice; Writing effective sentences; Basic sentence faults;

**Reference Books:**
1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House
2. Business Communications, Varinder Bhatia, Khanna Publishing House

**Audio Editing Lab**

Using Editing Software – editing basics and implementation of various techniques used in non-linear editing. Mastering final edit line – audio levels, colour correction, audio mixing, mixed and un-mixed versions, importing and applying compatible graphics files. Understanding compression and its affects along with various methods.

**Video Editing Lab**

1. Assisting Production department on shoot
2. Assisting Direction department on shoot
3. Assisting Art department on shoot
4. Assisting Camera department on shoot
5. Assisting Sound department on shoot
Level 6 (Semester III)

Principles of Animation and Techniques of Animation

UNIT – 1
Drawings with the help of basic shapes, Animal study, Human anatomy, Shading techniques, Live model study, Introduction- Importance of confidence, Difference between “looking at the drawing” and “seeing the drawing”, What is observation, Procedure- How to approach, Importance of Guideline- Line of action, Overcome the fear, Drawing for animation,

UNIT – 2
An Introduction on how to make drawings for animation, Shapes and forms, About 2d and 3d drawings, Caricaturing – fundamentals, Exaggeration, Attitude, Silhouettes, Boundary- breaking exercises and warm ups, gesture drawing, Line drawing and quick sketches, Drawing from observation, memory and imagination.

UNIT – 3
Drawing for Animation, Exercises and warm ups on pegging sheet, Quick Studies from real life, Sequential movement drawing, caricaturing the Action. Thumbnails, Drama and psychological effect,

Motion Studies, Drawing for motion,

UNIT – 4

Reference Books:

1. Multimedia and Animation, V.K. Jain, Khanna Publishing House
Basic of 3-D Modelling

UNIT – I
Interface of 3DS max, Understanding the concept of four view ports, Aligning object in the each view port in X, Y, Z axis, Hot keys, User defined hot keys, Using the menus, Floating and docking. Command panel, customizing the interface, Using drag and drop feature, Introduction to different workspaces, "Geometry, Sub objects, Extruding, Welding, bridging etc, Recognizing the workspaces".

UNIT – II
Introduction to standard and extended primitives. "Introduction to creating complex objects with Standard and extended primitives", Understanding the spline tools. Introduction to polytools. Using modifier stack, navigating the modifier stack, File navigation, Introduction to Connection (Hierarchy, Group, and Link).

UNIT – III
Introduction to the 3d elevators and walk through, "Introduction to modifiers and modifier gizmos, Familiarity with Modifiers like Bend, edit poly, X form, wave, lathe symmetry etc

UNIT – IV
Advanced 3DS Max, Modelling objects with lathe, loft, extrude etc, Creating 3D objects from 2D spline shapes, Organic and inorganic modelling

Texture and Lighting
Unit I:
Introduction to texturing, working with Diffuse, Opacity and Reflection, Basics of UV unwrapping, Creating texture maps, Bump and Displacement Mapping, Introduction to Video post, Introduction to standard lights.

Reference Books:
1. Mastering Photoshop, WebTech Solutions, Khanna Publishing House

Communication Skills III

UNIT-II Listening Skills: Types of Listening (theory/definition), Tips for Effective Listening Academic Listening- (lecturing), Listening to Talks and Presentations, Basics of Telephone Communication Writing Skills: Standard Business letter, Report writing, Email drafting and Etiquettes, Preparing Agenda and writing minutes for meetings, Making notes on Business conversations, Effective use of SMS, Case writing and Documentation

UNIT-III Soft Skills: Empathy (Understanding of someone else point of view), Intrapersonal skills, Interpersonal skills, Negotiation skills, Cultural Aspects of Communication.

UNIT-IV Group Communication: The Basics of Group Dynamics, Group Interaction and Communication, how to Be Effective in Groups, Handling Miscommunication, Handling Disagreements and Conflicts, Constructive Criticism

Reference Books:
1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House
2. Business Communications, Varinder Bhatia, Khanna Publishing House

Digital Animation with FlashLab
- Data management in postproduction.
- Setting up and preparing editing rooms and sound editing rooms
- Logging of rushes
- Assisting in rough cuts
- Assist in editing line-up
- Assist in synchronizing visuals and dialogue
- Assist in recording and matching sound effects

Maya Lab
- Navigate the Maya interface
- Access your objects in the Maya scene graph
- Use the Maya polygon and NURBS modeling tools
- Shade and apply texture maps to objects inside of Maya
- Union: Region belonging to one or both polygons
- Intersection: Region belonging to both polygons
- Difference: Region belonging to first but not second
- Polygon Texturing
Level 6 (Semester IV)

3D Animation

Unit I: Body Mechanics

Students learn to use principles of traditional animation within the context of 3D animation by effectively applying them onto the character.

Part of good acting for animation is planning. The students learn to create or collect authentic visual references (both still and video) for animating body mechanics and understanding acting. Good poses are not only essential to create believable physicality but also help to clearly convey the character emotion for storytelling. They learn the importance of balance and weight, checking the silhouette all the time to make clearer poses.

They learn to act out body mechanics, learn the effect of physics (gravity/friction etc.) and artistic Presentation (composition, staging, silhouette etc.)

Students learn to convey Emotion not only in the facial expression but also in the body language.

Unit II: Facial Expression and Lip Sync

Foundation of good facial expression depends upon the reference and pre-planning. Detailed expression chart and voice recording is used as a starting point for any facial animation. Students learn to internalize the dialogue and they rehearse the sounds to match the shapes. They also need to draw out key poses before starting to pose in 3D.

A good animator needs more skillset than just to be able to animate how to createlip-synch. Students explore how to create the subtle facial expressions to suit the personality of the character and the accent style of the pre-recorded dialogue.

Unit III: Animation and the Body

Exploration of the diverse ways in which the human form takes shape in animated films, from highly photorealistic representations to stream-of-consciousness movement. Specific examples from 2D, 3D, stop-motion and hybrid work will be examined in order to shed light on the construction and animation of the body in contemporary film.

Reference Books:

1. Multimedia and Animation, V.K. Jain, Khanna Publishing House
Introduction to 3 D Motion Graphics & VFX

UNIT – I
Concepts for Broadcast animation for logos, channel IDs and montages, Multi-layer compositing, Special effects, Super imposition and titling, Exporting various file formats outputs as per the end user requirements.

UNIT – II
Introduction to batch render & work group, Adding cameras & lights to a simple scene to make a complex compositing, Adding 2D back ground and elements into a 3D character layers, Creating object, material IDs for further adding special effects, Effects for digital video 2D layers and 3D layers for more effective outputs, adding particle effects into a scene.

UNIT – III
Introduction to colour character and keying, "Editing the real time video with CG based scene and merging both of them to create a final output, Exporting various file format, output as per the end user requirements.

UNIT – IV
Introduction to the batch rendering and work groups, Introduction to the concepts of editing in terms of compositing, Adding special effects in built in compositing software to make a simple shot into a perfect output.

UNIT – V
Chroma keying, Luma key, Blue screen, Key frame text & layer animation & 3D particles, Effects etc. Color correction, Introduction to 3D compositing concepts i.e. Layers and masking, Rot scoping, Rig removal, Morphing.

Reference Books:
1. Engineering AutoCAD, Pradeep Jain & A.P. Gautam, Khanna Publishing House
Introduction to Rendering

Unit I:
This unit teaches students about rendering concepts; formats and resolutions.

Unit II:
This unit teaches students the advantages of different render software such as mental ray, v-ray, render man etc.

Unit III:
This unit teaches students the benefits of layer based rendering. This process enhances the image quality without need of re-rendering the images again.

Unit IV:
The rendered layers or passes need to be composited to get the final output.

Communication Skills IV
Forms of non-verbal communication; interpreting body-language cues; Kinesics; Effective use of body language. The presentation and oral communication skill will be imparted through Group Discussion, Differences between group discussion and debate; Presentation Skills, Oral presentation and public speaking skills; The course also includes training and skill of Technology-based Communication, power-point presentation. Activities/tasks like role playing, group discussion, public speaking, extempore presentation and interviews will be conducted on regular basis.

Writing Skills: The activities will include: Writing Task: identifying the focus, generating ideas, outlining, etc. Paragraph Structure and Linking Sub-points in a Paragraph Cohesion and unity in a paragraph, Minding Punctuation and Proofreading, Summarising, Reviewing and Aspects of Creative Writing. Activities / tasks to be conducted like paragraph writing, essay writing, writing a review of a literary text, writing a summary of a literary text, comprehension and analysis of a literary text, preparing an advertisement.

Reference Books:
1. Effective Communication Skills, Kulbhushan Kumar, Khanna Publishing House
2. Business Communications, Varinder Bhatia, Khanna Publishing House
3D Animation Lab

- Assist in laying background music tracks
- Assist in mixing and mastering video
- Assist in creating titles and subtitles and basic animation sequences
- Understand and assist in the execution of modelling and rendering in 3D animation software.

3D Rendering Lab

Introduction to Scene, Preparing the Scene, Basic Settings for Texturing, Create & Assign Textures, Light Setup, V-Ray Rendering Settings

- Rendering with V-Ray
- V-ray light setup
- V-ray rendering settings
- HDRI Illumination
- Fine-tuning shadows
- Final render setting
Level 7 (Semester V)
Digital Compositing

- Introduction to Compositing software
- Principles of compositing
- Basic techniques
- Transparency
- Rotoscoping
- Wire Removal
- Chroma key
- Layer based compositing
- Compositing modes
- Animating layers

3D Texturing

UNIT – I
Introduction to basic material types & Procedurals. Study of concepts: Opacity, Smoothness, Specularity, and color, Working with Maya Surface Nodes-Blinn, Phong & Lambert, Working with Transparency, Reflection & Refraction, Bump & Displacement Maps, Introduction to unwrapping, Unwrapping the maps for various 3D characters.

UNIT – II
Working with 2D and 3D Texture, Introduction to the mapping and advanced texturing techniques, Shadow maps; ray traced shadows and radiosity, Creating photo real environments and textures, Basics of Utilities-Reverse, Stencil, Condition, Sampler Information.

Basic of Accounts-I

Chapter 1:
- Define the accounting process
- Describe the role of accountants
- Explain accounting concepts and principles
- Discuss the concept of the accounting equation
- Use the accounting equation to analyze basic transactions in terms of increases and decreases
- Reporting financial information on a balance sheet

Chapter 2:
- Determine how transactions change owner’s equity in an accounting equation
- Reporting a changed accounting equation on a balance sheet
Chapter 3:
- Analyze transactions using T-accounts and using debits and credits
- Use debits and credits to record increase and decreases in accounts

Chapter 4:
- Record journal entries in a 5-column journal
- Define accounting terms related to journalizing transactions
- Prove and rule a five-column journal and prove cash

Chapter 5:
- Prepare a chart of accounts and opening accounts
- Post separate amounts from a journal to a general ledger
- Post column totals from a journal to a general ledger
- Make correcting entries

Chapter 6:
- Reconcile a bank statement and record bank service charges, dishonoured checks, and petty cash transactions

Computer Graphics


UNIT-II 2-D Geometrical Transforms: Translation, scaling, rotation, reflection and shear transformations, matrix representations and homogeneous coordinates, composite transforms, transformations between coordinate systems. 2-D Viewing: The viewing pipeline, viewing coordinate reference frame, window to viewport coordinate transformation, viewing functions, Cohen-Sutherland and Cyrus-beck line clipping algorithms, Sutherland –Hodgeman polygon clipping algorithm.

UNIT-III 3-D Object Representation: Polygon surfaces, quadric surfaces, spline representation, Hermite curve, Bezier curve and B-Spline curves, Bezier and B-Spline surfaces. Basic illumination models, polygonrendering methods.

UNIT-IV 3-D Geometric Transformations: Translation, rotation, scaling, reflection and shear transformations, composite transformations. 3-D Viewing: Viewing pipeline, viewing coordinates, view volume and general projection transforms and clipping

Reference Books:
Digital Compositing Lab

- 2D animation preproduction
- 2D character design
- 2D environment and background layout
- Motion graphic sequences

3D Texturing Lab

1. Applying Texture for inorganic polygon models- I
   (Lamps, Mobile, Planet, Land with grass texture, rock, atmospheric objects system)
2. Applying Texture for organic polygon models – I (Cartoon, Semi cartoon)
3. Applying Texture for inorganic polygon models - II (Solar system, Car, Bike, Plane)
4. Applying Texture for organic polygon models - II (Human, Animal)
5. Applying Texture for organic Subdivision models – I (Cartoon, Semi cartoon)
6. Applying Texture for inorganic Subdivision models - II (Solar system, Car, Bike, Plane)
7. Applying texture for rendering final output with organic and inorganic objects
Level7 (SemesterVI)

Muscle System

Unit I:
Introduction to bone system/Joints and IK handles, creating bone system and maintaining naming conventions,

Unit II:
Skinning: types, import and export of skin weights, IK and FK basics, IK and FK switch, stretchy IK and FK,

Unit III:
Introduction to Deformers: attics, wrap, cluster, riggle, wire etc. Use of deformers in rigging process.

Rigging

UNIT –I
Introduction to constraints and implementation to rigging, Maintaining proper hierarchy, grouping and creating controls, Rigging the characters, Introduction to Muscle system, Working with Muscle rigging, Introduction to automated rigging systems and methods.

UNIT – II
"Embedding small scripts in the hierarchy control system, to save time and facilitate handling", Advanced rigging, Vertex weighting techniques, Rigging solutions to Anatomical Problems, Using advanced rigging to archive natural articulation of character.
STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc.
Banking Finance Services and Insurance (FS)
Branch Code: 108

Based on
AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
# EVALUATION SCHEME

## Banking Finance Services and Insurance (BFSI)

### BFSI Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
</tr>
<tr>
<td>1</td>
<td>BFSV511</td>
<td>Banking &amp; Micro Finance - I</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BFSV512</td>
<td>Indian Securities Markets - I</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BFSV513</td>
<td>Micro Finance Operations - I</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BFSV514</td>
<td>Mutual Fund Operations - I</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BFSP511</td>
<td>Vocational Practical –I</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>BFSP512</td>
<td>Vocational Practical –II</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>BFSP513</td>
<td>Language Lab</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>BFST511</td>
<td>Insurance Agent (BSC/Q3801)</td>
<td>Any one Training 400hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>BFST512</td>
<td>Business Correspondent / Business Facilitator(BSC/Q8401)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BFST513</td>
<td>Debt Recovery Agent (BSC/Q2303)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

### BFSI Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
</tr>
<tr>
<td>1</td>
<td>BFSV521</td>
<td>Banking &amp; Micro Finance – II</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BFSV522</td>
<td>Indian Securities Markets - II</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BFSV523</td>
<td>Micro Finance Operations - II</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BFSV524</td>
<td>Mutual Fund Operations - II</td>
<td>30</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BFSP521</td>
<td>Vocational Practical –III</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>BFSP522</td>
<td>Vocational Practical –IV</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>BFSP523</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8</td>
<td>BFST521</td>
<td>Mutual Fund Agent (BSC/Q3802)</td>
<td>Any one Training 400hrs/6 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>BFST522</td>
<td>Small and Medium Enterprise (SME) Officer (BSC/Q2302)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

DR. A.P.J. ABDUL KALAM TECHNICAL UNIVERSITY LUCKNOW

STUDY, EVALUATION SCHEME & SYLLABUS

For

B. Voc.

Electronics Manufacturing Services (EM)
Branch Code:111

Based on

AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
## EVALUATION SCHEME
### Electronics Manufacturing Services

#### NSFQ Level 5 SEMESTER- I

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BEMV511</td>
<td>Electronic Measurement and Instrumentation –I</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BEMV512</td>
<td>Identification of Components, Tools, SOP &amp; Work Instructions-I</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BEMV513</td>
<td>Tools, Equipment &amp; Safety Measures –I</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BEMV514</td>
<td>Soldering &amp; De-Soldering of Components –I</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BEMP511</td>
<td>Identification of Components, Tools, Equipment and its working –Lab</td>
<td>30</td>
<td>20 30</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BEMP512</td>
<td>Electronic Measurement and Instrumentation –I –Lab</td>
<td>30</td>
<td>20</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BEMP513</td>
<td>Language Lab</td>
<td>30</td>
<td>20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BEMT511</td>
<td>Embedded Software Engineer (ELE/Q1501)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT512</td>
<td>Security System Service Engineer (ELE/Q4610)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT513</td>
<td>Systems Analyst (ELE/Q8701)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMV511</td>
<td>Embedded Software Engineer (ELE/Q1501)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500 24</td>
<td></td>
</tr>
</tbody>
</table>

#### NSFQ Level 5 SEMESTER- II

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/ Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BEMV521</td>
<td>Electronic Measurement and Instrumentation –II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BEMV522</td>
<td>Identification of Components, Tools, SOP &amp; Work Instructions-II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BEMV523</td>
<td>Tools, Equipment &amp; Safety Measures –II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BEMV524</td>
<td>Soldering &amp; De-Soldering of Components &amp; Emergency actions II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BEMP521</td>
<td>Soldering &amp; De-Soldering of Components- Lab</td>
<td>30</td>
<td>20 30</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BEMP522</td>
<td>Electronic Measurement and Instrumentation -II (Lab)</td>
<td>30</td>
<td>20 30</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BEMP523</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>20 30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BEMT521</td>
<td>Smartphone Assembly Inspector (ELE/Q4001)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT522</td>
<td>Business Development Executive (ELE/Q1101)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500 24</td>
<td></td>
</tr>
<tr>
<td>S. No.</td>
<td>Subject Code</td>
<td>Subject</td>
<td>Total Teaching/Training Hours</td>
<td>Evaluation Scheme</td>
<td>End Semester Total Credit</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------------</td>
<td>----------------------------------------------</td>
<td>------------------------------</td>
<td>-------------------</td>
<td>---------------------------</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMV631</td>
<td>Fault analysis &amp; Repairs</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMV632</td>
<td>Good Manufacturing Concept &amp; Practices – I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMV633</td>
<td>Electronics Devices Circuit – I</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMV634</td>
<td>Electronics System Packaging and Manufacturing</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMP631</td>
<td>Electronics Devices Circuit – I Lab</td>
<td>30 20</td>
<td>30</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMP632</td>
<td>Fault analysis &amp; Repairs – Lab +</td>
<td>30 20</td>
<td>30</td>
<td>50 1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT631</td>
<td>Field Engineer RACW (ELE/Q3105)</td>
<td></td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150 12</td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT632</td>
<td>Security System Service Engineer (ELE/Q4610)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>BEMT633</td>
<td>Pre-Sales Solar Technical Support Engineer (ELE/Q5602)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500 24</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BEMV641</td>
<td>Good Manufacturing Concepts Practices–II</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td></td>
<td>BEMV642</td>
<td>Manufacturing &amp; Quality Norms</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td></td>
<td>BEMV643</td>
<td>Good Manufacturing Concepts &amp; Practices–III</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td></td>
<td>BEMV644</td>
<td>Electronics Devices Circuit – II</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td></td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30 10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td></td>
<td>BEMP641</td>
<td>Electronics Devices Circuit – II Lab</td>
<td>30 20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td></td>
<td>BEMP642</td>
<td>Manufacturing Practices</td>
<td>30 20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td></td>
<td>BEMT641</td>
<td>Purchase Executive (ELE/Q5701)</td>
<td></td>
<td>Any one Training 400 hrs/8 weeks</td>
<td>150 12</td>
</tr>
<tr>
<td></td>
<td>BEMT642</td>
<td>Quality Engineer (ELE/Q7901)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500 24</td>
</tr>
</tbody>
</table>
### NSFQ Level 7 SEMESTER - V

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BEMV751</td>
<td>Valuation &amp; Storage</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BEMV752</td>
<td>Shelf Life, Ware House Operations Management &amp; Material Transactions</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BEMV753</td>
<td>Industrial Electronics Product Design</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BEMV754</td>
<td>Pre-Production Activities</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>6</td>
<td>BEMP751</td>
<td>Pre-Production Activities-Lab</td>
<td>30</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BEMP752</td>
<td>Valuation &amp; Storage-Lab</td>
<td>30</td>
<td>20</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>BEMT751</td>
<td>Product Engineer (ELE/Q4201)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BEMT752</td>
<td>Incoming QC Technician (ELE/Q4401)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BEMT753</td>
<td>Assembly Supervisor (ELE/Q6305)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>150</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

### NSFQ Level 7 SEMESTER- VI

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Subject Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Evaluation Scheme</th>
<th>End Semester Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
</tr>
<tr>
<td>1</td>
<td>BEMV761</td>
<td>Entrepreneurship/Accounting/Management</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>BEMV762</td>
<td>Trouble shooting and Maintenance of Electronics Equipment</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>BEMP761</td>
<td>Major Project</td>
<td>180</td>
<td></td>
<td>150</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>BEMT761</td>
<td>FPGA Design Engineer (ELE/Q8201)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>BEMT762</td>
<td>Sales Executive-Consumer Electronics (ELE/Q3201)</td>
<td>Any one Training</td>
<td>400 hrs/ 8 weeks</td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>670</td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>
Detailed Curriculum
Level 5 (Semester I)

Electronic Measurements and Instrumentation-I

Unit, dimensions and standards
Scientific notations and metric prefixes, SI electrical units, SI temperature scales, Other unit systems, dimension and standards. Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis. PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes Digital voltmeter systems, digital multi-meters, digital frequency meter system.

Electromagnetic Effects
Permanent magnets and Electromagnets, their construction and uses, Polarities of an electromagnet and rules for finding them, Faraday’s Laws of Electromagnetic Induction, Dynamically induced e.m.f., its magnitude and induction, inductance and its unit. Mutually induced e.m.f., its magnitude and direction, Energy stored in an inductance. Force acting on a current carrying conductor in magnetic field, its magnitude and direction, Principles and construction of dynamo.

A.C Circuits
Generation of A.C. voltage, its generation and wave shape. Cycle, frequency, peak value R.M.S. value, form factor, crest factor, Phase difference, power and power factor, A.C. Series Circuits with (i) resistance and inductance (ii) resistance and capacitance and (iii) resistance inductance and capacitance, Q factor of R.L.C. series circuits.

Identification of Components, Tools, SOP & Work Instructions-I

1. Main components & modules/ sub-assemblies of electronic equipment
   • Control Panel (System Controller)
   • Keypads
   • Door and Window Contacts
   • Motion Detectors
   • Glass Break Detection
   • Smoke Detectors
   • Heat Sensors
   • Carbon Monoxide Detectors
   • Water Detectors (or Water Bug)
   • Temperature Sensors
   • Capacitance switches / control push buttons & rotary switches

2. Introduction to Basic Electricity
   Current Electricity
   Definition of Resistance, Voltage, Current, Power, Energy and their units, Relation between electrical, mechanical and thermal units, Temperature variation of resistance, Difference between AC and DC voltage and current.
D.C. Circuits

Electric Cells
Primary cell, wet cell, dry cell, battery, Li-ion battery, series and parallel connections of cells, Secondary cells, Lead Acid Cell, Discharging and recharging of cells, preparation of electrolyte, care and maintenance of secondary cells.

Lighting Effects of Current
Lighting effect of electric current, filaments used in lamps, and Tubelight, LED, their working and applications.

Capacitors
Capacitor and its capacity, Concept of charging and Discharging of capacitors, Types of Capacitors and their use in circuits, Series and parallel connection of capacitors, Energy stored in a capacitor.

3. Introduction and Identification of Electronics Components
   - Electronic controls in a common way
   - Diode, Transistors, Op-Amp
   - Number systems and Boolean Algebra
   - Logic Gates
   - Flip-Flops
   - Counters
   - Multiplexers
   - Decoders
   - LED, LCD and 7 segment display
   - RAM and ROM

4. Concept of Amplification factor, Gain & Signal distortion

Tools, Equipment and Safety Measures-I

1. Cables & Connectors
   - Non-Metallic Sheathed Cable
   - Un grounded & Grounded Power Supply Cable
   - Metallic Sheathed Cable
   - Multi-Conductor Cable
   - Coaxial Cable
   - Unshielded Twisted Pair Cable
   - Shielded twisted pair cable
   - Ribbon Cable
   - Armoured & Unarmoured Cable
   - Twin-Lead Cable
   - Twin axial Cable
   - Optical fiber cable
   - Connectors

1. ESD Clothing
   - What to wear, how to wear
Soldering & De-Soldering of Components-I

1. Soldering & De Soldering of Basic Components
   - Soldering Tools
   - Different types of Soldering Guns related to Temperature and wattages, types of tips
   - Solder materials and their grading
   - Soldering and De Soldering Stations and their Specifications
   - Preparing Component for Soldering
   - PCB Applications
   - Types of PCB
   - Soldering Basic Components on PCB
   - De soldering Basic Components
   - Safety precautions while Soldering & De soldering
   - Check for cold continuity of PCB
   - Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards
   - Join the broken PCB track and test
   - De soldering using Pump and wick
   - Introduction of SMD Components

Identification of Components, Tools, SOP & Work Instructions-I (Lab)

1. Identification & working of various electronic components
2. Working of testing equipment
3. Measurement using Multimeter & Clamp meter
4. Battery health check-up
5. Measure and test the voltage of given cells.
6. Verification of truth tables for AND, OR, NOT and NAND logic gates.
7. Verification of truth tables for NOR, XOR and XNOR logic gates.
8. Construction and verification of operations of half adder and full adder circuits using basic gates.
9. Study and verification of truth tables for 3 line to 8 line decoder.
10. Study and verification of truth tables for 4:1 MUX using gates
11. Study and verification of truth tables for 1:4 DEMUX using gates.
13. Study and verification of truth table for universal shift register.
14. Study the operation of a synchronous counter.

Electronic Measurement and Instrumentation -I (Lab)

1. Study of semiconductor diode voltmeter and its use as DC average responding AC voltmeter.
2. Study of L.C.R. bridge and determination of the value of the given components.
3. Study of distortion factor meter and determination of the % distortion of the given oscillator.
4. Study of the transistor tester and determination of the parameters of the given transistors.
Level 5 (Semester II)

Electronic Measurements and Instrumentation - II

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter
CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters

Identification of Components, Tools, SOP & Work Instructions-II

1. Introduction to wireless communication
2. Signal Converters
3. Tools & their Uses
   - Use of tester to monitor AC Power
   - Skin the electrical wires/cables using the wire stripper and cutter
   - Main cable for control & electronic circuit wires
   - Crimping tools and buses
4. Introduction to measuring equipment’s
   - Signal generator’s
   - CRO
   - Function Generators
   - Frequency Counter
   - Logic analyzer
   - Spectrum analyzer
   - LCRQ Meter
5. Standard Operating Procedures and Work Instructions
   - What is SOP and WI
   - How to read & follow SOP and WI
   - Overall Quality Assurance Plan

Tools, Equipment & Safety Measures-II

1. Tools & Equipment
   - Types of tools & equipment required and deployed in manufacturing, installing & servicing
   - Identification and termination process
   - General maintenance of tools/equipment and recalibration of Test equipment
   - General safety and common-sense safety
2. PPE
   - Usage & benefits of PPE
• Types & usage of various PPE
• Maintenance of PPE

2. Clean Room Environment
• Do’s and Don’t
• Shop Floor Discipline

Soldering & De-soldering components & Emergency actions

1. Introduction to SMD Components
• Identification of 2, 3, 4 terminal SMD components
• Soldering the SMD components on the PCB
• Make the necessary settings on SMD soldering station to solder various ICs of different packages by choosing proper clamping tools
• Identify various connections and the setup required for SMD soldering station
• De solder the SMD components from the given PCB
• Make the necessary settings on SMD soldering station to de solder various ICs of different packages by choosing proper clamping tools
• Make a panel board using different types of switches for a given application
• Identification of crimping tools for various IC packages
• Reliable Soldering Practices

2. Emergency actions
• Minimum Requirements
• Reporting Emergencies
• Emergency exits
• Primary and secondary evacuation routes
• Locations of fire extinguishers
• Fire alarm pull stations’ location
• Assembly points
• Medical Services

Soldering & De-soldering of components - II Lab

1. Assemble the product
2. Dis-assemble the product
3. Safety Precautions & emergency plans

Electronic Measurement-II Lab

1. Study of the following transducer (i) PT-100 trans (ii) J-type trans. (iii) K-type trans (iv) Pressure transducer
2. Measurement of phase difference and frequency using CRO (lissajous figure)
3. Measurement of low resistance Kelvin’s double bridge.
4. Radio Receiver Measurements
Level 6 (Semester III)  
Fault Analysis & Repairs

1. Classification of fault
2. Identification of fault
3. Rectification of fault
4. Repairing/Replacing Module
5. Analysis for the different types of equipment’s
   o Smartphones
   o Air Conditioning
   o Security systems
   o Electronically controlled doors
6. Fault analysis based on hardware and software component
7. Diagnostic and Testing Methods
8. Visual Inspection
9. Earth Continuity Test
10. Insulation Resistance Test

(6.GV.02) Good Manufacturing Concept & Practices – I

- TQM (Total Quality Management) & Kaizen
- Inventory Management & Logistics in brief
- Quality assurance
- Checklist
- SWOT analysis
- Lean Manufacturing
- Muda, Mura & Muri – Toyota Production System (TPS)
- Spatial considerations & other related concepts

Electronics Devices & Circuit-1

Unit I


Electronics System Packaging and Manufacturing

Evolution and Classification of Printed Circuit Boards, Challenges in Modern PCB Design and Manufacture, PCB fabrication methodologies (SSB, DSB and multilayer board), PCB design considerations/ design rules for analog, digital and power applications, Electromagnetic
interference in electronic systems and its impact. Analysis of electronic circuit from noise emission point of view (both conducted and radiated emission) cross talk and reflection behavior of the circuit in time domain, Thermal management of electronic devices and systems.

Semiconductor Packages: Single chip packages or modules. (SCM) Commonly used packages and advanced packages; Materials in packages, Current trends in Packaging, Multichip modules (MCM)- types; System-in package (SIP); Packaging roadmaps; Hybrid circuits. Pipe and FIFOs, Shared memory, Sockets

Electronic Devices and Circuits Lab

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.
6. Study CE configuration for NPN and PNP transistors and measurement of voltage and current gain.
7. Study CB configuration for NPN and PNP transistors and measurement of voltage and current gain.
8. Study CC configuration for NPN and PNP transistors and measurement of voltage and current gain.

Fault Analysis & Repairs - Lab

1. Categorization of faults
   - Hardware/Software, User Induced, Component Failures
   - L0 to L4 repairs
2. Testing electrical/electronic components in the product
3. Troubleshoot and repair of the faults identified in the product
   - Microphone
   - Musical Instruments (Loudspeakers)
   - Recorder (CD/ DVD Player)
4. Preventive Maintenance Services
5. Basic Occupational Safety and Precautions
6. Microphones and Loudspeakers
Level 6 (Semester IV)

Good Manufacturing Concepts & Practices – II

- Work Study Concepts
  - Method study
  - Work measurement
  - Sequencing of Operations and timing the flow steps
  - Advantages of work study

- Team Working
  - Forming
  - Storming
  - Norming
  - Performing
  - Adjourning

Manufacturing & Quality Norms

1. Manufacturing & Quality Norms- keep it differently according to all applications
  - Manpower Deployment and Operations as per Work Instructions and criticality of the process Understanding how to form each operation and practical training of operation
  - Understanding accept and reject criterion of a particular operation. Practical training of testing/checking each operation
  - Quality Norms of accept and practical training of electronic equipment’s/Devices
  - Acceptance/ Rejection training of various defects

2. Manufacturing & Quality Norms – II
  - Process in packing line-Packing line Operations sequence flow and its importance
  - Quality Systems - Accept, Reject criterion of various tests at OQA
  - Training of Assembly of electronic components - Assemble, Check, test electronic components
  - Various Labels and their Importance - Understanding Labels, Scanning and its importance
  - Packing of components/devices - Various Stages of packing
  - Acceptance, Reject and sampling following QA norms - AQL level, Sampling techniques, as per QA sampling accept, reject numbers

Good Manufacturing Concepts & Practices – III

1. Good Manufacturing Concepts & Practices - II
  - Brief Introduction
  - Total Quality Management
    - ISO Standards
  - Kaizen
  - Toyota Production System
Electronic Devices and Circuits –II

UNIT I MOSFET: Device structure and its operation in equilibrium, V-I characteristics. Circuits at DC, MOSFET as Amplifier and switch, Biasing in MOS amplifier circuits, small-signal operation and models, single stage MOS amplifier, MOSFET internal capacitances and high frequency model, frequency response of CS amplifier

UNIT II BJT: Review of device structure operation and V-I characteristics, BJT circuits at DC, BJT as amplifier and switch, biasing in BJT amplifier circuit, small-signal operation and models, single stage BJT amplifier, BJT internal capacitances and high frequency model, frequency response of CE amplifier.

UNIT III Feedback: The general feedback structure, properties of negative feedback, the four basic feedback topologies, the series-shunt feedback amplifier, the series-series feedback amplifier, the shunt-shunt and shunt series feedback amplifier. Oscillators: Basic principles of sinusoidal oscillators, op-amp RC oscillator circuits, LC oscillator

Electronic Devices and Circuits –II Lab

1. Characteristic of BJT: BJT in CE configuration- Graphical measurement of hparameters from input and output characteristics. Measurement of Av, Ai, Ro and Ri of CE amplifier with potential divider biasing.
5. Oscillators: Sinusoidal Oscillators a. Wein’s bridge oscillator b. phase shift oscillator.

Manufacturing Practices

1. Work study concepts
2. Team work concepts
Level 7 (Semester V)

Valuations & Storage

1. Valuation
   - Specific Item cost
   - Weighted average cost

2. Storage
   - Stacking Norms
   - Bin Cards
   - Stores Layout
   - Categorization of Materials
     - Hazardous/Non-Hazardous
     - Imported/Local
     - Assembly/ Parts
     - Consumables
     - Class A/B/C
     - Good/defective

Shelf Life, Ware House Operations Management & Material Transactions

1. Shelf Life Management
   - FIFO
   - FILO
   - LIFO
   - LILO

2. Material Transactions
   - Inward
   - Outward
   - Suspense
   - RMA (Return Material Authorization)
   - Insurance

Industrial Electronic Product Design


Pre-Production Activities

Pre-Production activities
   - Layout
   - Time Study & Motion Study
   - Two Hand Insertion
   - Non-value adding activities
   - Positioning of Bins
   - Line Balancing
Pre-Production Activities Lab

- Pre-Production activities
  - Two Hand Insertion
  - Positioning of Bins

- House Keeping
- 5S

Valuations & Storage Lab

- Categorization of Raw Material & Consumables
  - Hazardous/Non-Hazardous
  - Imported/Local
  - Assembly/Parts
  - Class A/B/C
  - Good/defective

- Material Transactions
  - Inward
  - Outward
  - Suspense

Level 7 (Semester II)

Accounting & Management/Entrepreneurship

1. Introduction
Meaning and Nature of Management, Management Approaches, Processes, Managerial Skills, Tasks and Responsibilities of a Professional Manager.

2. Organizational Structure and Process
Organizational Culture and Climate, Managerial Ethos, Organization Structure & Design, and Managerial Communication.

3. Planning and Controlling

4. Performance Evaluation Techniques:
Introduction to Budgeting and Budgetary Control; Performance Budgeting; Classification of Budget; Standard Costing and Variance Analysis; Balanced Scorecard; Responsibility Accounting.

5. Decision Making Techniques:
Cost Volume Profit Analysis; Management Accounting for Decision Making and Control; EVA and Performance Measurement; Introduction to Activity Base Costing, Targeting Costing, Life Cycle Costing; Uniform Costing.
Course Contents:

1. Entrepreneurship: Concept and Definitions; Entrepreneurship and Economic Development; Classification and Types of Entrepreneurs; Entrepreneurial Competencies; Factor Affecting Entrepreneurial Growth – Economic, Non-Economic Factors; EDP Programmes; Entrepreneurial Training; Traits/Qualities of an Entrepreneurs; Entrepreneur; Manager Vs. Entrepreneur.

2. Opportunity / Identification and Product Selection: Entrepreneurial Opportunity Search and Identification; Criteria to Select a Product; Conducting Feasibility Studies; Project Finalization; Sources of Information.

3. Small Enterprises and Enterprise Launching Formalities : Definition of Small Scale; Rationale; Objective; Scope; Role of SSI in Economic Development of India; SSI; Registration; NOC from Pollution Board; Machinery and Equipment Selection; Project Report Preparation; Specimen of Project Report; Project Planning and Scheduling using Networking Techniques of PERT / CPM; Methods of Project Appraisal.

4. Role of Support Institutions and Management of Small Business : Director of Industries; DIC; SIDO; SIDBI; Small Industries Development Corporation (SIDC); SISI; NSIC; NISBUD; State Financial Corporation SIC; Marketing Management; Production Management; Finance Management; Human Resource Management; Export Marketing; Case Studies-At least 4 (four) in whole course

Trouble Shooting & Maintenance of Electronics Equipment’s-II

1. TV System
   - Working principle with block diagram of TV transmitter and receiver, Brief description with circuit diagram: TV Tuner, Video IF stage, Sound stage, Picture tube & its associated circuit, Synchronizing circuits, Horizontal & vertical deflection circuits, Remote control of a TV receiver, Idea of bandwidth, blanking and synchronization pulses, modulation scheme, colour transmission.
   - Cable type TV system, Head end processor, Trunk & cable distribution system with block diagram, Scrambling.
   - Introduction to LCD and LED TV systems, Introduction to high definition systems. Steps for Fault finding & Analysis.

2. Modern Appliances

Project Work
STUDY, EVALUATION SCHEME & SYLLABUS
For
B. Voc.
Medical Imaging Technology (MI)
Branch Code: 112

Based on
AICTE Model Curriculum

(EFFECTIVE FROM THE SESSION: 2019-20)
1. Course Objectives

After successfully completing the vocational course, the student would have acquired relevant appropriate and adequate technical knowledge together with the professional skills and competencies in the field of Medical Imaging Technology so that he/she is properly equipped to take up gainful employment in this Vocation. Thus he/she should have acquired.

A. Understanding of

(a) The relevant basic concepts and principles in basic science subjects (Physics, Chemistry and Biology) so that he/she is able to understand the different vocational subjects.
(b) The basic concepts in engineering drawing.
(c) The concepts, principles of working of basic electronic devices and circuits.
(d) The knowledge of procedures of medical imaging.
(e) The procedure of operation and upkeep of Medical Imaging equipments.
(f) The concepts and principles used in safety while using equipments.

B. Adequate Professional Skills and Competencies in

(a) Testing different electronic components.
(b) Testing the performance of electronic circuits.
(c) Locating the fault at component level and at the stage level.

C. A Healthy and Professional Attitude so that He/She has

(a) An analytical approach while working on a job.
(b) An open mind while locating/rectifying faults.
(c) Respect for working with his/her own hands.
(d) Respect for honesty, punctuality and truthfulness.
### Curriculum

#### Semester-I (NSQF Level-5)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BMIV511</td>
<td>Electronic Measurement and Instrumentation -I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>TE: 50</td>
<td>PE: 2</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>BMIV512</td>
<td>Basic Anatomy (Cross Sectional Anatomy-II)</td>
<td>30</td>
<td>10 5 5 20</td>
<td>TE: 50</td>
<td>PE: 2</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>BMIV513</td>
<td>Tools, Equipment &amp; Safety Measures -I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>TE: 50</td>
<td>PE: 2</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>BMIV514</td>
<td>Soldering &amp; De-Soldering of Components -I</td>
<td>30</td>
<td>10 5 5 20</td>
<td>TE: 50</td>
<td>PE: 2</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>BMIP511</td>
<td>Identification of Components, Tools, Equipment and its working -Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>BMIP512</td>
<td>Basic diagnostics (Lab)</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>BMIP513</td>
<td>Language Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>On-Job-Training (OJT)/Qualification Packs</td>
<td>400hr 8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
<td>24</td>
<td></td>
</tr>
</tbody>
</table>

B. Voc.-Medical Imaging Technology (MI)  Branch Code: 112
<table>
<thead>
<tr>
<th>S. N.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BMIV521</td>
<td>Electronic Measurement and Instrumentation –II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>BMIV522</td>
<td>Basic Imaging</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>BMIV523</td>
<td>Tools, Equipment &amp; Safety Measures –II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BMIV524</td>
<td>Soldering &amp; De-Soldering of Components &amp; Emergency actions II</td>
<td>30</td>
<td>10 5 5 20 30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>BMIP521</td>
<td>Soldering &amp; De-Soldering of Components-Lab</td>
<td>30</td>
<td>20 30</td>
<td>50</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>BMIP522</td>
<td>Basic Imaging Practical Lab</td>
<td>30</td>
<td>20 30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>BMIP523</td>
<td>IT Tool Lab</td>
<td>30</td>
<td>20 30</td>
<td>50</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>On-Job-Training (OJT)/Qualification Packs (To continue with the same QP as opted in Level 5 First semester)</td>
<td>400hr/8 weeks</td>
<td>150</td>
<td>150</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>610</td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>
### Semester-III (NSQF Level-6)

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem Total</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>BMIV631</td>
<td>Fault analysis &amp; Repairs</td>
<td>30</td>
<td>10 5 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>2</td>
<td>BMIV632</td>
<td>Cross Sectional Anatomy-II</td>
<td>30</td>
<td>10 5 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>3</td>
<td>BMIV633</td>
<td>Electronics Devices Circuit –I</td>
<td>30</td>
<td>10 5 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>4</td>
<td>BMIV634</td>
<td>Radiation and administrative Issues</td>
<td>30</td>
<td>10 5 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>5</td>
<td>BKVH631</td>
<td>Human Values and Professional Ethics</td>
<td>30</td>
<td>10 5 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>6</td>
<td>BMIP631</td>
<td>Electronics Devices Circuits Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td>7</td>
<td>BMIP632</td>
<td>Fault analysis &amp; Repairs - Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>On-Job-Training (OJT)/Qualification Packs Assistant Duty Manager - Patient Relation Services (HSS/Q6103)</td>
<td>400hr/8 weeks</td>
<td></td>
<td>150</td>
<td>150 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>610</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Semester-IV (NSQF Level-6)

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem Total</th>
<th>Total Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BMIV641</td>
<td>CT and Ultrasound</td>
<td>30</td>
<td>20 10 5 10 40</td>
<td>60</td>
<td>100 4</td>
</tr>
<tr>
<td>2</td>
<td>BMIV642</td>
<td>Manufacturing &amp; Quality Norms</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>3</td>
<td>BMIV643</td>
<td>Electronics Devices Circuit –II</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>4</td>
<td>BKVE641</td>
<td>Environment and Ecology</td>
<td>30</td>
<td>10 5 5 20</td>
<td>30</td>
<td>50 2</td>
</tr>
<tr>
<td>5</td>
<td>BMIP641</td>
<td>Electronics Devices Circuit II Lab</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td>5</td>
<td>BMIP642</td>
<td>Manufacturing Practices</td>
<td>30</td>
<td>20</td>
<td>30</td>
<td>50 1</td>
</tr>
<tr>
<td>7</td>
<td></td>
<td>On-Job-Training (OJT)/Qualification Packs (To continue with the same QP as opted in Level 6 First semester)</td>
<td>400hr/8 weeks</td>
<td></td>
<td>150</td>
<td>150 12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>580</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Semester-V (NSQF Level-7)

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
<td>TE</td>
</tr>
<tr>
<td>1</td>
<td>BMIV751</td>
<td>MRI, Image Processing and Recording</td>
<td>60</td>
<td>20</td>
<td>10</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>BMIV752</td>
<td>Advanced Imaging</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>BKVH751</td>
<td>Constitution of India, Law and Engineering</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BMIP751</td>
<td>MRI, Image Processing and Recording</td>
<td>30</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>BMIP752</td>
<td>Advanced Imaging</td>
<td>30</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td><strong>On-Job-Training (OJT)/Qualification Packs</strong></td>
<td>400hr/8 weeks</td>
<td></td>
<td></td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Duty Manager - Patient Relation Services (HSS/Q6104))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>580</td>
<td></td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

### Semester-VI (NSQF Level-7)

<table>
<thead>
<tr>
<th>S. N.</th>
<th>Code</th>
<th>Subject</th>
<th>Total Teaching/Training Hours</th>
<th>Internal Evaluation Scheme</th>
<th>End Sem</th>
<th>Total</th>
<th>Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>CT</td>
<td>TA</td>
<td>AT</td>
<td>Total</td>
<td>TE</td>
</tr>
<tr>
<td>1</td>
<td>BMIV761</td>
<td>Admin, Medico Legal and Interventional Procedures</td>
<td>60</td>
<td>20</td>
<td>10</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>2</td>
<td>BMIV762</td>
<td>Project</td>
<td>60</td>
<td>20</td>
<td>10</td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>BKVH761</td>
<td>Indian Tradition, Culture and Society</td>
<td>30</td>
<td>10</td>
<td>5</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>3</td>
<td>BMIP761</td>
<td>Admin, Medico Legal and Interventional Procedures</td>
<td>30</td>
<td></td>
<td></td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td><strong>On-Job-Training (OJT)/Qualification Packs</strong></td>
<td>400hr/8 weeks</td>
<td></td>
<td></td>
<td>200</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(The practical and theory need to be performed in a hospital/radiological centre) To continue with the same QP as opted in Level 7 First semester</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td>580</td>
<td></td>
<td></td>
<td>500</td>
<td>24</td>
</tr>
</tbody>
</table>

---

**B. Voc.-Medical Imaging Technology (MI)**

Branch Code: 112
Detailed Curriculum (Semester I)

Electronic Measurements and Instrumentation-II

Unit, dimensions and standards: Scientific notations and metric prefixes. SI electrical units, SI temperature scales, Other unit systems, dimension and standards.

Measurement Errors: Gross error, systematic error, absolute error and relative error, accuracy, precision, resolution and significant figures, Measurement error combination, basics of statistical analysis.

PMMC instrument, galvanometer, DC ammeter, DC voltmeter, series ohm meter
Transistor voltmeter circuits, AC electronic voltmeter, current measurement with electronic instruments, probes Digital voltmeter systems, digital multimeters, digital frequency meter system.

Basic Anatomy (Cross Sectional Anatomy-II)

1. Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology
2. Anatomy of the upper thorax and mid thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels, Lungs, heart and great vessels, Esophagus
3. Anatomy of the Abdomen- Major organs and their accessories, Abdominal bloodvessels
4. Anatomy of the Pelvis- Major organs and their accessories, Bony structures, Digestive and urinary systems
5. Neuro Anatomy- Scan planes
6. Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves
7. Spine- Vertebra and disc, Spinal cord and meninges
8. Neck- Arterial/venous systems, Muscles, Glands and pharynx

Tools, Equipment and Safety Measures-I

1. Cables & Connectors
   - Non-Metallic Sheathed Cable
   - Un grounded & Grounded Power Supply Cable
   - Metallic Sheathed Cable
   - Multi-Conductor Cable
   - Coaxial Cable
   - Unshielded Twisted Pair Cable
   - Shielded twisted pair cable
   - Ribbon Cable
   - Armoured & Unarmoured Cable
   - Twin-Lead Cable
   - Twin axial Cable
   - Optical fiber cable
   - Connectors

2. ESD Clothing
   - What to wear, how to wear
Soldering & De-Soldering of Components-I

1. Soldering & De Soldering of Basic Components
   - Soldering Tools
   - Different types of Soldering Guns related to Temperature and wattages, types of tips
   - Solder materials and their grading
   - Soldering and De Soldering Stations and their Specifications
   - Preparing Component for Soldering
   - PCB Applications
   - Types of PCB
   - Soldering Basic Components on PCB
   - De soldering Basic Components
   - Safety precautions while Soldering & De soldering
   - Check for cold continuity of PCB
   - Identification of loose/dry solder, broken tracks on printed wire assemblies & discrete components mounted circuit boards
   - Join the broken PCB track and test
   - De soldering using Pump and wick
   - Introduction of SMD Components

Identification of Components, Tools, Equipment’s & working – Lab

1. Identification & working of various electronic components
2. Working of testing equipment
3. Measurement using Multimeter & Clamp meter
4. Battery health check-up
5. Measure and test the voltage of given cells.
Basic Diagnostics (Lab)

1. X–Ray Imaging
   - X–Ray Tubes.
   - Stationary & Rotation Anode.
   - X–ray Consolestation (Demo of KV, MA and exposure time settings).
   - Procedures to reduce Scattered Radiation.
   - Focus Principle.
   - Grids.
   - Screen.
   - Image intensifiers.
   - Use of contrast materials.

2. Dark Room Technique
   - Images to ring devices.
   - Film cassette construction.
   - Duplicating a films
   - Spectrum.
   - Films types - Specialized use.
   - Operation, storage.
   - Photo chemistry.
   - Development.
   - Fixing.
   - Radiation protection, counters.
   - Assessment.

3. Radiological Positioning
   - Patient transfer technique.
   - Turning the patient.
   - Restraint techniques - Trauma, Pediatric, Geriatric, physically handicapped, disturbed patients, an aesthetized patient, moving chair & stretcher patients.
   - Tubes & catheters, Nasogastric, chest, Urinary, intravenous, oxygen & other (Castsurgical & cardiac) Alcoholic, bed pans & urinals.
   - Assessment.
(Semester II)

Electronic Measurements and Instrumentation – II

Voltmeter and ammeter methods, Wheatstone bridge, low resistance measurements, low resistance measuring instruments AC bridge theory, capacitance bridges, Inductance bridges, Q meter
CRO: CRT, wave form display, time base, dual trace oscilloscope, measurement of voltage, frequency and phase by CRO, Oscilloscope probes, Oscilloscope specifications and performance. Delay time based Oscilloscopes, Sampling Oscilloscope, DSO, DSO applications
Instrument calibration: Comparison method, digital multimeters as standard instrument, calibration instrument Recorders: X-Y recorders, plotters

Basic Imaging

2. Image Characteristic: Real and mental images, reflected, transmitted and emitted light images Photographic emulsions. The photographic latent image. Positive process
3. Film materials in X-ray: History, structure of an x- ray film, single and double emulsion films, types of films, cross over effect.
5. Sensitometry: Photographic density, characteristic curves, features of the characteristic curve.
6. Intensifying screens and cassettes. Cassette design, care of cassettes, types of cassettes, and mounting of intensifying screens, loading and unloading of cassettes, Care of intensifying screens, tests to check screen film contact and lightleakage.
8. Film processing: Development. The nature of development-manual or automatic. The PH scale, constitution of developing solutions both in manual and automatic processing and properties of developing chemicals, development time, factors in the use of a developer, developer activity.
9. Dark Room: Layout and planning. Dark room construction - Nature of floor, walls, ceiling and radiation protection, Dark room equipment and its layout. Location of pass through boxes or cassette hatches.
Tools, Equipment & Safety Measures-II

1. Tools & Equipment
   • Types of tools & equipment required and deployed in manufacturing, installing & servicing
   • Identification and termination process
   • General maintenance of tools/equipment and recalibration of Test equipment
   • General safety and common-sense safety

2. PPE
   • Usage & benefits of PPE
   • Types & usage of various PPE
   • Maintenance of PPE

3. Clean Room Environment
   • Do's and Don’t
   • Shop Floor Discipline

Soldering & De-soldering components & Emergency actions

1. Introduction to SMD Components
   • Identification of 2, 3, 4 terminal SMD components
   • Soldering the SMD components on the PCB
   • Make the necessary settings on SMD soldering station to solder various ICs of different packages by choosing proper clamping tools
   • Identify various connections and the setup required for SMD soldering station
   • De solder the SMD components from the given PCB
   • Make the necessary settings on SMD soldering station to de solder various ICs of different packages by choosing proper clamping tools
   • Make a panel board using different types of switches for a given application
   • Identification of crimping tools for various IC packages
   • Reliable Soldering Practices

2. Emergency actions
   • Minimum Requirements
   • Reporting Emergencies
   • Emergency exits
   • Primary and secondary evacuation routes
   • Locations of fire extinguishers
   • Fire alarm pull stations’ location
   • Assembly points
   • Medical Services
**Soldering & De-soldering components – Lab**

1. Assemble the product
2. Dis-assemble the product
3. Safety Precautions & emergency plans

**Basic Imaging Practical’s Lab**

1. Test to check the x-ray films and screen contact in the cassette
2. Test to check light leakage in the cassette.
3. To check the effect of safe light on exposed as well as unexposed x-ray film

**IT Tools Lab.**

1. Spreadsheets, Word, Presentation
2. Multimedia Design
3. Troubleshooting
4. Project / Practical File
5. Viva Voce
(Semester III)

Fault Analysis & Repairs

1. Classification of fault
2. Identification of fault
3. Rectification of fault
4. Repairing/Replacing Module
5. Analysis for the different types of equipment’s
   - Smartphones
   - Air Conditioning
   - Security systems
   - Electronically controlled doors
6. Fault analysis based on hardware and software component
7. Diagnostic and Testing Methods
8. Visual Inspection
9. Earth Continuity Test
10. Insulation Resistance Test

Cross Sectional Anatomy-II

1. Introduction to Sectional Anatomy & Terminology- Sectional planes, Anatomical relationships/terminology
2. Anatomy of the upper thorax- Surface anatomy relationships, Bony structures and muscles, Blood vessels.
3. Divisions of the mid-thorax, heart and great vessels- Lungs, heart and great vessels, Esophagus
4. CT/MRI Images of the Thorax - Normal and pathologic
5. Anatomy of the Abdomen- Major organs and their accessories, Abdominal bloodvessels
6. CT/MR Images of Abdomen - Normal and pathologic
7. Anatomy of the Pelvis- Bony structures and associated muscles, Digestive and urinary systems
8. Reproductive Organs
9. CT/MR Images of the Male/Female Pelvis- Normal and pathologic
10. Neuro Anatomy- Scan planes
11. Brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves
12. Spine- Vertebra and disc, Spinal cord and meninges
13. Neck- Arterial/venous systems, Muscles, Glands and pharynx
Electronics Devices Circuit-I

Unit I


Radiation & Administrative Issues


2. Maintenance and care of equipment: Safe operation of equipment, Routine cleaning of equipment and instruments, Cassette, screen maintenance, Maintenance of automatic processor and manual processing units, Routine maintenance of equipment.


4. Units detection and measurement: Units of radiation for exposure, absorbed dose, dose equivalent, and radio-activity, Quality factor to determine the doseequivalent.

5. Radiation detection devices: Ion-Chambers, Proportional counter, Thermoluminescent dosimeters (TLD), Appropriate application and limitation of each radiation detection device.


7. Patient Protection:
Relationship of beam limiting devices with radiation protection of patients, Added and inherent filtration, Purpose and importance of patient shielding, Patient shielding devices and radiographic procedures shielding to the radiographic procedures, Protection of women at child- bearing age, Methods to avoid repeat radiographs, Importance of clear, concise, instruction (effective communication skills) as a method of radiation protection, Effects of immobilization techniques to eliminate voluntary motions.

8. AERB specifications: Radiation safety (lead glass equivalence, lead lined doors) - room size - type approval – registrations & licenses - selection of exposure parameter for
various protocols – diagnostic reference levels.

**Electronic Devices and Circuits Lab**

1. Study of Lab Equipments and Components: CRO, Multimeter, and Function Generator, Power supply- Active, Passive Components and Bread Board.
2. P-N Junction diode: Characteristics of PN Junction diode - Static and dynamic resistance measurement from graph.
4. Characteristics of Zener diode: V-I characteristics of zener diode, Graphical measurement of forward and reverse resistance.

**Fault Analysis & Repairs – Lab**

1. Categorization of faults
   - Hardware/Software, User Induced, Component Failures
   - L0 to L4 repairs
2. Testing electrical/electronic components in the product
3. Troubleshoot and repair of the faults identified in the product
4. Preventive Maintenance Services
(Semester IV)

CT and Ultrasound

1. Computed Tomography (CT)
   - **Basic Computed Tomography:** Basic principles of CT, generations of CT, CT instrumentation, image formation in CT, CT image reconstruction, Hounsfield unit, CT image quality, CT image display
   - **X-ray tube:** Construction working and limitations, generations, methods of cooling the anode, anode rating chart, speed of anode rotation, angle of anode inclination, Focus, anode heel effect, Effect of variation of anode voltage and filament temperature, inherent filter and added filter, bow tie filter, effect on quality of the spectrum.
   - **Collimator designs:** Pencil beam, Fan beam, Cone beam CT, Z-axis collimation, detector design – construction and working - Gas filled detectors – solid state detectors – flat panel detectors.
   - **Principles of tomography:** advantages and limitations – generations – spiral CT – slip ring technology - Multislice CT – dual source CT - pitch – rotation time.
   - **Basic principles of Image Reconstruction:** Back projection, analytical an iterative methods – MPR – MIP – volume rendering – surface shaded display (SSD) – bone reconstruction.
   - **CT artefacts:** motion artefacts, streak artefacts, ring artefacts, partial volume artefacts etc. causes and remedy.
   - **Dose and Dosimetry:** CT Dose Index (CTDI, etc.), Multiple Scan Average Dose (MSAD), Dose Length Product (DLP), Dose Profile, Effective Dose, Phantom Measurement Methods, Dose for Different Application Protocols, Technique Optimization
   - **Advanced Computed Tomography:** Helical CT scan: Slip ring technology, advantages, multi detector array helical CT, cone – beam geometry, reconstruction of helical CT images, CT artifact, CT angiography, CT fluoroscopy, HRCT, post processing techniques: MPR, MIP, Min IP, 3D rendering: SSD and VR, CT Dose, patient preparation, Imaging techniques and protocols for various parts of body, CT contrast enhanced protocols – CT angiography – (Aortogram, selective angiogram head, neck and peripheral) image documentation and Filing, maintenance of equipment and accessories.
   - **Technical Assessment and Equipment Purchase Recommendations**

2. Ultrasonography
   - **Basic Acoustics, Ultrasound terminologies:** acoustic pressure, power, intensity, impedance, speed, frequency, dB notation: relative acoustic pressure and relative acoustic intensity.
   - **Interaction of US with matter:** reflection, transmission, scattering, refraction and absorption, attenuation and attenuation coefficients, US machine controls, US focusing.
   - **Production of ultrasound:** Piezoelectricity, Medical ultrasound transducer: Principle, construction and working, characteristics of US beam.
   - **Ultrasound display modes:** A, B, M
• **Real-time ultrasound:** Line density and frame rate, Real-time ultrasound transducers: mechanical and electronic arrays, ultrasound artifacts, ultrasound recording devices, and Distance, area & volume measurements.

• **Techniques for imaging different anatomic areas, ultrasound artifacts, biological effects and safety.**

• **Doppler Ultrasound:** Doppler Theory, Doppler-Frequency Shift, Reflector Velocity Dependence, Doppler Angle Dependence, Spectral Analysis, Continuous Wave (CW) Doppler, Pulsed Doppler, Pulse Transmission and Range Gating, Aliasing, Duplex Scanning, Color Flow Imaging, Power Doppler, Patient preparation for Doppler, Doppler artifacts, vascular sonography.

---

**Manufacturing & Quality Norms**

1. Manufacturing & Quality Norms- keep it differently according to all applications
   - Manpower Deployment and Operations as per Work Instructions and criticality of the process Understanding how to form each operation and practical training of operation
   - Understanding accept and reject criterion of a particular operation. Practical training of testing/checking each operation
   - Quality Norms of accept and practical training of electronic equipment’s/Devices Acceptance/Rejection training of various defects

2. Manufacturing & Quality Norms – II
   - Process in packing line-packing line Operations sequence flow and its importance
   - Quality Systems - Accept, Reject criterion of various tests at OQA
   - Training of Assembly of electronic components - Assemble, Check, test electronic components
   - Various Labels and their Importance - Understanding Labels, Scanning and its importance
   - Packing of components/devices - Various Stages of packing
   - Acceptance, Reject and sampling following QA norms - AQL level, Sampling techniques, as per QA sampling accept, reject numbers

---

**Electronics Devices Circuit-II**

1. Good Manufacturing Concepts & Practices - II
   - Brief Introduction
   - Total Quality Management
   - ISO Standards

2. Kaizen
3. Toyota Production System
4. Lean Manufacturing
   - Combination of Inventory
   - Supply Chain

5. Quality and Inspection
   - 3 Sigma and 6 Sigma Orientation
**Electronic Devices and Circuits –II Lab**

1. Characteristic of BJT: BJT in CE configuration- Graphical measurement of parameters from input and output characteristics. Measurement of $Av$, $Al$, $Ro$ and $Ri$ of CE amplifier with potential divider biasing.

**Manufacturing Practices**

1. Work study concepts
2. Team work concepts
(Semester V)

MRI, Image Processing and Recording


2. Basic MR Image formation: RF Excitation, Relaxation (T1 and T2), Computation and display, Free induction decay, RF wave form designs.

3. Introduction to MR coils: Volume coils, Gradient coils, Slice selection, phase encoding, frequency encoding.

4. Artifacts: Cause of artifacts, Image quality, image contrast, signal to noise ratio, resolution, artefacts, MR contrast agents, Advanced MR techniques, flow effects, MR angiography echo planner imaging, magnetization transfer, fat suppression, MR spectroscopy, functional imaging, Magnetic resonance hazards and safety, Recent development.

5. MRI Scanners: Methods of MRI imaging methods; Head and Neck, Thorax, Abdomen, Musculoskeletal System imaging; Clinical indications and contraindications; types of common sequences effects of sequence on imaging; Protocols for various studies, slice section, patient preparation; positioning of the patient; patient care-calibration - paramagnetic agents and dose, additional techniques and recent advances in MRI; image acquisition-modification of procedures in an unconscious or uncooperative patient; plain studies; contrast studies; special procedures; reconstructions; 3D images; MRS blood flow imaging, diffusion/perfusion scans; strength and limitations of MRI; role of radiographer.

6. MR safety: instrumentation and biological effects.

Advanced Imaging

1. Computed Tomography its principle, various generations and advancements.

2. Ultrasonography, Color Doppler- its principle, advancements and applications.

3. Digital Radiography and Digital subtraction angiography equipment- principle, advancements and applications.

4. Fusion Imaging including PET-CT, PET- MRI.

5. Digital Mammography, DEXA equipment- principle, advancements and applications.

6. Tele radiology HIS, RIS and PACS

7. Image processing in digital radiography systems: Post processing techniques in console using CR, DR and flat panel fluoroscopy systems.

8. Basic angiography and DSA.

MRI, Image Processing and Recording

1. MRI Images of the Thorax - Normal and pathologic
2. MR Images of Abdomen - Normal and pathologic
3. MR Images of the Male/Female Pelvis- Normal and pathologic
4. Neuro Anatomy- Scan planes brain - Cerebral hemispheres, Sinuses, Ventricles, Brainstem and associated parts, Arterial/venous systems, Basal ganglia, Cranial nerves
5. Spine- Vertebra and disc, Spinal cord and meninges
Advanced Imaging

1. Central Nervous System: Myelography, Cerebral studies, Ventriculography
2. Arthrography: Shoulder, Hip, Knee, Elbow
3. Angiography: Carotid Angiography (4 Vessel angiography), Thoracic and Arch Aortography, Selective studies: Renal, SMA, Coeliac axis, Vertebral angiography, Femoral arteriography, Angiocardiography
4. Venography: Peripheral venography, Cerebral venography, Inferior and superior venocavography, Relevant visceral phlebography
5. Cardiac catheterization procedures: PTCA, BMV, CAG, Pacemaker, Electrophysiology
6. Gynaecology: Hysterosalpingography
10. Other: Sialography
(Semester VI)

Admin, Medico Legal and Interventional Procedures


2. Medical law and ethics: Medical ethics; Definition, Goal, Scope; Introduction to Code of conduct; Basic principles of medical ethics – Confidentiality; Malpractice and negligence; Autonomy and informed consent - Right of patients; Care of the terminally ill-Euthanasia; Organ transplantation; Medico legal aspects of medical records – Medico legal case and type- Records and document related to MLC - ownership of medical records - Confidentiality Privilege communication - Release of medical information - Unauthorized disclosure - retention of medical records - other various aspects; Professional Indemnity insurance policy; Development of standardized protocol to avoid near miss or sentinel events; Obtaining an informed consent.

3. Quality and patient safety: Quality assurance; Concepts of Quality of Care, Quality Improvement Approaches, Standards and Norms, Quality Improvement Tools, Introduction to NABH guidelines; AERB specifications, radiation safety (lead glass equivalence, lead lined doors), room size, type approval, registrations & licenses, selection of exposure parameter for various protocols, diagnostic reference levels.

4. Basics of emergency care and life support skills: Basic life support (BLS), sudden Cardiac Arrest (SCA), cardiopulmonary resuscitation (CPR), Automated External Defibrillator (AED).

Project

Project work may include case study related to Newer Imaging Technology.

Admin, Medico Legal and Interventional Procedures

1. Quality assurance and Radiation safety survey in diagnostic X-ray installations.
2. Community orientation and clinical visit: Visit will include visit to the entire chain of healthcare delivery system - sub centre, PHC, CHC, SDH, DH and Medical College, private hospitals, dispensaries and clinics.
3. Governance at village level including interaction and group discussion with village panchayat and front line health workers.
4. Clinical visit to their respective professional department within the hospital.