

**LOT 12 - BIOMEDICAL ENGINEERING**

| S/No.   | LOT NO. | EXPECTED EQUIPMENT                           | QTY | Estimated Units Price | Estimated Total Price |
|---|---------|--|-----|-----------------------|-----------------------|
|   |         | <b>WORKSHOP</b>                              |     |                       |                       |
| 1.  | 12-1    | Electronics Toolbox (Tool kits)              | 10  |                       |                       |
| 2.  | 12-2    | Variable output isolation transformer        | 1   |                       |                       |
| 3.  | 12-3    | Signal Generator                             | 1   |                       |                       |
| Assorted equipment testing instruments/Simulators and Calibration equipment |         |  |     |                       |                       |
| 4.  | 12-4    | Patient Monitor Analyzer (Patient Simulator) | 2   |                       |                       |
| 5.  | 12-6    | Defibrillator Analyzer                       | 2   |                       |                       |
| 6.  | 12-7    | Electrical Safety Analyzer                   | 2   |                       |                       |
| 7.  | 12-8    | Electrosurgical Analyzer                     | 2   |                       |                       |
| 8.  | 12-9    | Gas Flow Analyzer                            | 2   |                       |                       |
| 9.  | 12-10   | Infusion and Syringe Pump Analyzer           | 2   |                       |                       |
| 10.   | 12-11   | Oscilloscope                                 | 1   |                       |                       |
| 11.   | 12-12   | Oxygen Analyzer                              | 3   |                       |                       |
| 12.   | 12-13   | Radiation Analyzer                           | 1   |                       |                       |
| 13.   | 12-14   | Ultrasound Wattmeter                         | 1   |                       |                       |

**LOT 12: BIOMEDICAL CALIBRATION EQUIPMENT**

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**LOT 12-1 Electronic Toolbox**

| Item Code No.          |  | Department  | Section             | Item Description                                 |  |  |
|------------------------|--|-------------|---------------------|--|--|--|
| LOT 12-1               |  | Engineering | Biomedical Workshop | Electronic Toolbox                               |  |  |
| 1. General Description |  |             |                     |  |  |  |
|                        |  |             |                     |  |  |  |
| 2. Composition         |  |             |                     |  |  |  |
| 2.1.                   | Main unit                                |             |                     |  |  |  |
| 3.                     |  |             |                     |  |  |  |
| 3.1.                   | Utility component storage box            |             | 3.2.                | Crimping tool (inch) or (metric)                 |  |  |
| 3.3.                   | Long nose plier 135mm                    |             | 3.4.                | Desoldering pump                                 |  |  |
| 3.5.                   | Diagonal cutting plier 110mm             |             | 3.6.                | 5pcs needle file set                             |  |  |
| 3.7.                   | Dual Color Lineman’s plier               |             | 3.8.                | Testing screwdriver                              |  |  |
| 3.9.                   | Bent nose plier 130mm                    |             | 3.10.               | Alignment tool (200mm/2.0mm)                     |  |  |
| 3.11.                  | Side cutting plier 150mm                 |             | 3.12.               | IC extractor                                     |  |  |
| 3.13.                  | Dual Color Long nose plier               |             | 3.14.               | Oil can  |  |  |
| 3.15.                  | Reverse action tweezer                   |             | 3.16.               | Flash light                                      |  |  |
| 3.17.                  | 3pcs soldering aid tools                 |             | 3.18.               | 7pcs Folding type hex key set (inch) or (metric) |  |  |
| 3.19.                  | Soldering iron stand with sponge         |             | 3.20.               | 3 Prong holder                                   |  |  |
| 3.21.                  | Adjustable wrench 6"                     |             | 3.22.               | 6pcs open-end wrench set                         |  |  |
| 3.23.                  | Ceramic soldering iron 110V or 220V      |             | 3.24.               | Heavy Duty Curved-Claw Hammer                    |  |  |
| 3.25.                  | Screw driver 3/16"(inch) or 5mm (metric) |             | 3.26.               | PVC insulated tape                               |  |  |
| 3.27.                  | Screw driver 1/4"(inch) or 6mm (metric)  |             | 3.28.               | Stainless scissors 6"                            |  |  |
| 3.29.                  | Screw driver 3.2x75mm                    |             | 3.30.               | Solder core 63%, SN                              |  |  |
| 3.31.                  | Screw driver #0x75mm                     |             | 3.32.               | Parts tube                                       |  |  |
| 3.33.                  | Screw driver 5.0x75mm                    |             | 3.34.               | Heat sink  |  |  |
| 3.35.                  | Screw driver #1x75mm                     |             | 3.36.               | Utility knife (3 blades self-loading)            |  |  |

| Item Code No. |                                 | Department  | Section             | Item Description                |
|---------------|---------------------------------|-------------|---------------------|---------------------------------|
| LOT 12-1      |                                 | Engineering | Biomedical Workshop | Electronic Toolbox              |
| 3.37.         | Screw driver 6.0x100mm          |             | 3.38.               | Measuring tape 3M/10FT          |
| 3.39.         | Screw driver #2x100mm           |             | 3.40.               | Inspection mirror               |
| 3.41.         | Screw driver 6.0x40mm           |             | 3.42.               | Slip-channel pump pliers 254mm  |
| 3.43.         | Screw driver #2 x40mm           |             | 3.44.               | Pallet for 1PK-1700N series     |
| 3.45.         | Desoldering wick                |             | 3.46.               | Top Pallet for 1PK-1700N series |
| 3.47.         | Brush                           |             | 3.48.               | Carrying tool case              |
| 3.49.         | 6pcs electronic screwdriver set |             | 3.50.               | Professional Multimeter         |

#### LOT 12-2 Variable Output Isolation Transformer

| Item Code No.   |           | Department  | Section             | Item Description      |  |  |
|---|-----------|-------------|---------------------|-----------------------|--|--|
| LOT 12-2  |           | Engineering | Biomedical Workshop | Isolation Transformer |  |  |
| 1. General Description  |           |             |                     |                       |  |  |
| Digital Single phase Output isolation Transformer   |           |             |                     |                       |  |  |
| 2. Composition  |           |             |                     |                       |  |  |
| 2.1.  | Main unit |             |                     |                       |  |  |
| 240VAC Single Phase 50/60 Hz Input;<br>0-280VAC Output;<br>At least 9.5 Amps Max, the higher the better.<br>Microprocessor Controlled system;<br>Includes case, cord, plug, receptacle, lighted switch and output fuse.<br>Digital Voltmeter (output)<br>Digital Ammeter (output)<br>True Sine Wave Output<br>Universal Output Receptacle to allow connection to most US, UK and EU plugs.<br>The Metered Bench Top VARIAC to provide a precise voltage output. |           |             |                     |                       |  |  |

| Item Code No.  | Department  | Section             | Item Description      |
|--|-------------|---------------------|-----------------------|
| LOT 12-2   | Engineering | Biomedical Workshop | Isolation Transformer |
| <p>The output to be a true sine wave.</p> <p>The output voltage to be digitally adjusted via a large front panel knob or digital buttons.</p> <p>Digital readouts to be provided for output voltage and load amperage.</p> <p><b>Details</b></p> <p>Voltmeter Accuracy: +/- 0.5% F.S. +/- 1LSD</p> <p>Enclosure: Ventilated enclosure</p> <p>Voltmeter Resolution: 1 VAC</p> <p>Line Cord: at least 5 ft with plug</p> <p>Ammeter Accuracy: +/- 1.0% F.S. +/-1 LSD</p> <p>Receptacle: (2) Universal mounted on front</p> <p>Ammeter Resolution: 0.01 AAC</p> <p>Input/Output Isolation: None</p> <p>Regulation: None</p> <p>Protection: Input &amp; output fuses</p> |             |                     |                       |

#### **LOT 12-3 Patient Monitor Analyzer (Patient Simulator)**

| Item Code No.          | Department  | Section                          | Item Description                             |
|------------------------|-------------|----------------------------------|--|
| LOT 12-3               | Engineering | Biomedical Workshop              | Patient Monitor Analyzer (Patient Simulator) |
| 1. General Description |             |                                  |  |
|                        |             |                                  |  |
| 2. Composition         |             |                                  |  |
| 2.1.                   | Main unit   |                                  |  |
|                        |             |                                  |  |
| Temperature            | Operating   | 10 °C to 40 °C (50 °F to 104 °F) |  |

| Item Code No.                       | Department  | Section   | Item Description                             |
|-------------------------------------|---|---|--|
| LOT 12-3                            | Engineering   | Biomedical Workshop   | Patient Monitor Analyzer (Patient Simulator) |
|                                     | Storage   | -20 °C to +60 °C (-4 °F to 140 °F)  |  |
| Humidity                            | 10 % to 90 % non-condensing   |   |  |
| Altitude                            | 3,000 meters (9,843 ft)   |   |  |
| Dimensions (L x W x H)              | 14.5 cm x 30.2 cm x 8.6 cm (5.7 in x 11.9 in x 3.4 in)  |   |  |
| Display                             | LCD color display   |   |  |
| Communication                       | USB device upstream port  | Mini-B connector for control by a computer  |  |
|                                     | USB host controller port  | Type A, 5 V output, 0.5 A max load. Connector for keyboard, barcode reader, and printer |  |
|                                     | Wireless  | IEEE 82.15.4 for control by a computer  |  |
| Power                               | Lithium-ion rechargeable battery  |   |  |
| Battery charger                     | 100 V to 240 V input, 15 V/2.0 A output. For best performance, the battery charger should be connected to a properly grounded ac receptacle         |   |  |
| Battery life                        | 9 hours (minimum), 100 NIBP cycles typical  |   |  |
| Safety standards                    | IEC/EN 61010-1 3rd Edition; Pollution degree 2 CAT None   |   |  |
| Certifications                      | CE, CSA, C-TICK N10140 , RoHS   |   |  |
| Electromagnetic compatibility (EMC) | IEC 61326-1:2012  |   |  |
| Normal-sinus-rhythm waveform        |   |   |  |
| ECG reference                       | The ECG amplitudes specified are for Lead II (calibration), from the baseline to the peak of the R wave. All other leads are proportional           |   |  |
| Normal sinus rhythm                 | 12-lead configuration with independent outputs referenced to right leg (RL). Output to 10 universal ECG jacks, color-coded to AHA and IEC standards |   |  |

| Item Code No.             | Department   | Section   | Item Description                             |
|---------------------------|--|---|--|
| LOT 12-3                  | Engineering  | Biomedical Workshop   | Patient Monitor Analyzer (Patient Simulator) |
| High-level output         | 0.5 V/mV $\pm$ 5 % of the ECG amplitude setting available on a BNC connector   |   |  |
| Amplitude                 | 0.05 mV to 0.5 mV (0.05 mV steps); 0.5 mV to 5.0 mV (0.25 mV steps) Other leads are proportional to Lead II (reference lead) in percentage per:<br>Lead I: 70<br>Lead II: 100<br>Lead III: 30<br>Lead V1: 24<br>Lead V2: 48<br>Lead V3: 100<br>Lead V4: 120<br>Lead V5: 112<br>Lead V6: 80 |   |  |
| Amplitude accuracy        | $\pm$ (2 % of setting + 0.05 mV)   |   |  |
| ECG rate                  | 10 BPM to 360 BPM in 1 BPM steps   |   |  |
| Rate accuracy             | $\pm$ 1 % of setting   |   |  |
| ECG waveform selection    | Adult (80 ms) or pediatric (40 ms) QRS duration  |   |  |
| ST-segment elevation      | Adult mode only. -0.8 mV to +0.8 mV (0.1 mV steps). Additional steps: + 0.05 mV and - 0.05 mV  |   |  |
| Power-on default          | 60 BPM, 1.0 mV, adult QRS and ST-segment elevation of 0 mV   |   |  |
|                           |  |   |  |
| <b>Pacemaker waveform</b> |  |   |  |
| Pacer pulse               | Amplitude  | 0 (off), $\pm$ 2, $\pm$ 4, $\pm$ 6, $\pm$ 8, $\pm$ 10, $\pm$ 12, $\pm$ 14, $\pm$ 16, $\pm$ 18, $\pm$ 20, $\pm$ 50, $\pm$ 100, $\pm$ 200, $\pm$ 500, and $\pm$ 700 mV for lead II (reference lead) |  |
|                           | Accuracy   | Reference lead II: $\pm$ (5 % setting + 0.2 mV)   |  |
| Pacer pulse width         | 0.1 ms, 0.2 ms, 0.5 ms, 1 ms, and 2 ms $\pm$ 5 %   |   |  |
| Paced arrhythmias         | Atrial 80 BPM  |   |  |
|                           | Asynchronous 75 BPM  |   |  |
|                           | Demand with frequent sinus beats   |   |  |

| Item Code No.                 | Department  | Section  | Item Description                             |
|-------------------------------|---|--|--|
| LOT 12-3                      | Engineering   | Biomedical Workshop  | Patient Monitor Analyzer (Patient Simulator) |
|                               | Demand with occasional sinus beats  |  |  |
|                               | Atrio-ventricular sequential  |  |  |
|                               | Noncapture (one time)   |  |  |
|                               | Nonfunction   |  |  |
|                               | Amplitude 5 mV, width 1 ms, atrial waveform   |  |  |
| Arrhythmia                    |   |  |  |
| Baseline NSR                  | 80 BPM  |  |  |
| PVC focus                     | Left focus, standard timing (except where specified)  |  |  |
| Supraventricular arrhythmia   | Atrial fibrillation (coarse or fine); atrial flutter; sinus arrhythmia; missed beat (one time); atrial tachycardia; paroxysmal atrial tachycardia; nodal rhythm; and supraventricular tachycardia   |  |  |
| Premature arrhythmia          | Premature atrial contraction (PAC); premature nodal contraction (PNC); PVC1 left ventricular; PVC1 left ventricular, early; PVC1 left ventricular, R on T; PVC2 right ventricular; PVC2 right ventricular, early; PVC2 right ventricular, R on T; and multifocal PVCs                       |  |  |
| Ventricular arrhythmia        | PVCs 6, 12, or 24 per minute; frequent multifocal PVCs; bigeminy; trigeminy; multiple PVCs (one-time run of 2, 5, or 11 PVCs); monoventricular tachycardia (120 to 300 BPM in 5 BPM steps); poly-ventricular tachycardia (5 types); ventricular fibrillation (coarse or fine); and asystole |  |  |
| Conduction defect             | First-, second-, or third-degree heart block; and right- or left-bundlebranch block   |  |  |
| Advanced cardiac life support | Shockable pulseless arrest rhythms  | Ventricular fibrillation (coarse), ventricular fibrillation (fine), unstable polymorphic ventricular tachycardia |  |
|                               | Non-shockable pulseless arrest rhythms  | Asystole   |  |
|                               | Symptomatic bradycardia   | Sinus bradycardia (< 60 BPM)   |  |
|                               |   | 2nd degree AV block, mobitz type I   |  |
|                               |   | 2nd degree AV block, mobitz type II  |  |

| Item Code No.                       | Department  | Section             | Item Description  |
|-------------------------------------|---|---------------------|---|
| LOT 12-3                            | Engineering   | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator)  |
|                                     |   |                     | Complete/3rd degree AV block  |
|                                     |   |                     | Right bundle branch block   |
|                                     |   |                     | Left bundle branch block  |
| Advanced cardiac life support cont. | Symptomatic tachycardia: regular narrow-complex tachycardia (QRS < 0.12 seconds)  |                     | Sinus tachycardia > 150 BPM   |
|                                     |   |                     | Supraventricular Tachycardia  |
|                                     | Symptomatic tachycardia: regular wide-complex tachycardias (QRS ≥ 0.12 seconds)   |                     | Sinus tachycardia > 150 BPM   |
|                                     |   |                     | Supraventricular tachycardia SVT with aberrancy   |
|                                     | Irregular tachycardia   |                     | Atrial fibrillation (coarse and fine), atrial flutter, unstable monomorphic ventricular tachycardia (120 BPM to 300 BPM), torsade de pointes/polymorphic ventricular tachycardia (long QT interval) |
| <b>ECG Performance testing</b>      |   |                     |   |
| Amplitude                           | 0.05 mV to 0.5 mV (0.05 mV steps);<br>0.5 mV to 5.0 mV (0.25 mV steps)<br>Other leads are proportional to Lead II (reference lead) in percentage per: |                     |   |
| Lead I: 70                          |   |                     |   |
| Lead II: 100                        |   |                     |   |
| Lead III: 30                        |   |                     |   |
| Lead V1 through V6: 100             |   |                     |   |
| Pulse wave                          | 30 BPM, 60 BPM, with 60 ms pulse width  |                     |   |
| Square wave                         | 0.125 Hz, 2 Hz, 2.5 Hz  |                     |   |
| Triangle wave                       | 0.125 Hz, 2 Hz, 2.5 Hz  |                     |   |



| Item Code No.   | Department   | Section             | Item Description  |
|---|--|---------------------|---|
| LOT 12-3  | Engineering  | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator)                    |
| Sine wave   | 0.05 Hz, 0.5 Hz, 1, 2 Hz, 5 Hz, 10 Hz, 25 Hz, 30 Hz, 40 Hz, 50 Hz, 60 Hz, 100 Hz, and 150 Hz |                     |   |
| R-wave detection  | Waveform   |                     | Triangular pulse  |
|   | Rate   |                     | 30 BPM, 60 BPM, 80 BPM, 120 BPM, 200 BPM, and 250 BPM           |
|   | Width  |                     | 8 ms to 20 ms in 2 ms steps, and 20 ms to 200 ms in 10 ms steps |
|   | Width accuracy   |                     | ± (1 % of setting + 1 ms)                                       |
| QRS detection   | Widths   |                     | 8 ms to 20 ms in 2 ms steps, and 20 ms to 200 ms in 10 ms steps |
|   | Width accuracy   |                     | ± (1 % of setting + 1 ms)                                       |
|   | Rate   |                     | 30 BPM, 60 BPM, 80 BPM, 120 BPM, 200 BPM, and 250 BPM           |
|   | R-Wave up slope  |                     | 0.875 amplitude, 0.4375 x width                                 |
|   | R-Wave down slope  |                     | Full amplitude, 0.5 x width                                     |
|   | S-Wave up slope  |                     | 0.125 amplitude, 0.0625 x width                                 |
| Tall T-wave rejection   | Waveform   |                     | QT Interval 350 ms  |
|   |  |                     | T-Wave width 180 ms   |
|   |  |                     | T-Wave shape ½ sinewave   |
|   | Amplitude  |                     | 0 % to 150 % reference lead amplitude in 10 % steps             |
|   | Rate   |                     | 80 BPM  |
| Rate accuracy   | ± 1 % of setting   |                     |   |
| Amplitude accuracy  | ± (2 % of setting + 0.05 mV)   |                     |   |
| Amplitude <ul style="list-style-type: none"><li>0 % to 150 % reference lead amplitude in 10 % steps</li></ul> |  |                     |   |
| Rate  |  |                     |   |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <ul style="list-style-type: none"> <li>• 80 BPM</li> </ul> <p>ECG Artifact</p> <p>Type</p> <ul style="list-style-type: none"> <li>• 50 Hz, 60 Hz, muscular, baseline wander, respiration</li> </ul> <p>Size</p> <ul style="list-style-type: none"> <li>• 25 %, 50 %, 100 % of the normal sinus R-Wave for each lead</li> </ul> <p>Lead Select</p> <p>All, RA, LL, LA, V1, V2, V3, V4, V5, V6</p> <ul style="list-style-type: none"> <li>• Fetal/Maternal ECG</li> <li>• Fetal Heart Rate (fixed)</li> <li>• 60 BPM to 240 BPM in 1 BPM steps</li> <li>• Fetal Heart Rate (IUP)</li> <li>• 140 BPM at beginning, then varies with pressure</li> <li>• Intrauterine-Pressure Waveforms</li> <li>• Variable deceleration, early deceleration, late deceleration, and uniform acceleration</li> <li>• Wave Duration</li> <li>• 90 seconds, bell-shaped pressure curve, from 0 mmHg to 90 mmHg and returning to 0</li> <li>• IUP Period</li> <li>• min, 3 min, or 5 minutes; and manual</li> <li>• Default Settings</li> <li>• FHR 120 BPM, uniform deceleration wave, manual</li> </ul> <p>Invasive Blood Pressure</p> <p>Channels</p> <ul style="list-style-type: none"> <li>• 2, each independently settable with identical parameters and are individually electrically isolated from all other signals</li> </ul> <p>Input/Output Impedance</p> <ul style="list-style-type: none"> <li>• 300 <math>\Omega</math> - or <math>\pm 10</math> %</li> </ul> <p>Exciter Input Range</p> <ul style="list-style-type: none"> <li>• to 16 V peak</li> </ul> <p>Exciter-Input Frequency Range</p> <ul style="list-style-type: none"> <li>• DC to 5000 Hz</li> </ul> <p>Transducer Sensitivity</p> <ul style="list-style-type: none"> <li>• 5 (default) or 40 <math>\mu</math> V/V/mmHg</li> </ul> <p>Pressure Accuracy</p> <ul style="list-style-type: none"> <li>• <math>\pm</math> (1 % of setting + 1 mmHg) accuracy guaranteed for dc excitation only</li> </ul> <p>Static Pressure</p> <ul style="list-style-type: none"> <li>• - 10 to + 300 mmHg in 1 mmHg steps</li> </ul> |             |                     |  |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <p>Pressure Units</p> <ul style="list-style-type: none"> <li>• mmHg or Kpa</li> <li>• Cardiac Catheterization</li> <li>• Chambers: Aortic, pulmonary valve, and mitral valve</li> </ul> <p>BP Output</p> <ul style="list-style-type: none"> <li>• Circular DIN 5-Pin</li> <li>• Power-On Default</li> <li>• 0 mmHg</li> <li>• Swan-Ganz Sequence</li> <li>• Right atrium, right ventricle (RV), pulmonary artery (PA), pulmonary artery wedge (PAW)</li> </ul> <p>Dynamic Waveforms</p> <p>Types (default pressures)</p> <ul style="list-style-type: none"> <li>• Arterial (120/80)</li> <li>• Radial artery (120/80)</li> <li>• Left ventricle (120/00)</li> <li>• Right ventricle (25/00)</li> <li>• Pulmonary artery (25/10)</li> <li>• Pulmonary-artery wedge (10/2)</li> <li>• Right atrium (central venous or CVP) (15/10)</li> </ul> <p>Pressure variability</p> <ul style="list-style-type: none"> <li>• Systolic and diastolic pressures are independently variable in 1 mmHg steps</li> <li>• Respiration Artifact</li> <li>• Arterial, radial artery, and left ventricle</li> <li>• 5 % to 10 % multiplication</li> </ul> <p>Other</p> <ul style="list-style-type: none"> <li>• 5 mmHg or 10 mmHg</li> </ul> <p>Respiration</p> <p>Rate</p> <ul style="list-style-type: none"> <li>• 0 (OFF), 10 BrPM to 150 BrPM in 1 BrPM steps</li> </ul> <p>Waves</p> <ul style="list-style-type: none"> <li>• Normal or ventilated</li> </ul> <p>Ratio (inspiration:expiration)</p> <ul style="list-style-type: none"> <li>• Normal 1:1, 1:2, 1:3, 1:4, 1:5</li> </ul> |             |                     |  |

| Item Code No.   | Department  | Section             | Item Description                             |
|---|-------------|---------------------|--|
| LOT 12-3  | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <ul style="list-style-type: none"> <li>Ventilated 1:1</li> </ul> <p>Impedance Variations (<math>\Omega</math>)</p> <ul style="list-style-type: none"> <li>0.00 <math>\Omega</math> to 1.00 <math>\Omega</math> in 0.05 <math>\Omega</math> steps and 1 <math>\Omega</math> to 5 <math>\Omega</math> in 0.25 <math>\Omega</math> steps</li> <li>Accuracy Delta</li> <li><math>\pm</math> (3 % of setting + 0.05 <math>\Omega</math>)</li> </ul> <p>Baseline</p> <ul style="list-style-type: none"> <li>500 <math>\Omega</math>, 1000 <math>\Omega</math> (default), 1500 <math>\Omega</math>, 2000 <math>\Omega</math>, Leads I, II, III</li> </ul> <p>Accuracy Baseline</p> <ul style="list-style-type: none"> <li><math>\pm</math>5 %</li> </ul> <p>Respiration Lead</p> <ul style="list-style-type: none"> <li>LA or LL (default)</li> </ul> <p>Apnea Selection</p> <ul style="list-style-type: none"> <li>12 sec, 22 sec, or 32 seconds (one-time events), or continuous (Apnea ON = respiration OFF)</li> </ul> <p>Power-On Default</p> <ul style="list-style-type: none"> <li>20 BrPM, delta 1.0 <math>\Omega</math></li> </ul> <p>Temperature</p> <ul style="list-style-type: none"> <li>30 <math>^{\circ}\text{C}</math> to 42.0 <math>^{\circ}\text{C}</math> in 0.5 <math>^{\circ}\text{C}</math> steps</li> </ul> <p>Accuracy</p> <ul style="list-style-type: none"> <li><math>\pm</math> 0.4 <math>^{\circ}\text{C}</math></li> </ul> <p>Compatibility</p> <ul style="list-style-type: none"> <li>Yellow Springs, Inc. (YSI) Series 400 and 700</li> </ul> <p>Output</p> <ul style="list-style-type: none"> <li>Circular DIN 4-Pin</li> </ul> <p>Cardiac Output</p> <ul style="list-style-type: none"> <li>Catheter Type</li> <li>Baxter Edwards, 93a-131-7f</li> </ul> <p>Calibration Coefficient</p> <ul style="list-style-type: none"> <li>0.542 (0 <math>^{\circ}\text{C}</math> injectate), 0.595 (24 <math>^{\circ}\text{C}</math> injectate)</li> </ul> <p>Blood Temperature</p> <ul style="list-style-type: none"> <li>36 <math>^{\circ}\text{C}</math> (98.6 <math>^{\circ}\text{F}</math>) to 38 <math>^{\circ}\text{C}</math> (100.4 <math>^{\circ}\text{F}</math>) <math>\pm</math> 2 % in 1 <math>^{\circ}\text{C}</math> steps</li> </ul> <p>Injectate Volume</p> <ul style="list-style-type: none"> <li>10 cc</li> </ul> <p>Injectate Temperature</p> <ul style="list-style-type: none"> <li>0 <math>^{\circ}\text{C}</math> or 24 <math>^{\circ}\text{C}</math></li> </ul> |             |                     |  |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <p>Cardiac Output</p> <ul style="list-style-type: none"> <li>• 2.5, 5, 10 liters per minute <math>\pm</math> 7.5 %</li> </ul> <p>Faulty-Injectate Curve</p> <ul style="list-style-type: none"> <li>• Waveform for simulation available</li> <li>• Left-To-Right-Shunt Curve</li> <li>• Waveform for simulation available</li> </ul> <p>Calibrated Pulse</p> <ul style="list-style-type: none"> <li>• 1.5 ° for 1 second</li> </ul> <p>Connector</p> <ul style="list-style-type: none"> <li>• Circular DIN 7 pin</li> </ul> <p>Power-On Default</p> <ul style="list-style-type: none"> <li>• 5 liters per minute, 0 °C injectate, 37 °C blood temperature</li> </ul> <p>Non-Invasive Blood Pressure</p> <p>Pressure Units</p> <ul style="list-style-type: none"> <li>• mmHg or kPa</li> </ul> <p>Pressure Relief Test Range</p> <ul style="list-style-type: none"> <li>• 100 to 400 mmHg</li> </ul> <p>Synchronization: Arrhythmias</p> <ul style="list-style-type: none"> <li>• Premature atrial contraction (PAC), premature ventricular contraction (PVC), atrial fibrillation, and missed beat</li> <li>• Manometer (Pressure Meter)</li> </ul> <p>Range</p> <ul style="list-style-type: none"> <li>• 10 mmHg to 400 mmHg</li> </ul> <p>Resolution</p> <ul style="list-style-type: none"> <li>• 0.1 mmHg</li> </ul> <p>Accuracy</p> <ul style="list-style-type: none"> <li>• <math>\pm</math> (0.5 % reading + 0.5 mmHg)</li> </ul> <p>Pressure Source</p> <p>Target pressure range</p> <ul style="list-style-type: none"> <li>• 20 mmHg to 400 mmHg</li> </ul> <p>Resolution</p> <ul style="list-style-type: none"> <li>• 1 mmHg</li> </ul> <p>NIBP Simulations</p> <p>Pulse</p> <ul style="list-style-type: none"> <li>• 2 mmHg max into 500 ml NIBP system</li> </ul> <p>Volume of air moved</p> <ul style="list-style-type: none"> <li>• 1.25 ml max</li> </ul> |             |                     |  |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <p>Simulations (systolic/diastolic [MAP])</p> <ul style="list-style-type: none"> <li>Adult: 60/30 (40), 80/50 (60); 100/65 (77); 120/80 (93); 150/100 (117); and 200/150 (167) and 255/195 (215)</li> <li>Neonatal: 35/15 (22); 60/30 (40); 80/50 (60); 100/65 (77); 120/80 (93) and 150/100</li> <li>Pressure variability: systolic and diastolic pressures are variable by 1 mmHg</li> </ul> <p>Repeatability</p> <ul style="list-style-type: none"> <li>Within <math>\pm 2</math> mmHg (at maximal pulse size independent of device under test)</li> </ul> <p>Synchronization: normal Sinus heart rates: 30 BPM to 240 BPM</p> <ul style="list-style-type: none"> <li>Maximum rate at 1 ml: 240 BPM achievable with pulses up to 1 ml</li> <li>Maximum rate at 1.25 ml: 180 BPM</li> <li>Leak Test</li> </ul> <p>Target pressure</p> <ul style="list-style-type: none"> <li>20 to 400 mmHg</li> </ul> <p>Elapse time</p> <ul style="list-style-type: none"> <li>0:30 to 5:00 minutes: seconds in 30 second steps</li> </ul> <p>Leakage rate</p> <ul style="list-style-type: none"> <li>0 mmHg/minute to 200 mmHg/minute</li> </ul> <p>SpO2 Test (Optional)</p> <p>Heart Rate</p> <ul style="list-style-type: none"> <li>30 BPM to 300 BPM in 1 BPM steps. SpO2 test is synchronized with ECG rate delayed by 150 ms, accuracy <math>\pm 1\%</math> of setting</li> </ul> <p>Masimo Rainbow Technology</p> <p>Test Masimo Rainbow technology with an optional adapter supplied by Masimo that allows the ProSim two wavelength to test the Rainbow multiple wavelength system</p> <p>% O2</p> <p>Range</p> <ul style="list-style-type: none"> <li>30 % to 100 %</li> </ul> <p>Resolution</p> <ul style="list-style-type: none"> <li>1 %</li> </ul> <p>% O2 Accuracy</p> <p>With oximeter manufacturer's R-curve</p> <p>Saturation within UUT specific range: <math>\pm (1 \text{ count} + \text{specified accuracy of the UUT})</math> Saturation outside UUT specific range: monotonic with unspecified accuracy</p> <p>With Fluke Biomedical R-curves</p> <ul style="list-style-type: none"> <li>91 % to 100 % <math>\pm (3 \text{ counts} + \text{specified accuracy of the UUT})</math></li> <li>81 % to 90 % <math>\pm (5 \text{ counts} + \text{specified accuracy of the UUT})</math></li> <li>71 % to 80 % <math>\pm (7 \text{ counts} + \text{specified accuracy of the UUT})</math></li> </ul> |             |                     |  |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <ul style="list-style-type: none"> <li>Below 7 % monotonic with unspecified accuracy</li> </ul> <p>Transmission: ratio of detector current to LED current, expressed in parts per million (ppm)</p> <p>Range</p> <ul style="list-style-type: none"> <li>0 ppm to 300.00 ppm</li> </ul> <p>Resolution</p> <ul style="list-style-type: none"> <li>0.01 ppm</li> </ul> <p>Accuracy</p> <ul style="list-style-type: none"> <li>+ 50 %/- 30 % for compatible monitors, unspecified for others. Selected by finger size and color: dark, thick finger, medium finger, light, thin finger, neonatal foot. The full range and resolution are available in the engineering mode</li> </ul> <p>Pulse Amplitude</p> <p>Range</p> <ul style="list-style-type: none"> <li>0 % to 20.00 %</li> </ul> <p>Resolution</p> <ul style="list-style-type: none"> <li>0.01 %</li> </ul> <p>Artifact</p> <p>Respiration</p> <p>Range:</p> <ul style="list-style-type: none"> <li>0 % to 5 % of transmission</li> </ul> <p>Resolution:</p> <ul style="list-style-type: none"> <li>1 %</li> </ul> <p>Rate:</p> <ul style="list-style-type: none"> <li>all ProSim or equivalent respiration simulation settings</li> <li>Ambient light</li> </ul> <p>Range:</p> <ul style="list-style-type: none"> <li>0 to 5X transmitted light</li> </ul> <p>Resolution:</p> <ul style="list-style-type: none"> <li>1X</li> </ul> <p>Frequency:</p> <ul style="list-style-type: none"> <li>DC, 50 Hz, 60 Hz, and 1 kHz to 10 kHz in 1 kHz steps</li> </ul> <p>Compatible Manufacturer Products</p> <ul style="list-style-type: none"> <li>With manufacturer R-curve</li> <li>Nellcor, Masimo, Nonin, and Nihon Kohden</li> <li>With Fluke R-curve</li> <li>Mindray, GE-Ohmeda, Philips/HP, and BCI</li> </ul> <p>Pre-Defined Simulations</p> <ul style="list-style-type: none"> <li>Normal</li> <li>Hypertensive</li> <li>Hypotensive</li> </ul> |             |                     |  |

| Item Code No.  | Department  | Section             | Item Description                             |
|--|-------------|---------------------|--|
| LOT 12-3   | Engineering | Biomedical Workshop | Patient Monitor Analyzer (Patient Simulator) |
| <ul style="list-style-type: none"> <li>• Tachycardic</li> <li>• Bradycardic</li> <li>• Ventricular Fibrillation</li> <li>• Asystole</li> </ul> <p>Autosequences</p> <ul style="list-style-type: none"> <li>• Monitor Testing Sequence</li> <li>• ECG Sequence</li> <li>• Oximeter Testing Sequence</li> <li>• Cardiac Failure Sequence</li> <li>• Arrhythmia Sequence</li> <li>• Exercise Sequence</li> <li>• Respiration Sequence</li> <li>• NIBP Testing Sequence</li> <li>• IBP Testing Sequence</li> <li>• Temperature Sequence</li> </ul> |             |                     |  |

#### LOT 12-4 Defibrillator Analyzer

| Item Code No.                     | Department  | Section                   | Item Description       |
|-----------------------------------|-------------|---------------------------|------------------------|
| LOT 12-4                          | Engineering | Biomedical Workshop       | Defibrillator analyzer |
| General Description               |             |                           |                        |
|                                   |             |                           |                        |
| Composition                       |             |                           |                        |
|                                   |             |                           |                        |
| <b>Defib - Energy Measurement</b> |             |                           |                        |
| Load Resistance                   |             | 50Ω ± 1% non-inductive    |                        |
| Range                             |             | 0 - 199.9 Joules          |                        |
| Accuracy                          |             | ± 1% of reading ± 1 Joule |                        |
| Range (High)                      |             | 200 - 600 Joules          |                        |
| Resolution                        |             | 0.1 Joules                |                        |
| Voltage                           |             | 0 - 5000 Volts            |                        |



| Item Code No.   | Department  | Section                                    | Item Description       |
|---|-------------|--|------------------------|
| LOT 12-4  | Engineering | Biomedical Workshop                        | Defibrillator analyzer |
| Current   |             | 0 - 100 Amps                               |                        |
| Sampling Rate   |             | 250 kHz sampling frequency                 |                        |
| Maximum pulse width   |             | 5us – 120ms                                |                        |
|   |             |  |                        |
| ECG Simulator   |             |  |                        |
| ECG simulation with hi-level output.  |             |  |                        |
|   |             |  |                        |
| ECG Waveforms – Ventricular Arrhythmias   |             |  |                        |
| Premature Ventricular Contraction - Intermittent 80 BPM, Amplitude 0.50 - 5.00mV(±2%) |             | Default Spec Value                         |                        |
| (PVC)   |             |  |                        |
| Bigeminy (BIG)  |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)       |                        |
| Trigeminy (TRIG)  |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)       |                        |
| Ventricular Flutter (VFLT)  |             | 240 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Ventricular Fibrillation - Coarse (VFBC)  |             | 240 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Ventricular Fibrillation - Fine (VFBF)  |             | 240 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Monomorphic Ventricular Tachycardia (MVT)   |             | 210 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Right-focal Premature Ventricular Contraction   |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)       |                        |
|   |             |  |                        |
| ECG Waveforms – Atrial Arrhythmias  |             |  |                        |
| Sinus Arrhythmia (SAR)  |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| Missing Beat (MB)   |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| Atrial Flutter (AFLT)   |             | 300 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Atrial Fibrillation (AFB)   |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| Paroxysmal Atrial Tachycardia (PAT)   |             | 180 BPM, Amplitude 0.50 - 5.00mV(±2%)      |                        |
| Premature Junctional Contraction (PJC)  |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |

| Item Code No.                  | Department  | Section   | Item Description       |
|--------------------------------|-------------|---|------------------------|
| LOT 12-4                       | Engineering | Biomedical Workshop   | Defibrillator analyzer |
|                                |             |   |                        |
| ECG Performance Waveforms      |             |   |                        |
| Sine(SINE)                     |             | 0.1 - 300Hz, 1.00 – 10.00mV   |                        |
| Square (SQ)                    |             | 0.1 - 300Hz, 1.00 – 10.00mV   |                        |
| Triangle (TRI)                 |             | 0.1 - 300Hz, 1.00 – 10.00mV   |                        |
| Sawtooth (SAW)                 |             | 0.1 - 300Hz, 1.00 – 10.00mV   |                        |
| Sine Inverse Sawtooth (INVSAW) |             | 0.1 - 300Hz, 1.00 – 10.00mV   |                        |
| Pulse (PULSE)                  |             | 0.1 - 300Hz, 0.50 – 5.00mV  |                        |
|                                |             |   |                        |
| ECG Waveform Output            |             |   |                        |
| Low Level                      |             | Low Level   |                        |
| Hi Level                       |             | Output Jack   |                        |
|                                |             |   |                        |
| Pacer Input                    |             |   |                        |
| Fix Load                       |             | 50Ω   |                        |
| Accuracy                       |             | +/- 4% + 10μJ   |                        |
| Over voltage protection        |             | 5000V   |                        |
| Variable Load                  |             | 50 to 1600Ω in 50Ω steps  |                        |
| Pulse Rate                     |             | 5.0 to 800 ppm  |                        |
| Heart rate selection           |             | 20 – 300 bpm  |                        |
| Under & overdrive              |             | 85% (20 bpm min) and 115% (300 bpm max)   |                        |
| Wave form selection            |             | NSR, VFibC, VFibF, MVT, AFib, Missing Beat, R-Wave detection                    |                        |
| Pulse Current Amplitude        |             | 5.00 – 200mA  |                        |
| Accuracy +/-                   |             | (1% rdg +0.02mA)  |                        |
| Current Measurements           |             | Average (RMS), Leading edge, Trailing edge, Peak (the highest during the pulse) |                        |
| Pulse Width                    |             | 1.00 - 100ms  |                        |

| Item Code No.                             | Department  | Section                                    | Item Description       |
|---|-------------|--|------------------------|
| LOT 12-4                                  | Engineering | Biomedical Workshop                        | Defibrillator analyzer |
| Pulse Energy                              |             | 1μJ – 2.00J                                |                        |
|   |             |  |                        |
| Pacer Refractory Periods                  |             |  |                        |
| Refractory Period test                    |             | 15 – 500mS (Paced and sensed)              |                        |
| Accuracy                                  |             | +/- 1ms                                    |                        |
|   |             |  |                        |
| Pacer Interference Test (Immunity)        |             |  |                        |
| Heart rate                                |             | 20-300 bpm                                 |                        |
| Frequency                                 |             | 50 or 60 Hz                                |                        |
| Noise level in mV                         |             | 0-15.0mV                                   |                        |
|   |             |  |                        |
| AED Pulse Mode Waveforms                  |             |  |                        |
| Normal Sinus Rhythm (NSR)                 |             | 20 - 300 BPM, Amplitude 1.00mV(±2%)        |                        |
| Asystole (ASYS)                           |             |  |                        |
| Ventricular Fibrillation - Coarse (VFBC)  |             | 240 BPM, Amplitude 1.00mV(±2%)             |                        |
| Ventricular Fibrillation - Fine (VFBF)    |             | 240 BPM, Amplitude 1.00mV(±2%)             |                        |
| Monomorphic Ventricular Tachycardia (MVT) |             | 210 BPM, Amplitude 1.00mV(±2%)             |                        |
| Atrial Fibrillation (AFB)                 |             | 20 - 300 BPM, Amplitude 1.00mV(±2%)        |                        |
|   |             |  |                        |
|   |             |  |                        |
| ECG Waveforms - Sinus                     |             |  |                        |
| Normal Sinus Rhythm (NSR)                 |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| ST Elevation (STE)                        |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| ST Depression (STD)                       |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |
| Myocardial Infarction (MI)                |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%) |                        |

| Item Code No.                                 | Department  | Section  | Item Description       |
|---|-------------|--|------------------------|
| LOT 12-4                                      | Engineering | Biomedical Workshop  | Defibrillator analyzer |
| Tall T (TT)                                   |             | 20 - 300 BPM, Amplitude 0.50 - 5.00mV(±2%)                           |                        |
| Asystole (ASYS)                               |             |  |                        |
|   |             |  |                        |
| ECG Waveforms – Atrial Conduction Arrhythmias |             |  |                        |
| First Degree AV Block (FAVB)                  |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)                                 |                        |
| Second Degree AV Block - Mobitz I (SAVB_MI)   |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)                                 |                        |
| Second Degree AV Block - Mobitz II (SAVB_MII) |             | 80 BPM, Amplitude 0.50 - 5.00mV(±2%)                                 |                        |
| Third Degree AV Block (TAVB)                  |             | 50 BPM, Amplitude 0.50 - 5.00mV(±2%)                                 |                        |
|   |             |  |                        |
| ECG Pacer Waveforms                           |             |  |                        |
| Synchronous Atrial (AAI)                      |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV, Pulse width 0.1 – 2.0ms |                        |
| Asynchronous Atrial (AOO)                     |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV, Pulse width 0.1 – 2.0ms |                        |
| Pacer (PCR)                                   |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV, Pulse width 0.1 – 2.0ms |                        |
| Ventricular Pacer (VVI)                       |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV, Pulse width 0.1 – 2.0ms |                        |
| Atrial & Ventricular Pacer (DDD)              |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV, Pulse width 0.1 – 2.0ms |                        |
| R-Wave Detection (RWD)                        |             | 20 - 300 BPM, Pulse amplitude 0.50 – 5.00mV                          |                        |
|   |             |  |                        |
| ECG Noise Selection                           |             |  |                        |
| Amplitude                                     |             | Default Spec Value0 – 10.00mV  |                        |
| Frequency                                     |             | 50 - 60Hz  |                        |
|   |             |  |                        |
| ECG Accuracy                                  |             |  |                        |
| Rate  |             | Default Spec Value± 1%   |                        |
| Amplitude                                     |             | ± 2% (LA-LL), ± 10% (Paddles)  |                        |

| Item Code No.  | Department  | Section   | Item Description       |
|--|-------------|---|------------------------|
| LOT 12-4   | Engineering | Biomedical Workshop   | Defibrillator analyzer |
|  |             | Lead II : 1 – 10 mV (in steps of 0.5 mV).                             |                        |
|  |             | Other leads are proportional to Lead II by the following percentages: |                        |
|  |             | Lead I : 60 %   |                        |
|  |             | Lead II : 100 %   |                        |
|  |             | Lead III : 40 %   |                        |
|  |             | V1 : 63 % [ Reference LA ]  |                        |
|  |             | V2 : 71 % [ Reference LA ]  |                        |
|  |             | V3 : 68 % [ Reference LA ]  |                        |
|  |             | V4 : 80 % [ Reference LA ]  |                        |
|  |             | V5 : 55 % [ Reference LA ]  |                        |
|  |             | V6 : 49 % [ Reference LA ]  |                        |
|  |             |   |                        |
|  |             |   |                        |
| Pacer Manufacturer Algorithms  |             |   |                        |
| CU Medical, GE, HP, Laerdal, Mindray, Philips, PhysioControl, Schiller, WelchAllyn, Zoll |             |   |                        |
|  |             |   |                        |
| Pacer Sensitivity Test   |             |   |                        |
| Wave form, R Wave  |             | Polarity Normal and Reversed, selectable                              |                        |
| Dynamic Sensitivity  |             | 0.05mV to 5.00mV in 50µV steps  |                        |
|  |             |   |                        |
| General Specifications   |             |   |                        |
|  |             |   |                        |
| approximate Weight (for ease of management)  |             | 1.5kg   |                        |
| Operation  |             | 9.6V/2400mAh Nickel Metal Hydride battery pack                        |                        |
| Battery charge time  |             | 2.5 hours   |                        |
| Battery capacity (fully charged)   |             | 12 hours  |                        |

| Item Code No.                            | Department  | Section                                    | Item Description       |
|--|-------------|--|------------------------|
| LOT 12-4                                 | Engineering | Biomedical Workshop                        | Defibrillator analyzer |
| Main supply                              |             | 110/230V AC; 48 to 66Hz, 35VA power supply |                        |
| Storage environment                      |             | -15°C to +60°C                             |                        |
| Operating conditions                     |             | 0°C to +40°C                               |                        |
| Environmental protection                 |             | IP 40                                      |                        |
| Communication                            |             | USB  |                        |
| Display LCD colour graphic display (Min) |             | ¼" VGA                                     |                        |
| Memory (min)                             |             | 500 test results including graphs          |                        |
| Impact rating                            |             | 5J   |                        |

#### **LOT 12-5     Electrical Safety Analyzer**

| Item Code No.                    | Department  | Section                             | Item Description           |
|----------------------------------|-------------|-------------------------------------|----------------------------|
| LOT 12-5                         | Engineering | Biomedical Workshop                 | Electrical Safety Analyzer |
| 1. General Description           |             |                                     |                            |
|                                  |             |                                     |                            |
| 2. Composition                   |             |                                     |                            |
| 2.1.                             | Main unit   |                                     |                            |
|                                  |             |                                     |                            |
| Software automation capabilities |             | Yes                                 |                            |
| ECG simulation                   |             | Yes                                 |                            |
| GFCI protection                  |             | Yes                                 |                            |
| DUT load current                 |             | Yes                                 |                            |
| 20 A test capabilities           |             | Yes                                 |                            |
| 25 A test capabilities           |             | Yes                                 |                            |
| Test loads                       |             | AAMI, IEC60601-1, IEC61010          |                            |
| Other available standards        |             | NFPA-99, ANSI, IEC62353, AS/NZ 3551 |                            |

| Item Code No.                            | Department  | Section  | Item Description           |
|--|-------------|--|----------------------------|
| LOT 12-5                                 | Engineering | Biomedical Workshop  | Electrical Safety Analyzer |
| Mains voltage measurements               |             | All lines  |                            |
| PE test current                          |             | 200mA ac , 25A ac  |                            |
| Leakage result parameters                |             | True – rms ac only, dc only                                    |                            |
| Leakage range                            |             | 0 $\mu$ A to 10,000 $\mu$ A, 0 $\mu$ A to 20mA ( differential) |                            |
| Patient auxiliary leakage lead selection |             | Any 1 to all, RA-LL-LL-LA RA-LA                                |                            |
| MAP test voltage                         |             | 110% or 100% of mains, pending standard selection              |                            |
| Power supply ( V ac)                     |             | 120 or 230   |                            |
| Applied part connections                 |             | 10 insulated posts   |                            |
| Language selection                       |             | English  |                            |
| Communication options                    |             | wired  |                            |
| Printer port                             |             | Available via software   |                            |
| Dual lead testing                        |             | $\mu$ A/mV, V and $\Omega$                                     |                            |
| connectivity                             |             | USB  |                            |
| Power cord                               |             | Removable  |                            |
| Weight                                   |             | 4.7 kg   |                            |
| Dimensions ( L*W*H)                      |             | 31 cm*23cm*10 cm( 12.2” *9.1” *3.9”)                           |                            |

## LOT 12-6      Electrosurgical Analyzer

| Item Code No.           | Department  | Section             | Item Description         |
|-------------------------|---|---------------------|--------------------------|
| LOT 12-6                | Engineering   | Biomedical Workshop | Electrosurgical Analyzer |
| 1. General Description  |   |                     |                          |
| Electrosurgery Analyzer |   |                     |                          |
| 2. Composition          |   |                     |                          |
| 2.1.                    | Main unit   |                     |                          |
| 2.1.1.                  | Approximate Size (HxWxL): (For ease of management) 14.5 cm x 35 cm x 47 cm (5.75 in x 13.75 in x 18.5 in)   |                     |                          |
| 2.1.2.                  | Power Requirements:<br>100 V ac, 115 V ac, 230 V ac, 50 Hz / 60 Hz, universal input 100 V/115 V: 20VA 230V: 30 VA   |                     |                          |
| 2.1.3.                  | User interface<br>LCD: Colour display   |                     |                          |
| 2.1.4.                  | Environmental specifications  |                     |                          |
| 2.1.4.1.                | Operating temperature: - 10 °C to 40 °C (50 °F to 104 °F)   |                     |                          |
| 2.1.4.2.                | Storage temperature: - 20 °C to 60 °C (-4 °F to 140 °F)   |                     |                          |
| 2.1.4.3.                | Humidity: - 10 % to 90 % non-condensing   |                     |                          |
| 2.1.5.                  | IP rating: - IEC60529:IP20  |                     |                          |
| 2.1.6.                  | Electromagnetic Compatibility (EMC)<br>IEC 61326-1: Basic Emissions Classification:<br>IEC CISPR11: Group 1, Class A. Group 1 have intentionally generated and/or use conductively coupled radio-frequency energy which is necessary for the internal functioning of the equipment itself. Class A equipment is suitable for use in non-domestic locations and/or directly connected to a low-voltage power supply network USA (FCC): |                     |                          |
| 2.1.7.                  | Intentional Radiators<br>Device should comply with part 15 of the FCC Rules. Operation is subject to the following two conditions: <ul style="list-style-type: none"> <li>• This device may not cause harmful interference, and</li> <li>• This device must accept any interference received, including interference that may cause undesired operation.</li> </ul>   |                     |                          |
| 2.1.8.                  | Safety<br>IEC 61010-1: - Overvoltage category II, pollution degree 2<br>IEC 61010-2-030: Measurement 5,000 V  |                     |                          |
| 2.1.9.                  | Wireless module listing<br>FCC (United States) compliant (Class A):<br>FCC ID: X3ZBTMOD3<br>IC (Industry Canada) compliant:<br>IC: 8828A-MOD3<br>CE (European) certified:   |                     |                          |



| Item Code No.   | Department  | Section             | Item Description         |
|---|-------------|---------------------|--------------------------|
| LOT 12-6  | Engineering | Biomedical Workshop | Electrosurgical Analyzer |
| CE0051<br>2.1.10. Measurements and tests specifications<br>Measures:<br><ul style="list-style-type: none"> <li>Cut and coag waveforms, monopolar and bipolar outputs</li> </ul> Power and current measurements:<br><ul style="list-style-type: none"> <li>True RMS</li> </ul> 2.1.11. Bandwidth:<br><ul style="list-style-type: none"> <li>MHz at -3 dB including loads</li> </ul> 2.1.12. Delay time for single measurements:<br><ul style="list-style-type: none"> <li>0.2 seconds to 4.0 seconds from Foot Switch activation to start of measurement</li> </ul> 2.1.13. Duty cycle<br>2.1.13.1. Variable load:<br><ul style="list-style-type: none"> <li>10 seconds on, 30 seconds off, at 100 W, all loads</li> </ul> 2.1.13.2. Fixed 200 $\Omega$ load:<br><ul style="list-style-type: none"> <li>10 seconds on, 30 seconds off, at 400 W</li> </ul> 2.1.13.3. Generator output measurements<br>Oscilloscope Output<br><ul style="list-style-type: none"> <li>1 V per ampere of input current, typical</li> </ul> 2.1.13.4. Footswitch simulations<br>Cut and Coag<br><br>2.1.13.5. Load resistance<br>Variable:<br><ul style="list-style-type: none"> <li>0 <math>\Omega</math>, 10 <math>\Omega</math>, 20 <math>\Omega</math>, 25 <math>\Omega</math> to 2500 <math>\Omega</math> (by 25 <math>\Omega</math>), 2500 <math>\Omega</math> to 5200 <math>\Omega</math> (by 100 <math>\Omega</math>)<br/> DC Accuracy: <math>\pm 2.5\%</math><br/> Power (0.0 W to 99.9 W <math>\pm 5\%</math> + 1W), 100 W to 500 W <math>\pm 5\%</math><br/> Maximum: At 25% duty cycle (10 seconds on, 30 seconds off): 10 <math>\Omega</math>: 300 W, 20 <math>\Omega</math> to 2900 <math>\Omega</math>: 400 W, 3000 <math>\Omega</math> to 5200 <math>\Omega</math>: 200 W<br/> At 10% duty cycle (5 seconds on, 45 seconds off): 10 <math>\Omega</math>: 300 W, 20 <math>\Omega</math> to 2400 <math>\Omega</math>: 500 W, 2425 <math>\Omega</math> to 2900 <math>\Omega</math>: 400 W, 3000 <math>\Omega</math> to 5200 <math>\Omega</math>: 200 W</li> </ul> 2.1.13.6. Current<br>RMS: 0 mA to 5,500 mA<br>Accuracy: $\pm(2.5\%$ of reading + 1 mA)<br><br>2.1.13.7. Voltage<br>Peak: 10 kV Peak to Peak |             |                     |                          |

| Item Code No.                           | Department   | Section             | Item Description         |
|---|--|---------------------|--------------------------|
| LOT 12-6                                | Engineering  | Biomedical Workshop | Electrosurgical Analyzer |
| Accuracy: $\pm(10\%$ of reading + 50 V) |  |                     |                          |
| 2.1.13.8.                               | Crest factor:<br>1.4 to 16.0 Defined as the ratio of Peak voltage to RMS voltage ( $V_{pk}/V_{rms}$ ), using the larger of the 2 peaks (positive or negative)<br>Vessel sealing measurement<br>Loop current, RMS: 0 mA to 5500 mA<br>Accuracy: $\pm(2.5\%$ of reading + 1mA) |                     |                          |
| 2.1.13.9.                               | HF leakage current<br>Fixed load: 200 $\Omega$<br>Accuracy: $\pm 2.5\%$<br>Power rating: 400 W<br>Additional fixed load: 200 $\Omega$<br>Current, RMS: 0 mA to 5500 mA<br>Accuracy: $\pm(2.5\%$ of reading + 1 mA)   |                     |                          |
| 2.1.13.10.                              | CQM test (Contact Quality Monitor):<br>Resistances: 0 $\Omega$ to 475 $\Omega$ (by 1 $\Omega$ )<br>Accuracy: 0 $\Omega$ to 10 $\Omega$ 0.5 $\Omega$ , 11 $\Omega$ and above 5%   |                     |                          |
| 2.1.13.11.                              | Power rating: at least 0.5 W   |                     |                          |
| 2.1.13.12.                              | Auto time interval: 1 to 5 seconds   |                     |                          |
| 2.1.14.                                 | Communications:<br>USB device port: Micro B connector, full speed<br>Wireless port: 802.15, Speed: 115,200 baud  |                     |                          |
| 2.1.15.                                 | Memory:<br>Test records: at least 5,000<br>Non-volatile: retained through power cycling  |                     |                          |
| 2.1.16.                                 | Calibration:<br>Recommended cycle:<br>Traceable to the International System of Units (SI) through the appropriate National Metrology Institutes such as NIST or through intrinsic standards.   |                     |                          |

**LOT 12-7 Gas Flow Analyzer**

| Item Code No.          |   | Department  | Section                    | Item Description  |
|------------------------|---|-------------|----------------------------|-------------------|
| LOT 12-7               |   | Engineering | Biomedical Workshop        | Gas Flow Analyzer |
| 1. General Description |   |             |                            |                   |
|                        |   |             |                            |                   |
| 2. Composition         |   |             |                            |                   |
|                        |   |             |                            |                   |
| FEATURES               |   |             | MINIMUM REQUIREMENTS       |                   |
| 2.1.                   | Battery life  |             | 8 hours                    |                   |
| 2.2.                   | Charge time in hours                                |             | 5 hours                    |                   |
| 2.3.                   | memory  |             | Internal memory            |                   |
| 2.4.                   | Connection type                                     |             | USB, Micro – b device port |                   |
| 2.5.                   | Weight  |             | 1.6 kg                     |                   |
| 2.6.                   | Touch screen display                                |             | 7” inch                    |                   |
| 2.7.                   | Single full range channel                           |             | yes                        |                   |
| 2.8.                   | <b>FLOW</b>   |             |                            |                   |
| 2.9.                   | <b>Full range flow channel ( both high and low)</b> |             |                            |                   |
| 2.10.                  | range   |             | +/- 300 slpm               |                   |
| 2.11.                  | Accuracy(air)                                       |             | 1.7% Or 0.04 slpm          |                   |
| 2.12.                  | <b>volume</b>                                       |             |                            |                   |
| 2.13.                  | Range   |             | +/- 1001                   |                   |
| 2.14.                  | Accuracy  |             | +/- 1.75% Or 0.02 L        |                   |
| 2.15.                  | <b>PRESSURE</b>                                     |             |                            |                   |
| 2.16.                  | <b>High pressure</b>                                |             |                            |                   |
| 2.17.                  | Range   |             | -0.8 to 10 bar             |                   |
| 2.18.                  | Accuracy  |             | +/- 1% or +/- 0.0007 bar   |                   |
| 2.19.                  | <b>Differential low pressure</b>                    |             |                            |                   |
| 2.20.                  | range   |             | +/- 160mbar                |                   |

| Item Code No. |                                   | Department  | Section                              | Item Description  |
|---------------|-----------------------------------|-------------|--------------------------------------|-------------------|
| LOT 12-7      |                                   | Engineering | Biomedical Workshop                  | Gas Flow Analyzer |
| 2.21.         | accuracy                          |             | +/- 0.5% or +/-0.1 mbar              |                   |
| 2.22.         | <b>Airway pressure</b>            |             |                                      |                   |
| 2.23.         | range                             |             | +/- 160mbar                          |                   |
| 2.24.         | accuracy                          |             | +/- 0.5% or +/-0.1 mbar              |                   |
| 2.25.         | <b>Barometric pressure</b>        |             |                                      |                   |
| 2.26.         | range                             |             | 550 to 1240mbar                      |                   |
| 2.27.         | accuracy                          |             | +/-1%                                |                   |
| 2.28.         | <b>others</b>                     |             |                                      |                   |
| 2.29.         | <b>temperature</b>                |             |                                      |                   |
| 2.30.         | range                             |             | 0 – 50 degrees C                     |                   |
| 2.31.         | accuracy                          |             | +/-0.5%                              |                   |
| 2.32.         | resolution                        |             | 0.1 degrees C                        |                   |
| 2.33.         | <b>humidity</b>                   |             |                                      |                   |
| 2.34.         | range                             |             | 0-100%RH                             |                   |
| 2.35.         | accuracy                          |             | +/-3%RH (20-80%RH) +/-5%(-20-+80% RH |                   |
| 2.36.         | <b>oxygen</b>                     |             |                                      |                   |
| 2.37.         | Range                             |             | 0-100%                               |                   |
| 2.38.         | accuracy                          |             | +/-2%                                |                   |
| 2.39.         | <b>Breath parameters</b>          |             |                                      |                   |
| 2.40.         | Inspiratory tidal volume range    |             | 0 to 60 l                            |                   |
| 2.41.         | Inspiratory tidal volume accuracy |             | +/- 1.75%                            |                   |
| 2.42.         | Expiratory tidal volume range     |             | 0 to 60 l                            |                   |
| 2.43.         | Expiratory tidal volume accuracy  |             | +/- 1.75%                            |                   |
| 2.44.         | Minute volume range               |             | 0 to 100 l                           |                   |
| 2.45.         | Minute volume accuracy            |             | +/- 1.75%                            |                   |
| 2.46.         | Breath rate range                 |             | 1 to 1500 bpm                        |                   |

| Item Code No. |  | Department  | Section             | Item Description  |
|---------------|--|-------------|---------------------|-------------------|
| LOT 12-7      |  | Engineering | Biomedical Workshop | Gas Flow Analyzer |
| 2.47.         | Breath accuracy                                      |             | +/-1%               |                   |
| 2.48.         | Inspiratory to expiratory time ratio ( I;E) range    |             | 1:300 to 300:1      |                   |
| 2.49.         | Inspiratory to expiratory time ratio ( I;E) accuracy |             | +/-2%               |                   |
| 2.50.         | Peak inspiratory pressure ( PIP) range               |             | +/- 160mbar         |                   |
| 2.51.         | Peak inspiratory pressure ( PIP) accuracy            |             | +/-0.75%            |                   |
| 2.52.         | Inspiratory pause pressure range                     |             | +/- 160mbar         |                   |
| 2.53.         | Inspiratory pause pressure                           |             | +/-0.75%            |                   |
| 2.54.         | Mean airway pressure range                           |             | +/- 160mbar         |                   |
| 2.55.         | Mean airway pressure accuracy                        |             | +/-0.75%            |                   |
| 2.56.         | Positive end expiratory pressure (PEEP) range        |             | +/- 160mbar         |                   |
| 2.57.         | Positive end expiratory pressure (PEEP) accuracy     |             | +/-0.75%            |                   |
| 2.58.         | Lung compliance range                                |             | 0-1000 ml/mbar      |                   |
| 2.59.         | Lung compliance accuracy                             |             | +/- 3%              |                   |
| 2.60.         | Inspiratory time range                               |             | 0-60 s              |                   |
| 2.61.         | Inspiratory time accuracy                            |             | 0.02 s              |                   |
| 2.62.         | Inspiratory holding time range                       |             | 0-60 s              |                   |
| 2.63.         | Inspiratory holding time accuracy                    |             | 1% or 0.1 s         |                   |
| 2.64.         | Expiratory time range                                |             | 0 to 90 s           |                   |
| 2.65.         | Expiratory time accuracy                             |             | 0.5% or 0.01 s      |                   |
| 2.66.         | Expiratory holding time range                        |             | 0 to 90 s           |                   |
| 2.67.         | Expiratory holding time accuracy                     |             | 0.02 s              |                   |
| 2.68.         | Peak expiratory flow range                           |             | +/- 300 lpm         |                   |
| 2.69.         | Peak expiratory flow accuracy                        |             | +/-1.7 %            |                   |
| 2.70.         | Peak inspiratory flow range                          |             | +/- 300 lpm         |                   |
| 2.71.         | Peak inspiratory flow accuracy                       |             | +/-1.7 %            |                   |

| Item Code No. |                      | Department  | Section             | Item Description  |
|---------------|----------------------|-------------|---------------------|-------------------|
| LOT 12-7      |                      | Engineering | Biomedical Workshop | Gas Flow Analyzer |
| 2.72.         | <b>Environmental</b> |             |                     |                   |
| 2.73.         | Operating temp       |             | 10 – 40 degrees C   |                   |
| 2.74.         | Storage temp         |             | -20 to 60 degrees C |                   |
| 2.75.         | Operating humidity   |             | 10 to 90%           |                   |
| 2.76.         | Storage humidity     |             | 5 to 95%            |                   |

#### LOT 12-8      Infusion and Syringe Pump Analyzer

| LOT 12-8      Infusion and Syringe Pump Analyzer |                   |  |                                    |  |  |
|--|-------------------|--|------------------------------------|--|--|
| Item Code No.                                    | Department        | Section  | Item Description                   |  |  |
| LOT 12-8   | Engineering       | Biomedical Workshop  | Infusion and Syringe Pump Analyzer |  |  |
| 1. General Description                           |                   |  |                                    |  |  |
| Infusion and Syringe Pump Analyzer               |                   |  |                                    |  |  |
| 2. Composition                                   |                   |  |                                    |  |  |
| 2.1.   | Main unit         |  |                                    |  |  |
| 3. Technical specifications                      |                   |  |                                    |  |  |
| 3.1. Flow rate measurement                       |                   |  |                                    |  |  |
| 3.1.1.   | Range             | 0.1 ml/h to 1500 ml/h (2500 ml/h is shown)   |                                    |  |  |
| 3.1.2.   | Accuracy          | 1 % of reading ±1 LSD for flows of 16 to 200 ml/h for volumes over 20 ml, otherwise 2 % of reading ±1 LSD for volumes over 10 ml under laboratory conditions. Degassed water at 15 °C to 30 °C (59 °F to 86 °F) is recommended for long tests. |                                    |  |  |
| 3.1.3.   | Max test duration | 100 hours  |                                    |  |  |
| 3.2. Volume measurement                          |                   |  |                                    |  |  |
| 3.2.1.   | Range             | 0.06 ml to 9999 ml   |                                    |  |  |
| 3.2.2.   | Accuracy          | 1 % of reading ±1 LSD for flow rates of 16 ml/h to 200 ml/h for volumes over 20 ml. Otherwise 2 % of reading ±1 LSD for volumes over 10 ml under laboratory conditions.  |                                    |  |  |
| 3.2.3.   | Max test duration | 100 hours  |                                    |  |  |

| Item Code No.                        | Department              | Section  | Item Description                   |
|--------------------------------------|-------------------------|--|------------------------------------|
| LOT 12-8                             | Engineering             | Biomedical Workshop  | Infusion and Syringe Pump Analyzer |
| 3.3. PCA bolus/dual flow measurement |                         |  |                                    |
| 3.3.1.                               | Min bolus volume        | 0.5 ml   |                                    |
| 3.3.2.                               | Resolution              | 60 ul increments   |                                    |
| 3.3.3.                               | Max test duration       | 100 hours  |                                    |
| 3.4. Pressure measurement            |                         |  |                                    |
| 3.4.1.                               | Range                   | 0 psi to 45 psi or equivalent in mmHg and kPa  |                                    |
| 3.4.2.                               | Accuracy                | 1 % of full scale $\pm 1$ LSD under laboratory conditions                                      |                                    |
| 3.4.3.                               | Max test duration       | 1 hour   |                                    |
| 3.5. Other specification             |                         |  |                                    |
| 3.5.1.                               | Templates               | Predetermined test sequences. Typical capacity 200.  |                                    |
| 3.5.2.                               | Storage of results      | Test results stored for later viewing, printing or transfer to PC. Typical capacity 250 tests. |                                    |
| 3.6. General specifications          |                         |  |                                    |
| 3.6.1.                               | Operating voltage range | 100 V ac to 240 V ac   |                                    |
| 3.6.2.                               | Supply frequency        | 50/60 Hz   |                                    |
| 3.6.3.                               | Supply power            | <50 VA   |                                    |
| 3.6.4.                               | Fuses                   | 20 mm T1.6 A H 250 V x 2   |                                    |
| 3.6.5.                               | Size (HxWxD)            | 30 cm x 20 cm x 20 cm (12 in x 8 in x 8 in)  |                                    |
| 3.6.6.                               | Weight                  | 3.4 kg (approx) (7.5 lbs.)   |                                    |
| 3.6.7.                               | Altitude                | 0 m to 3000 m (0 ft to 10000 ft)   |                                    |
| 3.7. Temperature                     |                         |  |                                    |
| 3.7.1.                               | Operating               | 15 °C to 30 °C (59 °F to 86 °F)  |                                    |
| 3.7.2.                               | Storage                 | -20 °C to +40 °C (-4 °F to +104 °F) when drained of all liquid                                 |                                    |
| 3.7.3.                               | Humidity                | 10 % to 90 % non-condensing  |                                    |

**LOT 12-9 Oscilloscope**

| Item Code No.   | Department  | Section             | Item Description                 |
|---|-------------|---------------------|----------------------------------|
| LOT 12-9  | Engineering | Biomedical Workshop | Medical Scope Meter Oscilloscope |
| 1. General Description  |             |                     |                                  |
|   |             |                     |                                  |
| 2. Composition  |             |                     |                                  |
| 2.1.  | Main unit   |                     |                                  |
| 3. Technical Specification:   |             |                     |                                  |
| <p>3.1. <b>Bandwidth</b> : 100 Megahertz Or Better</p> <p>3.2. <b>Sampling Rate</b> : 1 Giga Samples/Second Or Better</p> <p>3.3. <b>Number Of Channels</b> : 4 Isolated And Floating Channels</p> <p>3.4. <b>Record Length</b> : 2.5 K Points Or Better</p> <p>3.5. <b>Vertical Resolution</b> : 8 Bits (Normal Or With Averaging) Or Better</p> <p>3.6. <b>Vertical Sensitivity</b> : 2 Millivolt To 5 V/Div(Or Better) With Calibrated Fine Adjustment</p> <p>3.7. <b>Position Range</b> : 2 Millivolt To 200 Millivolt/Div <math>\pm 1.8</math> V &gt;200 Millivolt To 5 V/Div <math>\pm 45</math> V</p> <p>3.8. <b>Input Impedance</b> : 1 Mega Ohm <math>\pm 2\%</math> In Parallel With 20 Picofarad</p> <p>3.9. <b>Input Coupling</b> : Ac, Dc, Gnd</p> <p>3.10. <b>Display Type</b> : 1/4 Vga Active Tft Color Lcd Display</p> <p>3.11. <b>Trigger Types</b>: Edge, Pulse (Width), Video</p> <p>3.12. <b>Connectivity</b> : Rs-232 (Includes Rs-232-To-Usb Host Serial Cable), Centronics, Compact Flash</p> <p>3.13. <b>Waveform Math And Analysis</b> : Automated Measurements, Arithmetic Waveform Math, Fft</p> <p>3.14. <b>Data Storage</b> : Non-Volatile Storage – Compact Flash</p> <p>3.15. <b>Power Source</b> : Ac Adapter With Power Cord</p> <p>3.16. <b>Battery Operation</b> : Capacity To Have Two Hot-Swappable Battery Packs<br/>Must Have Isolation Between Channels And Ground Compliance With Ec61010-1:2001, Iec60529:2001, As/Nzs 2064.1/2</p> <p><b>ACCESSORIES</b></p> <p>3.17. <b>Inclusions:</b></p> <p>3.17.1. 100 Megahertz,</p> <p>3.17.2. 10x Passive Probe Front Protective Cover</p> <p>3.17.3. Ac Adapter With Power Cord (Uk Plug)</p> <p>3.17.4. Usb To Rs-232 Cable</p> |             |                     |                                  |



| Item Code No.   | Department  | Section             | Item Description                 |
|---|-------------|---------------------|----------------------------------|
| LOT 12-9  | Engineering | Biomedical Workshop | Medical Scope Meter Oscilloscope |
| 3.17.5. Hard Case For Carrying Instrument   |             |                     |                                  |
| <b>3.18. Technical features</b> <ul style="list-style-type: none"> <li>3.18.1. How old is this technology &amp; when is going to be discontinued?</li> <li>3.18.2. When is the upgraded/Updated version likely to come</li> <li>3.18.3. Additional features very particulate to the system.</li> <li>3.18.4. If workstation or PC is quoted, its full configuration, brand, model No. etc.</li> <li>3.18.5. Period of warranty as called for in the Tender.</li> <li>3.18.6. AMC coverage items <ul style="list-style-type: none"> <li>a. Comprehensive (Spares &amp; Labour)</li> <li>b. Labour alone</li> </ul> </li> <li>3.18.7. History of service and maintenance support locally</li> <li>3.18.8. List of Installations in public sector/private sector with contact person Name, Designation &amp; Telephone No.</li> <li>3.18.9. List of essential spares</li> <li>3.18.10. Certificate of quality like CE,ISO,FDA</li> </ul> |             |                     |                                  |

#### LOT 12-10 Oxygen Analyzer

| Item Code No.  | Department  | Section             | Item Description |
|--|-------------|---------------------|------------------|
| LOT 12-10  | Engineering | Biomedical Workshop | Oxygen Analyzer  |
| 1. General Description   |             |                     |                  |
|  |             |                     |                  |
| 2. Composition   |             |                     |                  |
| 2.1.   | Main unit   |                     |                  |
| 3. Detailed requirements   |             |                     |                  |
| <b>3.1. Operational characteristics:</b> <ul style="list-style-type: none"> <li>3.1.1. Handheld oxygen analyzer for spot check and/or continuous measurement of the oxygen concentration from a medical gas source and in an environment (depending on the configuration or version of the analyser).</li> <li>3.1.2. Galvanic fuel cell (electro-chemical) oxygen sensing technology.</li> <li>3.1.3. Supplied with connectors and/or adapters suitable for measurement of various medical gas supply sources, for example (but not limited to) oxygen concentrators, ventilators/anaesthesia machines and patient circuits (T-piece and/or in-line adapters), wall/column/cylinder supplies (compliance with ISO 7396-1).</li> </ul> |             |                     |                  |

| Item Code No.   | Department  | Section             | Item Description       |
|---|-------------|---------------------|------------------------|
| LOT 12-10   | Engineering | Biomedical Workshop | <b>Oxygen Analyzer</b> |
| <p>3.1.4. Oxygen measurement to include the range: 15 - 99%.</p> <p>3.1.5. Oxygen resolution: 0.1%.</p> <p>3.1.6. Oxygen accuracy: within <math>\pm 3\%</math>.</p> <p>3.1.7. Suitable for measuring gas supply with pressure up to 345 kPa (3.5 bar, 50 psi).</p> <p>3.1.8. Performance and calibration requirements at different pressures to be stated.</p> <p>3.1.9. Response time at most 20 s.</p> <p>3.1.10. Warm-up time &lt; 10 s.</p> <p>3.1.11. Replaceable galvanic fuel cell (oxygen sensor), nominal operating life at least 1.5 years or 600 000 % O<sub>2</sub> -hours, whichever is greater.</p> <p>3.1.12. Calibration and self-test mode, two point calibration at ambient and 100% oxygen concentration.</p> <p>3.1.13. Internal calibration timer, with reminder (alarm and/or display message).</p> <p>3.1.14. Display visualizing oxygen concentration, system messages and battery status.</p> <p>3.1.15. Low and high oxygen concentration audible and visual alarms required.</p> <p>3.1.16. Automatic power-off when not in use.</p> <p>3.1.17. Enclosure to have ingress protection level IPX1 or better.</p> <p><b>3.2. Electrical characteristics:</b></p> <p>3.2.1. Operated by battery power supply.</p> <p>3.2.2. Internal replaceable batteries, either rechargeable or single use.</p> <p>3.2.3. Battery life &gt; 250 hours continuous use.</p> <p><b>3.3. Accessories, consumables, spare parts, other components</b></p> <p>3.3.1. Carry case.</p> <p>3.3.2. Adapters for measuring various medical gas supply sources/ambient air (if applicable, depending on the models).</p> <p>3.3.3. Adapters for all available standards for fittings, including T-pieces and/or in-line adapters for various types and sizes of breathing circuits and adapters for central supply systems and cylinders.</p> <p>3.3.4. Oxygen cell/sensor, sample line (if applicable), rechargeable and disposable batteries. Sample line (if applicable)</p> <p>3.3.5. Set of spare fuses (if non-resettable fuses are used), display, connectors, battery holder, control panel, casing and battery charger.</p> <p><b>3.4. Environmental requirements</b></p> <p>3.4.1. Capable of being stored in ambient temperature of at least 5 - 50°C, relative humidity of at least 15 - 95% non-condensing.</p> <p>3.4.2. Suitable for continuous operation in ambient temperature of at least 5 - 45°C, relative humidity of at least 15 - 90% non-condensing.</p> <p><b>3.5. Training</b></p> <p>3.5.1. Training of users in operation and basic maintenance shall be provided.</p> <p>3.5.2. Training of technical staff in advanced maintenance tasks shall be provided.</p> |             |                     |                        |

| Item Code No.  | Department  | Section             | Item Description       |
|--|-------------|---------------------|------------------------|
| LOT 12-10  | Engineering | Biomedical Workshop | <b>Oxygen Analyzer</b> |
| <p><b>3.6. Warranty and maintenance</b></p> <p>3.6.1. At least 2 years warranty and the product shall be in production and fully supported when procured.</p> <p>3.6.2. Proof to have the capacity to carry out preventive maintenance, functionality tests and calibration as per manufacturer's specifications.</p> <p>3.6.3. Guarantee of supply of spare parts at least 8 years from date of installation.</p> <p><b>3.7. Documentation</b></p> <p>3.7.1. User and technical manuals both hard and soft copies in English language.</p> <p>3.7.2. Certificate of calibration to be provided.</p> <p>3.7.3. List of equipment and procedure required for calibration and preventive maintenance to be provided.</p> <p>3.7.4. List for common spare parts and accessories with part numbers to be provided</p> <p>3.7.5. Contact details of manufacturer, supplier and local service agent to be provided</p> <p><b>3.8. SAFETY AND STANDARDS</b></p> <p>3.8.1. Risk classification (46 Risk classification Class II (USA), Class IIa (EU), Class IIa or IIb (Australia).</p> <p>3.8.2. Regulatory approval/certification (Proof of regulatory compliance (e.g. registration, clearance, approval) must be provided as appropriate per the product's risk classification (e.g. by a founding member of IMDRF-EU, USA, Canada, Australia, Japan).</p> <p>3.8.3. International standards (ISO 13485 Medical devices - Quality management systems - Requirements for regulatory purposes or ISO 9001 Quality management systems - Requirements.</p> <p>3.8.4. ISO 14971 Medical devices - Application of risk management to medical devices.</p> <p>3.8.5. ISO 15001 Anaesthetic and respiratory equipment - Compatibility with oxygen.</p> <p>3.8.6. IEC 62133 - Secondary cells and batteries containing alkaline or other non-acid electrolytes - Safety requirements for portable sealed secondary cells. Part 1: Nickel, Part 2: Lithium.</p> |             |                     |                        |

**LOT 12-11 Radiation Analyzer**

| Item Code No.          | Department  | Section             | Item Description          |
|------------------------|-------------|---------------------|---------------------------|
| LOT 12-11              | Engineering | Biomedical Workshop | <b>Radiation Analyzer</b> |
| 1. General Description |             |                     |                           |

| Item Code No.   | Department  | Section             | Item Description          |
|---|-------------|---------------------|---------------------------|
| LOT 12-11   | Engineering | Biomedical Workshop | <b>Radiation Analyzer</b> |
| <p>1.1. This specification describes the requirements for a hand-held, high sensitivity, gamma and x-ray radiation detection and dose rate measurement tool with removable radioactive contamination measurement capability, hereinafter referred to as “The System”. The System will be used by security forces, metal recycling industry, first responders, border crossing and radiation source regulatory control authorities.</p> <p>1.2. Supplier may propose alternatives that differ from this Specification but are intended to produce the same or better results for this application. In such cases, these must be clearly stated and justified in the offer and sufficient technical information has to be provided for assurance of compliance with this Specification.</p>   |             |                     |                           |
| 2. Applicable Documents   |             |                     |                           |
| 2.1.  | Main unit   |                     |                           |
| ANSI N42.34 Performance Criteria for Handheld Instruments   |             |                     |                           |
| 3. Functional and Performance Requirements  |             |                     |                           |
| <p>3.1. The System shall meet the following functional and performance requirements:</p> <p>3.1.1. Menu-driven with an intuitive format</p> <p>3.1.2. Automated self-checks</p> <p>3.1.3. Clear graphic display</p> <p>3.1.4. Audible and visible alarms</p> <p>3.1.5. X-ray measurement capability (pulsed radiation)</p> <p>3.1.6. Rubber protective cover</p> <p>3.1.7. Alpha/beta contamination measurement capability</p>  |             |                     |                           |
| <p>3.2. Technical Requirements</p> <p>3.2.1. Units of dose rate measure: Sv/hr</p> <p>3.2.2. Display: backlite LCD</p> <p>3.2.3. Communication capability with a computer</p> <p>3.2.4. Automatic calibration</p> <p>3.2.5. Dose measuring range at least 0.05 <math>\mu</math>Sv – 9.99 Sv</p> <p>3.2.6. Dose rate measuring range at least 0.05 <math>\mu</math>Sv/h – 100 mSv/h</p> <p>3.2.7. Energy response range for gamma and x-ray photons at least 60 keV to 1.3 MeV (+/- 30%)</p> <p>3.2.8. Powered by standard, commercial batteries (AA or AAA or equivalent)</p> <p>3.2.9. Low battery warning</p> <p>3.2.10. Weight not exceeding 300 g (including batteries)</p> <p>3.2.11. Environmental conditions that shall be met</p> <ul style="list-style-type: none"> <li>• Operating temperature range at least: -20 to 50 °C</li> <li>• Operation at relative humidity exceeding 90% at 35oC</li> </ul> <p>3.2.12. Accessories: carrying case, rubber cover, extension for measurements from a distance, PC connection cable, software</p> |             |                     |                           |
| 4. Marking  |             |                     |                           |

| Item Code No.   | Department  | Section  | Item Description          |
|---|-------------|--|---------------------------|
| LOT 12-11   | Engineering | Biomedical Workshop  | <b>Radiation Analyzer</b> |
| <p>4.1. The System shall have all safety markings in English language.</p> <p><b>5. Packing</b></p> <p>5.1. The system, for shipment by air to the end user shall be packed in accordance with international standards that are applicable for the shipment by air of this kind of equipment.</p> <p><b>6. Quality Requirements</b></p> <p>6.1. The system shall be manufactured, shipped, and installed in accordance with the contractors ISO Quality Assurance System or an equivalent quality assurance system. Compliant with ANSI 42.33/1 &amp; 42.32, and IEC 62401</p> <p><b>7. Testing of the System prior to Shipment</b></p> <p>7.1. The System, prior to shipment, shall be tested for its conformance with manufacturer's performance specifications and the requirements specified herein.</p> <p>7.2. The system shall be calibrated by the manufacturer with a certificate of calibration provided in English</p> <p><b>8. Deliverable Data Items</b></p> <p>8.1. Operating manuals<br/>The Supplier shall provide 2 complete sets of operation and servicing manuals and technical drawings in the English language in hard copies and electronic version;</p> <p><b>9. Support</b></p> <p>9.1. The System shall be supplied with a comprehensive warranty, valid for one year from date of delivery;</p> <p>9.2. Availability of on-line support is required. Supplier to identify any routine or preventative support and maintenance plan that is appropriate for this End- User, with full contact details. Note that regional support is preferred;</p> |             |  |                           |
| <b>10. Technical requirements summary</b>   |             |  |                           |
| <b>Description</b>  |             | <b>Values &amp; Notes</b>  |                           |
| 10.1. Detection   |             | <ul style="list-style-type: none"> <li>• Detector with x-ray measurement capability</li> <li>• Software with natural background detection</li> </ul> |                           |
| 10.2. Minimum span of Energy Range  |             | 60 keV to 1.3 MeV  |                           |
| 10.3. Minimum span of Measurement Range:  |             | Dose: 0.05 $\mu$ Sv – 9.99 Sv<br>Dose rate: 0.05 $\mu$ Sv/h – 100 mSv/h<br>Contamination: 0-10 kcps  |                           |
| 10.4. Units   |             | cps, Sv/h  |                           |

| Item Code No.               | Department   | Section             | Item Description          |
|-----------------------------|--|---------------------|---------------------------|
| LOT 12-11                   | Engineering  | Biomedical Workshop | <b>Radiation Analyzer</b> |
| 10.5. User Menu with:       | Information necessary to operate and maintain the unit |                     |                           |
| 10.6. Weight                | Not exceeding 300 g                                    |                     |                           |
| 10.7. Alarms                | Audible/visible alarms                                 |                     |                           |
| 10.8. Pulsed radiation      | x-ray measurement capability                           |                     |                           |
| 10.9. Contamination monitor | Alpha/beta contamination measurement capability        |                     |                           |
| 10.10. Battery life         | At least 500 h of operation                            |                     |                           |

#### **LOT 12-12    Ultrasound Wattmeter**

| Item Code No.              | Department  | Section             | Item Description     |
|----------------------------|---|---------------------|----------------------|
| LOT 12-12                  | Engineering   | Biomedical Workshop | Ultrasound Wattmeter |
| 1. General Description     |   |                     |                      |
|                            |   |                     |                      |
| 2. Composition             |   |                     |                      |
| 2.1.                       | Main unit   |                     |                      |
| 3. Specifications Details  |   |                     |                      |
| 3.1. Measurement range     | 0.1 W to 30 W   |                     |                      |
| 3.2. Input power level     | 0 to 30 W   |                     |                      |
| 3.3. Test media            | Deionized/distilled and degassed water  |                     |                      |
| 3.4. Resolution            | 0.1 W   |                     |                      |
| 3.5. Reading accuracy      | Electrical accuracy: + 0.15 W ( $\pm 0.01$ g) full range<br>System repeatability: + 3 % of reading, $\pm 0.2$ W |                     |                      |
| 3.6. Input measurements    | Average pulsed or continuous power  |                     |                      |
| 3.7. Input frequency range | 0.5 MHz to 10 MHz   |                     |                      |
| 3.8. Zeroing               | Auto-zero button  |                     |                      |
| 3.9. Readout units         | Watts or grams (output energy mode)   |                     |                      |

| Item Code No.                 | Department  | Section   | Item Description     |
|-------------------------------|-------------|---|----------------------|
| LOT 12-12                     | Engineering | Biomedical Workshop   | Ultrasound Wattmeter |
|                               |             | Grams (cal mode)  |                      |
| 3.10. Maximum Transducer Size |             | 7.6 cm (3 in) diameter  |                      |
| 3.11. Operating Temperature   |             | 10 °C to 45 °C  |                      |
| 3.12. Data Output             |             | Bidirectional RS-232/USB compatible with any serial communications software such as Windows® Hyperterminal™ |                      |
| 3.13. Power                   |             | One 9 V battery   |                      |
| 3.14. Battery Life            |             | At least 10 hours (max) with automatic switch off when unit not in use.                                     |                      |

**Drawn by:**

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**Reviewed by:**

Name..... Signature ..... Date .....

Name..... Signature ..... Date .....

Name..... Signature ..... Date .....

**Confirmed by:**

1. Name: ..... Signature..... Date .....

2. Name: ..... Signature..... Date.....

3. Name.....Signature..... Date.....