Comprehensive Bedside Respiratory examination skills Lab

Should be suitable for comprehensive bedside respiratory examination .Set up should comprise of following

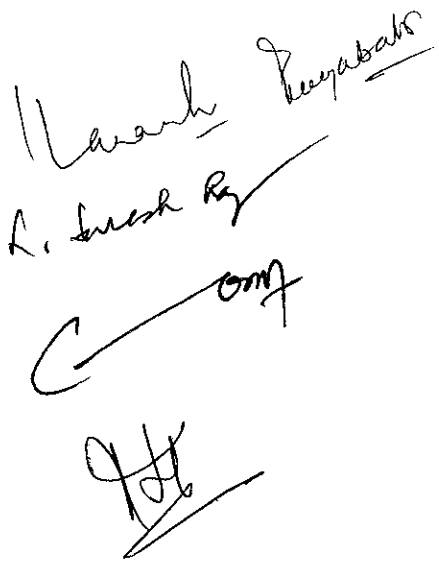
a) Bedside Chest and lungs examination simulator with following specifications

1. Simulator for comprehensive Lungs and chest examination with an actual stethoscope like in a real patient.
2. It should be Torso Manikin having realistic anatomical landmarks mounted on a platform trolley for comprehensive Chest and Lungs Examination
3. Manikin should be mounted on a rotatable base allowing easy anterior and posterior clinical examination as with the real patient.
4. It should be possible to use actual stethoscope for effective lung sound auscultation training
5. All lung sounds should be recorded from real patients and should not be synthetic sounds
6. All sounds should have natural propogation and sound transition across the chest wall
7. It should comprise of minimum 36 actual lung sound cases for following chest sounds:
   i) Normal sounds- Standard , Midley Weak, Midely strong,Loud heart sounds
   ii) Abnormal sounds-Weak Left Lower area,Weak Left whole area, absent left, weak right lower
   iii) area,weak right whole area, absent right, weak whole thorax, bronchial sounds
   iv) Coarse Crackles- right lower area, both lower area, right middle area,left lower area, both
   v) upper area, whole thorax
   vi) Fine Crackles- both lower area, both lower and middle area,whole thorax 1, whole thorax 2
   vii) Wheezes- upper and middle area, around trachea and upper area1,polyphonic
   viii) Rhonchi- Trachea and upper area, Polyphonic, with inspiratory wheeze, whole thorax
   ix) Miscellaneous continuous sound-stridor,squawk
   x) Miscellaneous- pleural friction rub left lower area, pleural friction rub left lower, pleural friction rub right lower and middle, Hamman's sign, vocal fremitus.
8. Each Case should be accompanied with detailed explanation and case reference with general descriptions and clinical data including patient histories, illustrations, radiographs and CT images for comprehensive teaching.
9. Each case should be available with and without heart sound for examination and teaching purpose.
10. Classification of the Lungs sound should be based on proven criteria of American Thoracic society
11. It should have graphical display of respiration sounds on computer screen/Tablet.
12. It should have Atleast Seven auscultation sites on Anterior side namely- Trachea ,upper right Lung Field, upper Left Lung Field, Middle left Lung Field, Middle right Lung Field, Lower right Lung Field, Lower Left Lung Field,
13. It should have Atleast Eight auscultation sites on Posterior side namely- upper right Lung Field, upper Left Lung Field, Middle left Lung Field, Middle right Lung Field, Lower right Lung Field, Lower Left Lung Field, right costophrenic angle, left costophrenic angle
14. It should have facility to play both posterior and anterior sounds simultaneously to allow examination by two or more students at a time
15. It should Indicate inspiration and expiration through LED light so as to confirm rhythm of breathing during sound auscultation
16. It should be operated by a wireless controller/tablet with facility to operate upto five simulators simultaneously with one tablet for efficient group teaching and examination.
17. It should be possible to program a playlist of scenarios according to teaching needs.

18. It should have an external speaker integrated in the trolley for demonstration and group studies.
19. Should have the facility to vary Sound volume (in five levels), respiration rate and operating time to offer variety of training options as per teaching needs.
20. It should have auto check facility to check for any error and keep the simulator in good condition
21. It should be possible to detach the Manikin from Trolley and use it as standalone unit.
22. Should be supplied complete with – Manikin torso with Trolley, PC with software,Wireless controller/Tablet , Inbuilt Amplifier and external speakers
    i) The setup should be supplied complete with stethoscope -10 nos

b) <u>Bronchoscopy Training simulator</u>

1. The simulator should be suitable for insertion training of ultrafine bronchoscopy as well as routine bronchoscopy.
2. The simulator should allow training using existing real Bronchoscopes in the department
3. It should be made up of specialized elastic silicone rubber to give a human like elastic texture and real life like feel.
4. The simulator should allow recreation of ultrafine bronchoscopy and should allow insertion all the way through three dimensional distal bronchus.
5. The internal bronchial tube should have natural human like color.
6. It should be supplied in a storage case for easy upkeep and storage.
7. The bronchial tube and the stand should be easily removable from the storage case.
8. 3D Distal Bronchus should be detachable and washable after training.
9. It should allow visualization of following bronchus structure
    - Primary bronchus(0^{th} order bronchi)
    - Intermediate bronchus (0^{th}-1^{st} order bronchi)
    - Lobar Bronchi (Superior, Middle and inferior lobe) (1^{st} order bronchi)
    - Superior Segmental bronchus, lingular bronchus, basal bronchus (1^{st} to 2^{nd} order bronchi)
    - Segmental bronchi (2^{nd} order Bronchi)
    - Subsegmental bronchi(3^{rd} order Bronchi)
    - Sub Subsegmental bronchi (4^{th}, 5^{th} order Bronchi)



Comprehensive Clinical Examination Skills simulator

The simulator should be suitable for teaching and training of students in bedside cardiovascular examination of patients Stethoscope and ECG Data
Simulator should have following specifications

1. State of the art clinical training system for comprehensive cardiovascular clinical examination using ECG data and Stethoscope
2. It should be life sized Torso model up to femoral arteries fixed on a platform trolley with Large monitoring screen (Min 20") for comprehensive bed side clinical examinations.
3. The system should have heart and breathing sounds recorded from the real patients and not computer-generated synthetic sounds,
4. Heart and breath sounds should have natural propagation and sound transitions across chest wall
5. The system should allow training in observation, auscultation, palpation of heart and breathing sounds as well as cardiac pulses, jugular vein and apex beat
6. The system should simulate realistic Respiration cycle to help students understand respiratory related phenomenon
7. It should have anatomically correct Auscultation, palpation and observation sites on life sized manikin as follows:
   a) 5 Sites for Heart Sound Ausculation
   b) 8 sites for arterial pulse palpitation
   c) 2 sites for Jugular vein observation
   d) 3 sites for apex beat palpitation
   e) 3 sites for breathing sound auscultation
   f) Abdominal respiration observation area
8. It should be suitable for training of students in identifying and differentiating heart sounds such as S1, S2,S3,S4 and systolic & diastolic Murmurs
9. It should have high quality reproduction of clinical examinations scenarios on a life size torso manikin body that comprises minimum 85 cases of-

   a) Normal heart simulation - S2 split (-) HR60/72/84 , S1 split (+), S2 split (+), S2 wide split, S3 gallop, S4 gallop,pulmonic ejection sound, S3 and S4 gallop, innocent murmur, midsystolic click sound,
   b) Heart disease simulation- aortic stenosis, mitral regurgitation, mitral stenosis, aortic regurgitation, hypertrophic cardiomyopathy, mitral steno-regurgitation, pulmonic valvular stenosis, atrial septal defect, ventricular septal defect, Ttricuspid regurgitation, Acute mitral regurgitation,Patent ductus arteriosus, Mitral valvular prolapsed, Dilated cardiomyopathy
   c) Arrhythmia simulation- Sinus arrhythmia,Sinus tachycardia, Sinus bradycardia, Ventricular premature contraction (1,2,3),Sino-atrial block, Atrio-ventricular block, Atrial fibrillation, Atrial flutter
   d) ECG arrhythmia simulation - Normal sinus R,Sinus tachycardia, Sinus arrhythmia, Apc solitary, Apc bigeminy , Ectopic pacemaker, Wondering pacemaker, Coronary sinus R, Sinus bradycardia, SS syndrome, Atrial fibrillation, Atrial flutter, Atrial flutter fib, Atrial flutter, AV block,AV block & crbbb, AV block (digital, mobitz), AV block (3:1&4:1),AV & crbbb, Paroxy atr tachy, AV junc R (svst), AV junc R (pat),AV junc R, AV junc contraction, VVI pacemaker, Atrial pacemaker, Vent pacemaker, AV seq pacemaker, icrbbb, crbbb, clbbb, , clbbb (by ami), wpw syndrome, vpc (solitary,quadrigeminy, trigeminy, bigeminy, couplet), pvc (repetitive,R-on-T type), non-sustained VT, vent (tachycardia, flutter, fibrillation), vent R (sinus cond), accel vent rhythm, agonal rhythm
10. It should simulate minimum 52 cases of arrhythmia along with real time dynamic ECG Chart for confirmation of findings
11. It should have Minimum 36 cases of total patient simulation including cases of normal Heart, Heart Diseases simulation, and arrhythmia simulation with corresponding sounds, pulses, apex beats and ECG
12. It system should provide explanation of all simulation/cases and its management to facilitate self learning and repeated training

13. It should have a large Touch screen to show ECG, Jugular Venous Pulses (JVP),Carotid Arterial Pulse(CAP) and Apex Cardiogram (ACG)
14. Each case can be freeze framed for in depth learning and should also show the HR,BP,RR and temperature of patient
15. The cardiology model unit should reproduce heart sounds and murmurs which can be auscultated using real stethoscope from Aortic ,Pulmonic ,Tricuspid and Mitral areas
16. It should have bilateral palpable cardiac impulses at Brachial, Radial, Carotid, femoral arteries linked to the simulated scenario and underlying physiology of the patient
17. It should have Apex Beat Palpable at RV, LV,DLV. with Right ventricular lifting, Left ventricular heaving and left ventricular enlargement
18. It should be possible to arrange/customize the display of the monitor as per training and examination needs
19. It should be supplied with a state of the art compression system with computer controls for real life like experience of arterial palpitation as well as abdominal respiration.
20. Should provide physical finding training in bedside cardiovascular clinical examination skills with total more than 85 cases **(preprogrammed /programmable)** of total patient, arrhythmia and ECG simulation.
21. It should give actual training by using actual diagnostic instruments such as real stethoscope,
22. It should have facility for repeated practice for learners to differentiate various heart sounds & murmurs using their own ear.
23. It should have tracheal and bronchial breath sounds and abdominal movements to facilitate understanding of respiratory related phenomenon
24. It should be operated by a wireless controller/tablet with facility to operate upto five simulators simultaneously with one tablet during examination and for efficient scenario based training involving more than one patient and to enable learning with comparison between related cases
25. It should be possible to program a playlist of scenarios according to teaching needs .
26. The training model should have the dual facility of (A) Hearing the murmurs and other sounds by doctors stethoscope for individual students experience (B) Possibility of playing sounds on speaker system for group /classroom teaching by faculty
27. It should have an external speaker integrated in the trolley for demonstration and large group studies.
28. The complete training system including manikin, compression system, computer, monitor and speakers should be integrated in a wheeled trolley for easy movements in the department as per training needs . The complete system should be pre wired and ready to use without any set up time
    i) The setup should be supplied complete with Stethoscope -10 nos

SPECIFICATION FOR EMG BASED NEUROLOGICAL SIMULATOR

Computerized EMG Driven interactive neurological simulator should have following specifications

A) **GENERAL SPECIFICATIONS**

1 The device should be emg based rehab robot that is user-friendly and easy-to-control.

2 The system should make use of reactive electromyography (EMG) for unique neurorehabiltation exercise. Training should be done with dynamically changing resistance, diagnostics, patient evaluation and interactive games.

3 Single joints or functional and dynamic joint movement should be trained with isolating extensions in order to exercise whole limbs in real patterns.

4 The robotic system should provide kinesiotherapy for orthopedic, neurological or cardiac patients of different age groups (with exclusion of neonatal patients).

5 The exercise program should be dedicated for patients with severe paresis and muscle atrophy. Patients with innerved muscles but severe atrophy (muscle flexion present on EMG but not palpable and undetectable with naked eye) could perform the active exercises on all extension.

6 The device should offer exercises for dexterity training with dynamically changing resistance: concentric with elastic resistance and weight simulation.

7 Rehabilitation games should work with reactive electromyography and dynamic resistance exercises and specially games could be used to improve movement coordination.

8 The robotic system should include the following components

a) Touch screen tablet computer

b) The Robot body

c) Extensions for all major joints and limbs

d) Accessories

B) **SYSTEM FEATURES**

1 TABLET COMPUTER -The tablet computer should be mounted to the robotic body with tablet holder and retractable arm with preloaded Software application for quick setup and operation.

a The robot body should be complete with Tablet holder, Head , Base and Lifting column .

b The lifting column should be height adjustable to fit different patients.

c There should be four base wheels with brakes that allow the transportation and immobilization of the robot

d The base should be low enough so that it could fit under most hospital beds and rehabilitation equipment.

e The robot should have two emergency stops for patient safety

f Dimensions: length: 420 mm x width: 600 mm x height: 1135-1485 mm

g Weight (excluding extensions): max 90 kg

h Each extension should support a maximal applied weight of at least 30 kg.

i The rotation axis height of head should be at least 720-1070 mm and rotation limits. should be at least 270o clockwise and anticlockwise

k The rotation position accuracy of the head should be at least ±2o.

l Maximum torque: at least 70 Nm (for a typical limb fixed at 0.3 m with the maximal weight equals 21 kg).

m Torque measurement accuracy should be at least ±0.2 Nm.

n Maximum head rotational speed (no load) at least: 50o/s.

o Lifting column stroke length: 350 mm.

p Lifting column stroke accuracy: ±1mm

q Lifting column height position accuracy: 2mm

r Maximal speed of lifting column (no load): 10 mm/s

s Base height: 97.5-122 mm

t Base wheel diameter: 75mm

3 EXTENSIONS

a Should be supplied with changeable extension parts for training and exercise of different joints including

i. Shoulder

ii. Elbow

iii. Hip

iv. Knee

v. Functional upper limb

b Various extensions should include

i. Elbow pronation/supination dynamic extension

ii. Steering wheel dynamic extension

iii. Upper limb universal extension

iv. Lower limb universal extension

c i. Upper limb extension should be used for flexion/extension of the elbow and shoulder rotation

ii. The length between the axis of rotation for the elbow and the hand grip should have the range of at least 7-24 cm.

iii. Hand grip diameter: 3 cm

d For pronation/supination of the elbow, hand grip diameter should be 3 cm.

e i. Lower limb extension should be used for flexion/extension of the knee, flexion/extension of the hip and abduction/adduction of the hip.

ii. The length between the axis of rotation for the knee/hip and the securing foam should have the range of at least 30.5-40.5 cm.

f Steering wheels should be used for functional training and the hand grip diameter should be 3 cm.

4 ACCESSORIES

a Accessories should include

i. Patient's emergency stop

ii. Bioelectricity cable and lead wires

iii. Single-use Surface electrodes

C **OPERATIONS**

1 During operations, there should be visual (LED light indicators) or sound (alarm) to notify the users of dangers, emergencies and current status.

2 Extensions (either dynamic or static) should be exchangeable accessories that mount on the front of the robot head and should be responsible for performing training exercises.

3 Dynamic extensions should be responsible for allowing joint movement with specified force resistance (or assistance). They should move or be moved by the user's joint.

4 Static extensions should remain in a single place throughout the training and should hold user's higher joint in place.

5 Extensions should be plugged in easily by mounting them on the dynamic extension mount in any orientation and then rotate the extension to upward position. The extensions should be connected to the connector pins.

6 The extension should be automatically detected by the software.

7 The system should allow bioelectric measurements especially for diagnostic and reactive electromyography.

8 One should use the provided single-use clip electrode and placed them (both positive and negative) on the

same muscle and measure EMG. For each electromyography exercise, reference electrode should also be attached to any part of the skin surface.

9 The software should allow patient profiling with information such as patient's personal data and training history which could be extension-specific.

10 Prior to training program, one should choose the patient and then insert the appropriate extensions. Range of motion, rotational torque and speed should be adjusted to suit different patient conditions.

11 The software should provide summary and detailed information about all performed exercises after every training.

12 Different exercises and diagnosis should be allowed

i. Continuous Passive Motion
ii. Progressive Continuous Passive Motion
iii. Spring (Elastic) exercises
iv. Isotonic exercises (weight lifting)
v. Dynamic reversal
vi. Prioperception – Hidden/Visible Position
vii. Reactive electromyography trigger and hold
viii. Reactive electromyography trigger and release
ix. EMG Biofeedback
x. Diagnostic EMG
xi. Reactive EMG Games
xii. Isometric EMG Games
xiii. Orthopaedic Games

13 Continuous passive motion (CPM)

i. Should be a standard therapy which the system will apply a set torque, moving astatic patient through the set range of motion with asset maximal speed.
ii. When a maximal value of range of motion is reached, CPM will switch the direction of the applied torque and guide the patients' limb to another direction.
iii. Range of motion, maximal torque and speed should be adjustable.
iv. The exercise should increase range of motion.

14 Progressive Continuous Passive Motion

i. Should be a standard therapy which the system will apply a set torque, moving astatic patient through the set range of motion with asset maximal speed.
ii. The range of motion should be increased incrementally with a set increment per repetition. The range of motion will be increased until it reaches the maximal set range of motion during calibration.
iii. When a maximal value of range of motion is reached, Incremental CPM will switch the direction of the applied torque and guide the patients' limb to another direction.
iv. Range of motion, maximal torque and speed should be adjustable.
v. The exercise should increase range of motion.

15 Spring (Elastic) exercises:

i. The system should provide dynamic resistance (based on extension position) that changes incrementally with the distance between a set "spring fix" position and the extension current position.
ii. The "spring fix" position should be configurable within the range of motion as: minimal, maximal or average.
iii. Range of motion, maximal torque and speed should be adjustable.

iv. The exercise should improve the muscle strength and coordination.

16 Isotonic exercises (weight lifting)

i. The system should provide static torque with a specific direction

ii. Range of motion, maximal torque and speed should be adjustable.

iii. The exercise should improve the muscle strength

17 Dynamic reversal

i. The system should provide dynamic resistance (based on applied torque) and allows the patient to move freely throughout the range of motion

ii. Range of motion, maximal torque and speed should be adjustable.

iii. The exercise should improve the muscle strength and coordination.

18 Prioperception – Hidden/Visible

i. The system should provide dynamic resistance (based on applied torque) and allows the patient to move freely throughout the range of motion

ii. During movement the system should randomly select a goal position, that the patient is encouraged to reach with the extension position.

iii. The system should present

iv. Range of motion should be adjustable.

v. The exercise should improve the muscle strength and coordination.

19 Reactive electromyography trigger and hold

i. Patient should control the movement of the extension through contraction of single or multiple muscles.

ii. When the EMG level (from single or multiple muscles) reach the preset "trigger", the system should start to move similarly to concentric exercises.

iii. When the resulting EMG signal remains above the trigger level, the movement should hold. Relaxing the muscles will allow the extension to return to its starting position.

20 Reactive electromyography trigger and release

i. Patient should control the movement of the extension through contraction of single or multiple muscles

ii. When the EMG level (from single or multiple muscles) reach the preset "trigger", the system should start to move throughout the whole range of motion.

iii. When the resulting EMG signal drop below the trigger level, the system will move throughout the whole range of motion until it returns to its starting position.

21 EMG Biofeedback:

i. Patient should be able to perform and monitor electrical activity of the muscles and calibrate the minimal (tonus) and maximal contraction values.

ii. Patient should be able to perform flexion and relaxation of the selected muscle that is recorded on the screen

iii. If the contraction level reaches a calibration trigger value an lasts for >0,2s, >3s, >120s the system should record that as a contraction: fast, slow and stabilizing, respectively.

iv. Number of contractions should be recorded on screen

22 Diagnostic EMG

i. No extension should be needed.

ii. The system should monitor all EMG channels and the electrical activity of connected muscles.

23 The software should have three primary game categories

i. Orthopedic – acting like concentric exercises

ii. Reactive EMG – acting like reactive electromyography trigger and hold

iii. Isometric EMG – acting like EMG biofeedback

24 At least two games should be provided: Space shooter and Bubble.

25 Space shooter

i. Should be a game where the patients control the movement of a spaceship.

26 Bubble

i. Should be a logic game where patients control the position of a bubble gun launching different color bubbles to form patterns.

D TECHNICAL INFORMATION

1 The system should meet the requirements of ISO60601-1-2 for electromagnetic compatibility, including immunity.

2 Power supply: 200-240V, 2.5 A

3 Class I protection against electric current

4 Medical device class: class IIa Applied part types: B, BF

5 The device should allow constant use and should stop the current operation and display error notification with the built-in sensor

Specifications for Real Time Virtual Human Physiology Simulator

1. The simulator suitable for comprehensive Physiology teaching
2. Should be capable to replicate virtually different body processes including respiratory systems, cardiac cycles without the use of any tactile device.
3. It should present virtual patient's cellular structure just as a real human body, with the ability to generate ECG and all vital biochemical processes like in real life.
4. Should have selectable modes to view processes like the respiratory mechanics of the lungs and diaphragm, Hemodynamic Mode to see the blood as it distributes nutrients to every organ in real time.
5. System should be built according to principle of Cells Organs, Systems and Organism working in real time.
6. Should have inbuilt scenarios for Pathological Processes including Disorders of Impulse Condition , Conduction Disorders, Complex Rhythm Disturbances and Infarcts.
7. Should allow simulation of Interventions like Defibrillation, Pacing rate and Cardiac massage including 12 Lead ECG.
8. Should Comprise of following Modules :
   a) **Physiological Module including** Hemodynamics, Virtual Heart and Coronary System, Biochemistry, Respiratory, Gas Exchange, Water-Salt Metabolism, Digestion and Soak Excretory Systems working together.
   b) **Pharmacology Module with capabilities of**
      i. Using drugs from library
      ii. Drug introduction via : oral, intravenous, and intramuscular
      iii. Real time Drug distribution and excretion
      iv. Pharmacodynamics of drugs
      v. Pharmacokinetics of drugs
   c) **Cardio System with capability of**
      i. Generation of electric potentials of heart cells
      ii. Heart rhythm generation
      iii. Simulation of Hypertension and hypotension
      iv. Cardiac arrhythmias with atleast
         a. 11 Scenarios of impulse condition disorders
         b. 4 Scenarios of conduction disorders
         c. 1 Scenario of rhythm disturbances
      v. Atleast five Selectable Scenarios of Infarcts
      vi. 12 Lead ECG monitoring
      vii. Facility of Defibrillation and Cardioversion
      viii. Monitoring of Pacing rate
      ix. Facility of Cardiac massage
   d) **Respiratory System with** Breathing in full compliance with the actual respiratory mechanics.
      i. Simulated spontaneous breathing
      ii. Real life like Simulation of All inhalation and exhalation gases (O_2, CO_2, H_2O, N_2, Argon, etc.)
      iii. Facility to Control rate and depth of respiration and realistic chest rise and fall
      iv. Real life like simulation of Gas composition in the chain: bronchi, alveoli, veins and arterioles
   e) **Biochemistry system –with facility of** Observation of all known biochemical changes of the human body and organs in real time. Complete with
      i. Module of biochemical transformations
      ii. Review of biochemical reaction in the virtual body
      iii. Fermentation system in the biochemical transformations and their classification
   f) **Circulation system with**
      i. Real time simulation of Transport of blood to organs

ii. Display of volume of blood in different organs
iii. Realistic accurate Model of oxygen transport to organs
iv. Real time simulation and observation of parameters
    a. p in arteries of vascular system/organ
    b. p in capillaries of vascular system/organ before and after metabolic processes take place
    c. p in veins of circulatory system
    d. Volume of blood passing through the vascular system/organ per minute (ml/min)

g) **Nervous System with capability of simulation of**

i. Entral, Peripheral, Sympathetic, Parasympathetic Nervous Systems
ii. Sensitivity and Motor Function of the Nervous System

h) Digestive and Excretory system with

i. Simulation of Digestion and soak process including

    a. Gastric substances received with food
    b. Secretion of gastric juices and enzymes in the stomach
    c. Final product of the gastrointestinal digestion
    d. Secretion of digestive juices and ferments in the intestine

ii. Urinary Module with simulation of

    a. Model of the nephron (filtration and reabsorption of urine)
    b. Automatic control of urine output

9. The vendor should undertake to provide training to end users for the operation and maintenance of the simulator and online support should also be available as and when required.