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TECHNICAL SPECIFICATIONS

Bioprinter and Accessories

1. Printer Technology:

Portable, benchtop printer with small footprint which can print soft materials, bioinks, biomaterials and various cell types.

1.1. Precision should be at least 1-micron on x, y, and z axes to allow to print the highest resolution structures.

1.2. Build volume should be greater than 5 cm in z-direction and greater than 10cm in at least one other dimension.

1.3. It should be possible to 3D print into Petri Dish, 6, 12, 24, 48, 96 & 384 well Microplates, and Slides bought from various commercial suppliers. All these options should be able to be selected via a drop-down menu either in the computer software or by a touch screen on the machine.

1.4. The system should be compatible with any Bioinks and should be an open system

1.5. The system should be supplied with accessories required for mixing live cells and printing bioink.

1.6. The whole setup including the controller etc. should be bench type which can be placed inside a 4 feet wide laminar hood or biosafety cabinet.

1.7. The system should be capable of able to photocuring layer by layer with UV of 405 nm and 365 nm, Droplet printing, and accommodate syringe printhead.

1.8. The Bioprinter should be a standalone system with inbuilt computer and touch screen controller for complete functionality. Or, the manufacture should provide the desktop computer, and software license necessary to the instrument to separate computer

1.9. Weight shall be less than 25 kg

2. Print Heads:

Should have minimum 3 to 6 printheads to print multi-cell tissues easily and quickly with multiple bioinks. Must be provided with exchangeable pneumatic print heads which can perform the following function individually or in combination:

2.1. Cooling upto 4 °C or better

2.2. Heating upto 60 °C or better

2.3. Photocuring with UV Light (365 nm) and Blue Light (405 nm). The machine should offer the flexibility of photocuring after printing each layer or photocuring of the entire part after complete printing is done.

2.4. Heating upto 250 °C for printing thermoplastic such as PLA & PCL.
2.5. Each print head must have individual temperature control.
2.6. Should be able to print wide range of bioinks including silk fibroin, collagen solutions, gelatin methacrylate, alginate, poloxamer, hyaluronic acid, and polycaprolactone (PCL). It should also be able to print novel synthesized polymers and new polymer blends and composites developed in-house.
2.7. Should have an autocalibration feature for print heads to improve convenience of use and minimise damage due to use by multiple users. The calibration of system should be user friendly and with minimum input and option for both manual and automated calibration should be available.

3. Print Bed:

3.1. Print-bed temperature should be controlled with heating options (up to 50^{o}C or better) and be compatible with Petri dish, well plates and slides.

4. Extruder:

4.1. Pressure ranges should be between 0 and 150 psi to accommodate a wide range of viscous materials and it must be easily possible to select a desired pressure value in this range.
4.2. Pneumatic extrusion should cause minimal shear stress on cells while enabling unlimited design freedom and the manufacturer should be able to demonstrate more than 90% cell viability for at least 2 cell lines in standard bioinks supplied by the vendor.
4.3. Mixer: Shall have provision for mixing two different materials before printing. Any accessory to enable this feature shall be included.
4.4. The extruders should be able to use disposable and commercial disposable syringes of at least 5mL in volume, making it easy to load custom bioinks.

5. Other Details:

5.1. Accepted Print Files should be STL, G-Code. It would be desirable to have acceptability towards other print file types such as *.obj as well. It must be possible to download the G-code file used for a particular print.
5.2. The printhead should be interchangeable so as ensure upgradation of printheads with the new developments.
5.3. Connectivity should be via Wi-Fi, Ethernet or pen drive.
5.4. Should be compatible with Windows, MAC and Linux Operating Systems
5.5. Power requirements: 24V DC@ 6-8 amps; AC input 100-240V, ~2 Amps, 50-60Hz; Operating voltage of 230V, 60Hz.
5.6. Should be provided with operating and service manual

6. Warranty and Service:

6.1. Price offered should include warranty of 2 years on all parts from the date of installation.

6.2. Additional 3-year warranty shall be included.

6.3. Service: A certified service engineer should be easily accessible and available on demand within 48 hours of any problem in the instrument. Two compulsory visits per year for maintenance must be included apart from the installation.

6.4. Installation and training: Vendor should provide training on operation and application at IIT Bombay after installation. The training event needs to be performed once a year for three years.

6.5. Spares: The supplier of the instrument must confirm in writing that the spares for the entire instrument will be available for a period of at least ten years from the date of installation.

6.6. If the system does not have an inbuilt computer and touch screen controller for complete functionality, then the supplier will supply suitable computer with Windows 10 (windows 7 also acceptable, if vendor commits to providing free instrument firmware upgrade compatible to Windows 10 when available), 6th Generation Intel (R) Core™ i5 processor or better, DVDRW, ≥500GB HDD, ≥8GB RAM, ≥21" LCD monitor, 4 or more USB ports and other necessary features to ensure smooth operation of the system. Laser Jet B/W printer with wireless networking and duplex

6.7. Stabilizer: 1 KVA servo stabilizer.

7. Other Accessories Needed:

7.1. Compatible plastic syringes for at least two different volumes (pack of 100 each)

7.2. Thermoplastic printing compatible metal syringes (5 each)

7.3. Syringe tips required:

7.4. Metal tips for metal syringes of at least two different sizes (10 each)

7.5. Plastic tips boxes of at least three different sizes (50 each)

7.6. Some size examples are 23-gauge, 27 gauge and 32 gauge. Equivalent acceptable.

7.7. Bio inks: include Gelatin Methacrylate, Pluronics, PCL, collagen methacrylate, photoinitiator

7.8. Others

7.8.1. Accessories, starter kit and consumables: All necessary consumables for demonstration of full functionality and installation such as tips, syringes, needles, inks, materials, start-up kit shall be included with the system. Shall enclose a detailed catalogue with price for all available accessories from OEM.