

Centre of Excellence, Bangalore

(An initiative of Ministry of MSME and Indian Institute of Science, Bangalore)

Verticals identified for further incubation and commercialization by MSMEs under Design Clinic Scheme:

1. Computer Science and Automation
2. Electrical Engineering
3. Electrical Communication Engineering
4. Electronic System Engineering
5. Aerospace Engineering
6. Chemical Engineering
7. Mechanical Engineering
8. Materials Engineering

1.Computer Science and Automation:

- a) Theoretical Computer Science – Algorithms, Algorithmic Algebra, Graph Theory, Combinational Geometry, Computational Geometry, Computational Topology, Coding Theory, Cryptology.
- b) Computer and Systems and software- Computer Architecture, Multi-core System, Embedded Systems, Operating Systems, Storage Systems, Data Base Systems, Cloud Computing System Security, Mobile and wireless Systems, Cyber-Physical Systems, Software Engineering
- c) Intelligent Systems- Pattern Recognition, Machine Learning, Convex Optimization, Graphical Models, Soft Computing, Bioinformatics, Social Network Analysis.

2. Electrical Engineering :

a) Power systems- Advanced Power Analysis, Power System Dynamics and computer control, Voltage Stability, Computer Aided protection and Design of Distribution Systems, Distribution Automation, Deregulated Power system operation.

b) Power electronics and Drives- Electromagnetic, Switched Mode Power Conversions, Compact SMPS Employing soft switches. PWM techniques, Digital control of industrial Drives, Induction Motor Drives, Control of slip-ring induction machines, Current source invertors drives for induction and synchronous Machines, Multi level invertors, High Power convertors,

c) High voltage engineering- Insulation Engineering, Dielectric Materials, Power Operators, Diagnostics and condition Monitoring, HV Testing and Measurement, EHV/UHV Transmission, Electromagnetic, EMI/EMC, Pulsed Power and Air Pollution Control.

d) Sensor Net works and Real-Time systems- Sensor networks resource management and communication protocols, Real –Time scheduling, Multi processor utilization bounds, Real time communication and QoS routing.

e) Signal Processing-Adoptive filtering and active noise cancellation, machine listening, audio retrieval, spike extraction in MEA recordings, online handwriting.

3. Electrical Communication Engineering:

a) Communications- Information theory distributed joint source-channel coding, error control coding including space- time codes, network coding, codes for storage systems code on graphs, coded modulation and pseudo random sequences CDMA, wireless communication mobile, interface modeling, physical layer security, machine learning for communication.

b) Communication Networking- Wireless sensor networks, distributed signal processing, system architectures for various applications, distributed computing

algorithms for sensor networks, Algorithms for energy management in sensor networks, Multimedia communication, cognitive radio communication.

c) Photonics-Fibre optics communications and networks systems (MOEMS), Bio photonics, Bio sensors.

d) Nano electronics and VLSI- Nano-CMOS technology, Non-classical transistor Design, Adoptable circuit design, integrated MEMS sensors, VLSI Architectures for high performance computing, low power technique in hardware and software, software and hardware for embedded systems and system-on-chip, fault-tolerant and self-healing system design, Mixed signal RF integrated signals.

e) Signal Processing- Speech and audio processing, statistical signal processing, bio medical signal processing.

4.Electronic Systems Engineering:

a) Power converters and Controls

- i. Power Module Layout Synthesis Tool
- ii. Power Packaging
- iii. ESS for Diesel Micro Grid
- iv. GaN Power Converters
- v. Advanced Power Devices and Convertors.

b) Semiconductor Device Modeling

- i. BGP Route Flap Damping Algorithms
- ii. Porcelain Insulators
- iii. RF Transistors
- iv. Mini-Circuits
- v. Transmission and Receiving Tubes.

c) Communication Networks

- i. Data Analysis in wireless and Wire line Networks
- ii. Data mining on billing traces of wireless networks
- iii. Modelling and performance analysis of public safety wireless networks

- iv. Intelligent control of communication Networks
- v. Simulation of Net works.
- vi. Bandwidth Aggregation Technologies
- vii. ISM Band Spectrum Analyser
- viii. Building Femtocells from Reference Design using Linux OS

d) VLSI Design

- i. Single chip WEB based server
- ii. Shift invert coding for Low Power VLSI
- iii. Image compression with different Types of wavelets
- iv. A VLSI architecture for a Runtime Multiprecision reconfigurable booth multiplier Low Power and high quality cordic based Loffler DCT for Signal processing
- v. Simulation model of visible water marking for JPEG image (3D) using VLSI/Matlab.

e) Bio Mechatronics, Sensors and Actuators, Electro mechanics.

- i. Street light that glows on detecting vehicle movement
- ii. SCADA for remote industrial plant
- iii. Railway level crossing gate control
- iv. RF enabled ICU caretaker
- v. Robotic control of wireless capsuler endoscopes.

5. Aerospace Engineering:

a) Composite Materials and Structures: Mathematical modeling involving mechanics and physics of Ceramic/polymer/metal fiber reinforced polymer matrix composites, understanding micro and nano-scale behavior of these composites using theoretical modeling and experimentation; processing and secondary manufacturing studies of composite materials and structural components; sustainable manufacturing of composite structures; design methodology for improved stiffness and strength properties dynamic response of composite structures under vibratory, acoustic and impact loadings. Multi-Functional

Materials and Smart Structures Piezoelectric, magnetostructure, shape memory and non-Newtonian fluidic materials and their novel properties which can be applied to sense, alter and control objects with applications in smart structures, vibration suppression, energy harvesting, smart electronics and bio-interface integration of these materials into systems to achieve a combined set of functions: technological applications related to aircraft and spacecraft, automobile, unmanned air vehicles, robots, human healthcare, safety and early warning systems.

b) Control and Dynamics of Aerospace Vehicles: Spacecraft formation flights, dynamics and control of smart structures, control of aerospace vehicles, autonomous unmanned air vehicles, robust control system synthesis for aircraft, precision satellite attitudes and rates estimation, orbital rendezvous, reentry vehicle dynamics and control of reusable vehicles; dynamic inversion for nonlinear and optimal control synthesis using neural networks.

c) Micro and Nanotechnologies: Nano-and micro-scale phenomena in solids and liquids and their applications in synthesis and phase transition of materials, sensing through electronics, ionics and photonics, coatings and thin films and composite materials; improvement of mechanical, thermal and electronic properties by suitable synthesis and design of materials and micro and nano-scales.

d) Structural Dynamics and Aero elasticity: Structural dynamics, wave propagation, fluid structure-interaction and finite element techniques, aeroservoelasticity and smart aeroservoelastic systems, nonlinear vibration of joint-dominated structures, flutter of airfoils with local structural nonlinearities, unsteady aerodynamics, nonlinear control synthesis for vibrations unsteady flow past oscillating airfoil and airfoil cascades.

e) Combustion and Propulsion: Study of full chemistry effects in fluid flows, flame propagation, extinction and ignition in boundary layer flows, combustion of droplets, computer simulation of reacting flows, combustion in separated flows, radiation from engine exhausts, spray characteristics of liquid propellant rockets and gas turbine engines, space electric propulsion, MPD thrusters, chemistry of

propellants: space propellant management, DNS of turbulent combustion; numerical modeling of solid rocket motors; combustion instability in rockets and gasturbine engines.

6. Chemical Engineering:

a) Bio-chemical Engineering: Bioleaching of ocean nodules and sulphides; kinetics of enzymatic reactions in supercritical fluids; metabolic control and sensitivity analysis of bioreactors; optimization and control of fermentation processes using genetic algorithms; transport and kinetic modeling of multiphase bioprocesses.

b) Colloids: Crystallization; formation of nanoparticles in micelles; liquid-liquid dispersions; Ostwald ripening; solubilisation in surfactant solutions stability of emulsions.

c) Complex Fluids: Analysis of slow granular flow ; flow of powders in bins, channels, and hoppers; fluid mechanics of suspension; hydrodynamic stability of flows on flexible surfaces; rheology of liquid crystalline materials; continuum modeling of tow phase flows.

d) Modeling and Simulation: Bubble nucleation; bon fabric studies; biosorption of heavy metals defluoridation of drinking water; polymer recycling; remediation of contaminated soils with supercritical fluids; solid waste management; synthesis of biodegradable polymers.

e) Reaction Engineering: Kinetics of reactions mediated by ultrasound and microwaves; multiphase sonochemical reactors; photo catalysis; polymer synthesis and degration reactions in supercritical fluids; sintering reactions using microwaves transport processes and reactions in packed beds.

7.Mechanical Engineering:

a) Mechanical Systems and Design: Structural and dimensional synthesis of kinematic and compliant mechanisms; theoretical kinematics; multi-disciplinary design optimization; dynamics and control of robot and multi-body mechanical systems; computer/controlled mechanical systems; hybrid automotive vehicles; bio-medical devices constructing 3D models from sketches, assembly sequence planning and evaluation, tools for early stages in design, vibrations, structural shape and topology optimization, kinematic assembly modeling, geometric and topological modeling.

b) Thermal Sciences: Turbulent Rayleigh-Benard convection; double-diffusive convection, mixed convection, heat pipes, thermal management of electronic systems; Heat and Mass transfer in building, natural ventilation, heat and mass transfer in food products; two-phase flows and heat transfer, heat transfer in renewable energy systems; numerical heat transfer; refrigeration and air-conditioning; adsorption coolers and gas storage; mathematical modeling and simulation of thermal systems; thermal modeling and experimentation in solidification, arc welding pools laser welding of dissimilar metals, surface alloying.

c) Combustion & IC engines: Multi-dimensional modeling of in-cylinder processes including two-phase flow, turbulence and combustion chemistry; cold-start emission reduction technologies; diesel engine combustion chamber geometry optimization; alternative fuel research, bio-lubricants; high-efficiency biogas-fuelled engine technology; application of laser-based diagnostic techniques in engine research; fuel spray characterization using shadowgraphy and interferometric Mie imaging techniques; trapped vortex based combustor research.

d) Metal Casting and Advanced Manufacturing: Semisolid forming, die casting, squeeze casting, mould design and metal flow analysis, computer aided design of near-net shaped casting; friction stir welding, friction stir processing.

e) Fluid Mechanics: Multiphase stability; stability of unsteady boundary layers; unsteady boundary-layer separation; transition and turbulence; turbulence modeling, fish-like propulsion.

8 Materials Engineering:

a) Mechanical behavior: Development of experimental and theoretical tools for studying mechanical behavior of thin films, coatings, and micropillars; microstructure-property correlations in bulk metallic glasses, shape memory alloys metallic foams, advanced Ti, Al- and Mg-alloys, ceramics, polymers, and ultra-fine and nanocrystalline materials. Effect of temperature and ultra-high strain rates; superplasticity; cavitations failure; friction, wear, and tribology; processing and mechanical properties of metal-matrix and polymer-matrix composites; fracture and failure analysis.

b) Ceramics: Synthesis of metastable multi-component oxides and ultra-fine powders; low temperature consolidation of glasses and nanocrystalline ceramics; grain boundary sliding and diffusion creep in doped and two-phase ceramics.

c) Bio materials: Polyelectrolyte multilayer films and capsules for drug delivery and diagnostics. Tissue engineering, Regenerative medicine, Medical implants.

d) Physical Metallurgy: Diffusion in binary and ternary systems, with applications to electronic packaging, processing of superconducting wires and thermal barrier coatings; Bulk metallic glasses high entropy alloys; phase field simulations of microstructural evolution; deformation and transformation textures at micron and sub-micron length scales; micro- and nanostructures produced by far-from-equilibrium processes such as welding of dissimilar metals laser and electron-beam welding, surface alloying spray forming rapid solidification, mechanical alloying and equi-channel angular processing.

e) Functional Materials: Electroactive polymers, organic photovoltaics, nanoelectronics and sensors; Polymer blends, carbon, nanotube and graphene based polymer nanocomposites, ferroelectric, pyroelectric, relaxor ferroelectric,

magnetic, and multiferroic materials; high-temperature thermo-electric materials (skutterudites and tellurides); oxide based semiconductors(titania and zirconia). Electromigration in solid films and liquid metals; thermo-electro-mechanical excursions and their effects on short and long term reliability of microelectronic packages.

ANNEXURE

Product list ready for value engineering and further incubation by MSMEs with Indian Institute of Science (IISc), Bangalore

1. Computer Science and Automation
2. Electrical Engineering
3. Electrical Communication Engineering
4. Electronic System Engineering
5. Aerospace Engineering
6. Chemical Engineering
7. Mechanical Engineering
8. Materials Engineering

A. Computer Science & Automation, Electrical, Electrical Communication, Electronic System Engineering

1. Power Module Layout Synthesis Tool
2. Power Packaging
3. ESS for Diesel Micro Grid
4. GaN Power Converters
5. Advanced Power Devices and Convertors
6. BGP Route Flap Damping Algorithms
7. Porcelain Insulators
8. RF Transistors
9. Mini-Circuits
10. Transmission and Receiving Tubes
11. Wireless and Wire line Networks
12. Wireless networks
13. Wublic safety wireless networks
14. Intelligent control of communication Networks
15. Simulation of Net works
16. Bandwidth Aggregation Technologies
17. ISM Band Spectrum Analyser

18. Femtocells from Reference Design using Linux OS
19. Single chip WEB based server
20. Shift invert coding for Low Power VLSI
21. Image compression with different Types of wavelets
22. Simulation model of visible water marking for JPEG image (3D) using VLSI/Matlab
23. Street light that glows on detecting vehicle movement
24. SCADA for remote industrial plant
25. Railway level crossing gate control
26. RF enabled ICU caretaker
27. Robotic control of wireless capsular endoscopes
28. Alkaline Cells
29. Aluminium Power cables
30. Aluminium Conductor
31. Alternators 1 to 75 KVA
32. ACSR & AC Aluminium Conductors
33. Telephone Recording & Answering Machine
34. Alternators
35. Carbon Brushes
36. Capacitors
37. Carbon Potentiometers
38. Transformers
39. Computer Software
40. Control Panels
41. Dry Cell
42. Digital Tachometers
43. Electronic Energy Meter
44. Electrical Panel Boards
45. Electrolytic Capacitors
46. EPABX/EPAX System
47. Electronic Testing And Measuring Instruments
48. F.H.P. Motors
49. G.L.S. Lamps
50. HT & LT Insulator
51. Invertors and Convertor
52. Integrated Circuits
53. Inverters 50 Hz; 100 to 1000 KVA
54. Miniature Circuit Breaker

55. Picture Tube
56. Printed Circuit Board
57. Power Capacitors
58. Power Amplifiers
59. Power Factor Capacitors
60. Solar Power Plant
61. Servo Motors
62. Squirrel Gauge Induction Motor
63. T V Signal Boosters
64. Automatic Wireless Health Monitoring System
65. Density Based Traffic Signal System
66. Railway Level Crossing Gate Control System
67. Non Contact Tachometer
68. Remote Jamming Device
69. Speed Synchronization of Multiple Motors
70. Detector equipment for Rash Driving
71. Railway Automation System with Sensors Network
72. Thermistor Based Temperature Control

B. Chemical Engineering

73. Rupturable Disposable Syringes
74. Potable Alcohol from damaged grain and fruits
75. Activated Carbon from CNT shells
76. Boiler Descaling Compound (TSP)
77. Carboxy Methyl Cellulose(CMC)
78. Bricks from Flyash
79. Bio Fuel
80. Synthesis of Bio-diesel in super critical fluids
81. DNA Vaccine
82. Hepatitis B-Vaccine
83. Gasifier for Thermal operation on a Kiln
84. Complex fluids and Dynamics of Suspensions
85. Carbon Emissions Reduction through Biomass Energy
86. Pectin
87. Soda Ash
88. Epoxy coating of TMT Steel Rebars

89. Copper Sulphate
90. Rose Crystals
91. Industrial Enzymes
92. Water Proffing Compound
93. Surgical Cotton
94. Synthetic Rubber Adhesives
95. Acid Slurry
96. Hydrogenation of Non-edible oils
97. Enamel Paints and Varnishes
98. Adhesives for Corrugation
99. Bricks from Fly Ash
100. Rubber based Adhesives
101. Resin Based Adhesives
102. Adhesives Textile Grade
103. CNSL Alkyd Resins
104. Caustic Soda
105. Ice Making Plant
106. PVC Furniture
107. Cement water Proofing Compound
108. PET Bottles
109. Zeolite-A
110. Amphotericin-B using Nanotechnology
111. Spitulina Algae
112. E-Waste Recycling

C. Aerospace, Mechanical and Materials Engineering

113. Suspension System Equipments
114. Radar Equipments and Components
115. Turbo Blades
116. Auto Electrical Components
117. Lube Oil System Components
118. Industrial Valves (Globe, Gate, NRVs)
119. Fuel Injection System
120. Heat Exchangers
121. Hydraulic and Pneumatic Components
122. Seamless Tubes and Pipes

123. Helical Coil/Springs
124. Air Duct System
125. Alloy Casting (Including Non-Ferrous Casting)
126. Collapsible Tubes
127. Aluminum Extrusion
128. Sheet Metal Components
129. Aluminum Alloy Conductor
130. Aluminum Ingots
131. Air Filters
132. Pistons
133. Brake Shoes
134. Leaf Spring
135. Gears and Gear Boxes
136. Radiators
137. Dynamo
138. Engine Cylinder
139. Automobile Silencers
140. Axle Shafts
141. Auto Control Cables
142. Piston Ring
143. Ball Bearing
144. Brass Casting
145. Fasteners (Ferrous & Non-Ferrous)
146. Brake Lining
147. Carbide Tips/Inserts/Index able
148. C.I. Casting Foundry
149. C.N.G. Cylinders
150. Carburetors
151. C.I. Pipes & Fittings
152. Copper Wire Drawing Unit
153. Crank Shaft
154. Cutting Tools
155. Cylinder Liners (for I.C. Engines)
156. Clutch Plates
157. Diamond Blade
158. Medical Equipments
159. Diamond Tools for Cutting/Drilling and Polishing
160. Diesel & Oil Filter Elements

161. Engine Valves for Automobiles
162. Forged Components
163. Pressure Vessels
164. Hand Tools
165. Auto Filters (Air and Oil Filters)
166. Grinding Wheels
167. Gun Metal Bushes
168. Hydraulic and Pneumatic Components
169. Earth Moving Machinery
170. Oil Filters
171. Induction Furnace
172. Muffler & Silencer Pipes
173. Micro Ovens
174. Welding Electrodes
175. Wire Drawing
176. Non Ferrous Rolling Mill
177. Power Presses
178. Pressure Die Casting
179. Spark Plugs
180. Shock Absorbers
181. Stainless Steel Casting
182. Sheet Metal Components
183. Transmission Power Fittings
184. Valves & Cocks
185. Super enameled copper wire
186. Iron ore pelletization plant
187. Safety seals
188. Aluminum angels,channels,doors & frames
189. Transmission towers & telecommunication towers
190. Elevators