Subject: Second meeting of the Project Approval Board (PAB) - Minutes regarding,

The Second meeting of the Project Approval Board (PAB) constituted under the Scheme National Initiative for Setting up of Design Innovation Centers, Open Design School and National Design Innovation Network was held under the Chairmanship of Secretary, Higher Education, MHRD at 3.00 PM on 13th January 2015 in Conference Room No. 112-C, Shastri Bhavan, New Delhi. Minutes of the meeting are attached herewith for your kind perusal.

Encl: As above.

(Rakesh Ranjan)
Joint Secretary (Policy) & Member Secretary (PAB)
Tel: 23071486
Fax: 23071487

To,
1. The Secretary, Department of Expenditure, M/o Finance
2. The Secretary, D/o Industrial Policy & Promotion
3. The Secretary, D/o Telecommunication
4. Additional Secretary (TE), D/o Higher Education, MHRD
5. Chairman, UGC
6. Chairman, AICTE
7. JS & FA, D/o Higher Education MHRD
8. Adviser, Higher Education, Planning Commission
9. The Director, National Institute of Design
10. The Director, Indian Institute of Management, Bangalore
11. The Director, Indian Institute of Technology, Kanpur
12. The Director, School of Planning & Architecture
13. The Director, NIFT, Gandhi Nagar
Copy for information and necessary action to:

1. Director, IIT Bombay,
2. Director, IIT Delhi,
3. Director, IIT Guwahati,
4. Director, IISc Bangalore
5. VC, Delhi University
6. Director, IIT Bhubaneswar
7. Vice-Chancellor, Rani Durgawati University
8. Vice-Chancellor, Savitribai Phule Pune University
9. Vice-Chancellor, University of Rajasthan
10. Vice-Chancellor, Central University of Kerala
11. Vice-Chancellor, Banaras Hindu University & Director, IIT BHU
12. The Principal, Sir J. J. College of Architecture, Mumbai

Copy for information to:

1. PPS to HRM/PPS to MOS(UK)/PPS to MOS(RSK)
2. PPS to Secretary (HE)

Copy to:

1. NIC for placing it on Website of Ministry of HRD
Minutes of the 2\textsuperscript{nd} meeting of the Project Approval Board constituted under the Scheme National Initiative for setting up of Design Innovation Centres, Open Design School & National Design Innovation Network, held on 13\textsuperscript{th} January, 2015.

A meeting of the Project Approval Board (PAB) constituted under the Scheme “National Initiative for setting up of Design Innovation Centres, Open Design School & National Design Innovation Network”, was held under the Chairmanship of Secretary (HE) on 13\textsuperscript{th} January, 2015 at 3 p.m. in Conference Hall, Shastri Bhawan. List of participants is enclosed at Annexure I.

2. At the outset, Secretary (HE) welcomed all the Members of the PAB and the representatives of the participating Institutes. Joint Secretary (Policy) briefed the Members about the scheme. He informed that the Scheme was launched in March, 2014 with an outlay of Rs.240 crores during the XII Plan. The Scheme has two major objectives. One of the objectives is to spread Design Education, thereby creating Design Culture and Design thinking. The second major objective is to promote innovation, mainly engaging but not limited to UG students. He then asked Director (Policy) to make a presentation before the PAB. It was informed that an amount of Rs.10 crores is being provided for establishment of a DIC and 5 DICs have already been established at IIT Bombay, IIT Delhi, IIT Guwahati, IISc Banagalore and Delhi University. It was informed by Director (Policy) that Project proposals from 10 institutes for setting up of DICs were received during the current year which have been scrutinized by a Review Committee constituted as per the recommendations of the PAB. Review Committee has recommended proposals of 7 institutes viz. (i) University of Rajasthan, (ii) Rani Durgawati University, Jabalpur, (iii) IIT BHU & BHU, (iv) Savitri Bai Phule Pune University, (v) IIT Bhubaneswar, (vi) Sir J.J. College of Architecture and (vii) Central University of Kerala for consideration of the PAB.

3. Initiating the discussions, Secretary (HE) asked existing DICs to make a presentation on their performance. PAB noted the progress made by these DICs and observed that the expenditure is very low, especially in case of Delhi University. IIT Bombay has only two spokes against the target of 3 spokes. Also, the details of the courses are not furnished by them. However, they have spent nearly 86% of the amount released last year and was advised to send proposal for release of next instalment. The
DIC at Delhi University are still at nascent stage despite lapse of around one year. Secretary (HE) asked all the DICs to take necessary steps to pace up the expenditure. It was also felt that the Director / VC of institutions should involve themselves more to give further impetus to this initiative.

4. Chairman then requested institutions with proposals for setting up new DICs to make a presentation before the PAB. Observations and decision of PAB are detailed below:

(i) **University of Rajasthan** - It was observed that the courses proposed are certificate/diploma courses and hence Director, NIFT asked about the background of the students. Representative of University of Rajasthan informed that these courses may be offered to both regular and part-time students. JS (P) raised the issue of meeting the recurring expenditure after completion of the project. It was informed that the centre would be self-sustaining by that time.

   Based on the recommendations made by the Review Committee and the presentation made, PAB approved the establishment of DIC at University of Rajasthan. The proposal of the institution is at Annexure II.

(ii) **R.D. University, Jabalpur** – The proposal intends to establish a DIC with special emphasis on Bio-Design. It was observed that the budget estimates includes a requirement for building also. Policy Division pointed out that though no funds are available under this component, the EFC Memo empowers PAB to take a decision in this regard in exceptional circumstances. It was observed that the proposed structure of the building does not match with the number of activities proposed to be undertaken at the proposed DIC. R.D. University also informed the members that it would be self-sustaining by the time the project is completed.

   Based on the recommendations made by the Review Committee and the presentation made, PAB, in principle, agreed to approve the establishment of DIC at R.D. University. It was, however, advised to rework the budgeted requirement and to resubmit the project report, which may be approved by Secretary (HE). Copy of proposal is at Annexure III.
(iii) **IIT (BHU) and Banaras Hindu University** – The proposal is a joint proposal of IIT-BHU and BHU. The PAB pointed out that details of spokes and their role are not clear. It was informed that the details in this regard will be furnished once the proposal is sanctioned. Though PAB appreciated the focus areas of the proposed DIC, there were reservations on the budget estimates proposed. The Members were of the view that the estimates require more detailing and also a provision towards development of prototypes/filing of patents.

Based on the recommendations made by the Review Committee and the presentation made, PAB approved, in principle, the establishment of DIC at IIT (BHU) and BHU. It was, however, advised to rework the budget requirement and to resubmit the project report for approval on file. Proposal is at Annexure IV.

(iv) **Savitribai Phule Pune University, Pune** - PAB noted that the proposed DIC is a standalone independent Centre, which may not be practical idea given the scope and nature of the scheme. DIC has to deliver in next 3 years, while setting up an independent entity will take time. The proposal revolves around 3 prototypes only and it does not have future plans for developing more prototypes. The proposed DIC appears to be lacking in virtuous spin-offs. Hence, sustainability of DIC after 3 years will be difficult. Courses proposed to be offered does not have design contents.

After detailed deliberations, PAB was of the view that the entire project proposal needs to be reworked and resubmitted for consideration. The proposal is at Annexure V.

(v) **IIT, Bhubaneswar** – During the presentation, representative of IIT Bhubaneswar informed that the focus of proposed DIC is to infuse the culture of innovative thinking among students through interdisciplinary projects leading to development of educational and community driven products including toys, teaching aids, furniture, books, etc. It will have 4
spokes and 6 courses running. One of the spokes proposed is Kendriya Vidyalaya, where school children will be exposed to design culture and thinking. PAB observed that KV should be taken as a learning workshop. Moreover, there should be matching of deliverables with curriculum content.

Based on the recommendations made by the Review Committee and the presentation made, PAB approved the establishment of DIC at IIT, Bhubaneswar, with the above changes. Proposal is at Annexure VI.

(vi) **University of Kerala** and **Sir J J College of Architecture** did not attend the meeting and, therefore, their proposals could not be taken up for discussion.

5. The issue regarding setting up Open Design School and National Design Innovation Network was deliberated in detail. During the discussions, it came to the notice that IIT, Bombay has already set up a school in collaboration with IIT, Guwahati and NID, Bangalore. The Chairman, PAB sought details of the same from IIT, Bombay to make a presentation of this. After detailed deliberations, PAB was of the view that IIT, Bombay may be assigned the task of preparing the contours of Open Design School under the Scheme National Initiative for Design Innovation. In next PAB meeting, it may be put up for consideration. A link of contents pertaining to DIC available on the website of IIT Bombay may be given on the site of MHRD. Details of funds or any other support required from MHRD in this regard are to be furnished by IIT, Bombay.

As regards setting up of National Design Innovation Network, it was felt that there is an urgent need to bring all DICs on a single platform especially in order to share the best practices in the design innovation field. After detailed deliberations, PAB was of the view that a Committee consisting of representatives of IIT Bombay, IIT Delhi, IISc Bangalore, IIIT Guwahati and NIC may be constituted to work out the modalities in this regard. JS(Planning) will form a committee with the approval of Secretary(HE).

6. PAB also deliberated upon the engagement of consultants and other staff under the Scheme, through EdCil. Secretary (HE) stated that with the increase in DICs and setting up of new DICs, ODS an NDIN, manpower is required to provide support in
terms of consultants etc. However, given the unique nature of scheme, it was felt that it is necessary that person/persons thus employed should have adequate understanding of the concept for effective implementation and monitoring of the Scheme. Hence, PAB approved, in principle, the proposal and authorised Joint Secretary (Policy) to initiate necessary steps in this regard.

7. The Meeting ended with a vote of thanks to the Chair.
<table>
<thead>
<tr>
<th>S.No.</th>
<th>Name &amp; Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sh. S.N. Mohanty, Secretary (HE), MHRD</td>
</tr>
<tr>
<td>2.</td>
<td>Sh. Amarjeet Sinha, AS(TE), MHRD</td>
</tr>
<tr>
<td>3.</td>
<td>Sh. Yogendra Tripathi, JS &amp; FA, MHRD</td>
</tr>
<tr>
<td>4.</td>
<td>Sh. Rakesh Ranjan, JS(P), MHRD</td>
</tr>
<tr>
<td>5.</td>
<td>Dr. Pitam Singh, Joint Adviser, Planning Commission</td>
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<tr>
<td>6.</td>
<td>Prof. Ved Prakash, UGC</td>
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<tr>
<td>7.</td>
<td>Sh. Chetan Vaidya, Director, SPA</td>
</tr>
<tr>
<td>8.</td>
<td>Sh. Arindam Das, Director, NIFT Gandhinagar</td>
</tr>
<tr>
<td>9.</td>
<td>Dr. Sushil Vachani, Director, IIM, Bangalore</td>
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<tr>
<td>10.</td>
<td>Shri G.R. Raghvender, Director, DIPP</td>
</tr>
<tr>
<td>11.</td>
<td>Sh. Sanjeev Sharma, Director (P), MHRD</td>
</tr>
<tr>
<td>12.</td>
<td>Sh. Fazal Mahmood, DS (Finance)</td>
</tr>
<tr>
<td>13.</td>
<td>Prof. B.K. Chakravarthi, Head IDC, IIT Bombay, Mumbai</td>
</tr>
<tr>
<td>14.</td>
<td>Sh. P.V.M. Rao, IIT Delhi</td>
</tr>
<tr>
<td>15.</td>
<td>Prof. M.M. Chaturvedi, Director, Cluster Innovation Centre Delhi University, Delhi</td>
</tr>
<tr>
<td>16.</td>
<td>Dr. Bibhu Biswal, Programme Co-ordinator, CIC, Delhi University</td>
</tr>
<tr>
<td>17.</td>
<td>Mr. Ravi Agarwal, Ph.D Scholar, CCT, University of Rajasthan, Jaipur</td>
</tr>
<tr>
<td>18.</td>
<td>Dr. Ramvir Singh, Associate Professor of Physics &amp; CCT, Jaipur</td>
</tr>
<tr>
<td>19.</td>
<td>Prof. Kailash Agarwal, Professor &amp; convener, DIC Proposal Committee, CCT, University of Rajasthan, Jaipur</td>
</tr>
<tr>
<td>20.</td>
<td>Prof. Ashok K. Nagawat, Co. Head, Deptt. of Physics &amp; Co-Chair, DIC Proposal Committee, University of Rajasthan, Jaipur</td>
</tr>
<tr>
<td>21.</td>
<td>Dr. Neeraj Sharma, Associate Professor, School of Biomedical Engg., IIT (BHU), Varanasi</td>
</tr>
<tr>
<td>22.</td>
<td>Dr. Manish Arora, Assistant Professor, Faculty of Visual Arts, Banaras Hindu University</td>
</tr>
<tr>
<td>23.</td>
<td>Sh. Dilip Dhavale, Co-ordinator, Savitribai Phule Pune University</td>
</tr>
<tr>
<td>24.</td>
<td>Prof. W.N. Gade, Vice Chancellor, Savitribai Phule Pune University</td>
</tr>
<tr>
<td>25.</td>
<td>Sh. Yogesh Kulkarni, Director, Vigyan Ashram, Vigyan Ashram Spoke Centre of Savitribai Phule Pune University</td>
</tr>
<tr>
<td>26.</td>
<td>Prof. S. V. Ghaisas, Director School of Energy Studies, Savitribai Phule Pune University</td>
</tr>
<tr>
<td>27.</td>
<td>Dr. Satyanarayan Panigrahi, Asstt. Prof. SMSC, IIT Bhubaneshwar</td>
</tr>
<tr>
<td></td>
<td>Name and Details</td>
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</tr>
<tr>
<td>28.</td>
<td>Prof. S.S. Sandhu, Professor, RD University, Jabalpur</td>
</tr>
<tr>
<td>29.</td>
<td>Dr. A. Gopala Krishna, Professor, Jawaharlal Nehru Technological University, Kakinada, Andhra Pradesh</td>
</tr>
<tr>
<td>30.</td>
<td>Dr. K. Karunamaharajan, Associate Professor &amp; Head, CFEMS, MKN</td>
</tr>
<tr>
<td>31.</td>
<td>Dr. S.V. Jagadeesn Chandra, Professor Convenor R&amp;D activities, LBRCE, Mylavaram</td>
</tr>
<tr>
<td>32.</td>
<td>Mr. J. Sivavara Prasad, Associate Professor, LBRCE, Mylavaram</td>
</tr>
<tr>
<td>33.</td>
<td>Dr. Jayaram Podnval, Co-ordinator, MRID, Maharaja Sayyajirao University, Baroda</td>
</tr>
</tbody>
</table>
Proposal for setting up of
DESIGN INNOVATION CENTRE (DIC)
at
Centre for Converging Technologies,
University of Rajasthan
13/01/2015

Submitted to:
MINISTRY OF HUMAN RESOURCE DEVELOPMENT,
DEPARTMENT OF HIGHER EDUCATION,
GOVERNMENT OF INDIA, NEW DELHI

University of Rajasthan – Overview of Achievements

- Identified as University with Potential for Excellence (UPE)
- The University leads among the top 50 Indian Scientific Institutions in Citations per paper under International collaboration. (Inaugural speech of Hon'ble Prime Minister in 99th Indian Science Congress)
- More than 2900 quality research papers in last 5 years
- Establishment of Centre for Converging Technologies (NBIC)
- CCT has MOU for research collaborations with Inje University, South Korea; Griffiths University, Australia & RMIT Australia, SMS Medical College, RUHS, Jaipur, CEERI, Pilani, BISR, Jaipur and DRDO. MOU with University of Illinois - UC, USA, University of Southern California is under process.
- PURSE granted by DST based on high H-index (75) of University (27 Crore)
- All science departments have support under FIST and CAS/DRS
- 13 Crore - For Centre of Excellence in Nano-Technology - by state DST
- 10 Crore – For BUILDER (IPLS) Programme – by DBT
- 2.22 Crore – For UIC-B – by NnC and BIRAC
Satellite centres (Spokes)

Birla Institute of Scientific Research, Statue Circle, Jaipur, Rajasthan
Apart from Research and Development BISR promotes science education through Museum and Planetarium. It has also a state of the art Convention Facility Networking with the leading institutions/establishments in the identified thrust areas is one of its important developmental strategies.

FACILITIES
• Advanced Bioinformatics Centre
• Life Science Research in Biotechnology
• Instrumentation for research
• Biotechnology Laboratory
• Microbiology and Molecular Biology Laboratory
• Plant Tissue Culture Lab & Green House
• ETIS Sub-Distributed Information Centre
• Nanodevice Sensing and Environmental Laboratory, Electrical and Electronics Laboratory
• Library Facility, Tool Room, The Bioinformatics Centre Bioinformatics Centre extensively. The centre

Shri Ratanlal Kanwarlal Patni Government P. G. College, Kishangarh, Rajasthan
It was selected as Centre of Excellence by State Government. Presently it is affiliated to M.D.U. University, Ajmer.

The Faculty of Science has five subjects with well-equipped labs. The Learning Faculty of this institution includes 61 members of which 25 have Ph.D. degree & 7 members are engaged in active Research. The institution has a well-established Library with about 65 thousands books, 39 Inter-National & National Journals. It also had a membership of D.E.I.N & INFLIBNET with facility of online availability of both e-journals.

The institution facilities its students by Science Hall, Student Advisory Bureau, Language Lab, Vocational cell, Knowledge centre, Computer labs for their overall development.

Lachoo Memorial College of Science & Technology, Jodhpur, Rajasthan
This well qualified, dedicated, committed and excellent faculty of the college has mixed the academic ambience upholding quality assurance of outshining education excellence in the college.

About 5000 young brain annually come here from the entire country as their inherent haven, making this college today as the shelter of quality benchmark in higher education.

The College is recognized under section 2(b) and 12(B) is the UGC act and affiliated to Jai Narain Vyas University, Jodhpur. The College has unique distinction of being first and only College in the Western Rajasthan which has been awarded 'A' grade by NAAC and selected as "College with potential for Excellence" by UGC and selected under Star College Scheme by Dept of Biotechnology, Govt of India. The college has now enlisted emerging as the foremost Autonomous College, commencing from academic session 2012-13.

Proposed courses for DIC

<table>
<thead>
<tr>
<th>No.</th>
<th>Title</th>
<th>Timelines</th>
<th>Spokes involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Certificate course in RF planar component test</td>
<td>6 months</td>
<td>Shri Ratanlal Kanwarlal Patni Government P. G. College, Kishangarh, Rajasthan</td>
</tr>
<tr>
<td>2</td>
<td>Diploma course in innovative food designing</td>
<td>12 months</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Certificate course in computer assisted drug designing</td>
<td>6 months</td>
<td>1. Birla Institute of Scientific Research, Statue Circle, Jaipur, Rajasthan 2. Lachoo Memorial College of Science &amp; Technology, Jodhpur, Rajasthan</td>
</tr>
<tr>
<td>4</td>
<td>Certificate course in product design employing by different types of coatings</td>
<td>6 months</td>
<td>Shri Ratanlal Kanwarlal Patni Government P. G. College, Kishangarh, Rajasthan</td>
</tr>
<tr>
<td>5</td>
<td>Certificate course in product design optimization for artificial limb via soft computing approach</td>
<td>6 months</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Certificate course in innovation in material sciences for inclusive development</td>
<td>6 months</td>
<td>Lachoo Memorial College of Science &amp; Technology, Jodhpur, Rajasthan</td>
</tr>
</tbody>
</table>
## Prototypes to be Developed

<table>
<thead>
<tr>
<th>S. No</th>
<th>Title</th>
<th>Timelines</th>
<th>No. of prototypes</th>
<th>Contribution of Spokes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Design and testing of planar RF component</td>
<td>1 year</td>
<td>3 per year</td>
<td>Training and development</td>
</tr>
<tr>
<td>2</td>
<td>Value added innovative food designing</td>
<td>1 year</td>
<td>4 per year</td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>Protocol for computer assisted drug designing</td>
<td>1 year</td>
<td>3 per year</td>
<td>Training and design</td>
</tr>
<tr>
<td>4</td>
<td>Product design via different types of coatings</td>
<td>1 year</td>
<td>2 per year</td>
<td>Training</td>
</tr>
<tr>
<td>5</td>
<td>Artificial limb design optimization</td>
<td>1 year</td>
<td>2 per year</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>New materials for inclusive development</td>
<td>1 year</td>
<td>4 per year</td>
<td>Training and development</td>
</tr>
</tbody>
</table>

## Budget - 1

(a) Budget lines for courses including prototypes:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Proposed Courses</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Total INR in Lakhs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Certificate course in RF planar component test</td>
<td>109</td>
<td>-</td>
<td>-</td>
<td>109</td>
</tr>
<tr>
<td>2</td>
<td>Diploma course in Innovative food designing</td>
<td>63</td>
<td>-</td>
<td>-</td>
<td>63</td>
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<tr>
<td>3</td>
<td>Certificate course in computer assisted drug designing</td>
<td>130</td>
<td>-</td>
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<td>4</td>
<td>Certificate course in product design employing by different types of coatings</td>
<td>95</td>
<td>-</td>
<td>-</td>
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<tr>
<td>5</td>
<td>Certificate course in product design optimization for artificial limb via soft computing approach</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>6</td>
<td>Certificate Course In Innovation In Material Sciences For Inclusive Development</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>442</strong></td>
<td>-</td>
<td>-</td>
<td><strong>442</strong></td>
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</tbody>
</table>
**Budget - 2**

**(b) Operational costs and others**

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Needs (Common budget for all courses)</th>
<th>First Year INR in Lakhs</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Total INR in Lakhs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Refurbishing and Renovation cost and furnishing</td>
<td>10</td>
<td>10</td>
<td>2</td>
<td>22</td>
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<tr>
<td>2.</td>
<td>Fellowships (6 innovation fellows @35,000/month)</td>
<td>25.2</td>
<td>25.2</td>
<td>25.2</td>
<td>75.6</td>
</tr>
<tr>
<td>3.</td>
<td>Manpower (5 Lab Assistants @10,000/month)</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>4.</td>
<td>Manpower (2 Office Assistants @10,000/month)</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>7.2</td>
</tr>
<tr>
<td>5.</td>
<td>Workshops/Trainings</td>
<td>12</td>
<td>15</td>
<td>15</td>
<td>42</td>
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<tr>
<td>6.</td>
<td>Travel grant</td>
<td>3</td>
<td>3</td>
<td>4</td>
<td>10</td>
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<tr>
<td>7.</td>
<td>Consumables (chemicals, glasswares, kits, raw/plant materials, etc.)</td>
<td>26</td>
<td>30</td>
<td>10</td>
<td>66</td>
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<tr>
<td>8.</td>
<td>Stationery</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>9.</td>
<td>Website creation</td>
<td>1</td>
<td>0.5</td>
<td>0.5</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td><strong>237.8</strong></td>
</tr>
</tbody>
</table>

(C) Budget for Satellite Centres (Spokes) : INR 300 Lakhs

(D) Grand Total Budget requirement: 442 + 257.8 + 100 = 9 Lakhs

9,998 Crore (Rs. Nine Crore ninety nine lakhs and eighty thousand only)

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**Benefits through establishment of DIC**

**Students:**
- Availability of Research Projects
- Industrial Training
- Enhancement of Technical Knowhow
- Fellowships
- Research Publications & Patents

**Industry:**
- Availability of R&D facility
- Technically Trained Human Resource
- Patents & IP portfolio management
- Technology Commercialization & Business Development

**Faculty Involved:**
- Research Publications
- Patents
- Technical Profile Enhancement
- Academia-Industry Collaborative Research

**University:**
- Networking Groups
- Database Management & Innovation Mapping
- Availability of Knowledge Sharing Mechanisms
- Patents

THANKS
Proposal for setting up of

DESIGN INNOVATION CENTRE (DIC)

at

CENTRE FOR CONVERGING TECHNOLOGIES,

UNIVERSITY OF RAJASTHAN, JAIPUR

Submitted to:

MINISTRY OF HUMAN RESOURCE DEVELOPMENT,

DEPARTMENT OF HIGHER EDUCATION,

GOVERNMENT OF INDIA, NEW DELHI
1. **DESIGN INNOVATION CENTRE DETAILS**

   i. **Name of Lead Institute and Location:**

   Centre for Converging Technologies (CCT), University of Rajasthan, JLN Marg, Jaipur, Rajasthan – 302004

   1. **Contact no.:** +91-141-2700370 (Office), +91-9414344787
   Email: [ashok.nagawat@gmail.com](mailto:ashok.nagawat@gmail.com) (Prof. Ashok K. Nagawat, Co-Chairman, Committee for Proposal for Design Innovation Centre and Head, Department of Physics)

   2. **Contact no.:** +91-9414306665; Email: [agkailashindia@gmail.com](mailto:agkailashindia@gmail.com) (Prof. Kailash Agrawal, Convener, Committee for Proposal for Design Innovation Centre and Addl. Director (Academic), CCT & Professor, Department of Botany)

   University website: [www.uniraj.ac.in](http://www.uniraj.ac.in)

   CCT website: [www.uniraj.ac.in/cct](http://www.uniraj.ac.in/cct)

   ii. **Focus area for DIC:**

   Design Innovation using Converging Technologies

   iii. **Proposed courses and areas of design innovations:**

   1. Certificate course in RF planar component test
   2. Diploma course in innovative food designing
   3. Certificate course in computer assisted drug designing
   4. Certificate course in product design employing different types of coatings
   5. Certificate course in product design optimization for artificial limb via soft computing approach
   6. Certificate course in innovation in material sciences for inclusive development

   iv. **Satellite centres**

   1) **BIRLA INSTITUTE OF SCIENTIFIC RESEARCH, Statue circle, Jaipur, Rajasthan**

   Phone:+91-141-2385283
   Fax: +91-141-2385121
   Contact Person: Dr. Medicherla Krishna Mohan (kmohan@bisr.res.in)
   Alternate contact: director@bisr.res.in, ghoshiiitbisr@gmail.com

   Mailing Address: Prof. P. Ghosh, Executive Director, Birla Institute of Scientific Research, Statue Circle, Jaipur-302001, Rajasthan, INDIA

   Birla Institute of Scientific Research (BISR) was established in realization of the dreams of visionary industrialist Shri Braj Mohan Birla to foster and promote Science and Technology. Apart from Research and Development BISR promotes science education through Museum and Planetarium. It has also a state of the art Convention Facility. The institute has grown with time
and is now poised to emerge as an important Centre cultivating science and technology, art and culture. Keeping in view the contemporary trends, modern thinking and global opportunities BISR looks forward to strengthen its status as a leading R & D Institute of the country by investing in and broadening specific infrastructure and human resources. Networking with the leading institutions/industries in the identified thrust areas is one of its important developmental strategies.

FACILITIES

- Bioprocessing Laboratory
- Microbiology and Molecular Biology Laboratory
- Plant Tissue Culture Laboratory & Green House
- Analytical Chemistry Laboratory
- BTIS Sub-Distributed Information Centre
- Advanced Bioinformatics Centre
- Remote Sensing and Environmental Laboratory
- Electrical and Electronics Laboratory
- Library Facility
- Tool Room

The Bioinformatics Centre at BISR has created an infrastructure for providing facilities to the users working in the field of Biological Sciences. The users of Rajasthan, Jaipur in particular, are using facilities available at the Bioinformatics Centre extensively. The centre has leased line Internet connection as well latest Bioinformatics software for sequence and structure analysis. The centre provides the following services:

- Bioinformatics supports to researchers
- Customized training in Bioinformatics for researchers and faculty members
- Support in Installing, implementing and maintaining software on computer.
- Create awareness for taking preventive measure against data security
- Organize workshops on thrust areas of Bioinformatics
- Research Training to students of Biotechnology and Bioinformatics

2) SHRI RATANLAL KANWARLAL PATNI GOVERNMENT P. G. COLLEGE, Kishangarh, Rajasthan

Contact Person: Principal, SHRI RATANLAL KANWARLAL PATNI GOVERNMENT P. G. COLLEGE, Kishangarh 305802, Rajasthan

Alternate contact: Mr. Ashwani Garg, Head, Department of Physics

website: www.gckishangarh.edu.in
http://dce.rajasthan.gov.in
email: gckishangarh@gmail.com
Phone/Fax No. 01463 245660
Established by Government of Rajasthan in the year 1951 as Inter College, Shri R K Patni Government P.G. College, Kishangarh, raised to Under Graduate College in 1959 and Post Graduate College in faculty of Arts & Commerce in 1978. It was selected as Centre of Excellence by State Government. Presently it is affiliated to MDS University, Ajmer.

The institution is a centre of about 5000 regular students & examination centre of 12000 Non-Collegiate students. The Faculty of Science has five subjects with well-equipped labs. The faculty of commerce has three subjects in U.G as well as P.G. & ten subjects in U.G. with three subjects in P.G in Arts Faculty. The Management faculty has facility of B.B.A.CAT course is also running in the college by ICWA. The college is a Study Centre of Vardhman Mahveer Open University Kota.

The Learned Faculty of this institution includes 61 members out of which 35 has Ph.D. degree & 7 members are engaged in active Research. The institution has a well-established Library with about 65 thousands books, 30 Inter-National & National Journals. It also had a membership of DELNET & INFLIBNET with facility of online availability of Books & Journals. The institution has various co-curricular & extracurricular activities as NCC Boys & Girls wing, four units of NSS and an active Youth Development Centre & Placement Cell. The institution facilitates its students by Seminar Hall, Student Advisory Bureau, Language Lab, Vocational cell, Knowledge centre, Computer labs for their overall development. The institution has Various Sports & Games facilities with Tennis, Badminton, Basket Ball, Kabaddi, KhoKho, & Hand Ball Courts with 200 meter Track and a Sports Complex. The College Development Committee & Alumni Association is actively working to enhance student's facilities.

3) LACHOO MEMORIAL COLLEGE OF SCIENCE & TECHNOLOGY,

Sector - A , Shastri Nagar, Jodhpur - 342001, Rajasthan - India.
Phone No : 0291-2431238, Fax : 0291-2433919, E-mail : office@lachoomemorial.org
Contact Person: Principal, LACHOO MEMORIAL COLLEGE OF SCIENCE & TECHNOLOGY, Sector - A, Shastri Nagar, Jodhpur - 342001, Rajasthan - India.
Phone No : 0291-2431238, Fax : 0291-2433919
E-mail: principal@lachoomemorial.org

Alternate contact person: Dr. Rajeev Mathur
Email: rajeev.mathur69@gmail.com
Mobile no.: +91-9166609777

Lachoo college, a modest creation of the year 1965, has travelled an incredible journey of almost five decades. For concepts savoured by visionary Shri Mathuradas Mathur, a connoisseur of higher education in science and technology, this institution has come up synonymous with impeccable academic standards preferred for pursuing multi-disciplinary graduate and post-graduate programmes in the field of science, computers, pharmacy, bio-technology and management.

Boasting with its imposing presence, the college spans over a 7 acre land located in the heart of the city yet with a welcome departure from the usual hustle and bustle of the city. The well qualified, devoted, committed and excellent faculty of the college has raised the academic ambience upholding quality assurance of unaltering education excellence in the college.
About 3000 young brats annually come here from the entire country as their choicest heaven, making this college today as the shelter of quality benchmark in higher education.

The College is recognized under section 2(f) and 12(B) in the UGC act and affiliated to Jai Narain Vyas University, Jodhpur. The College has unique distinction of being first and only College in the Western Rajasthan which has been awarded 'A' grade by NAAC and selected as "College with potential for Excellence" by UGC and selected under Star College Scheme by Deptt of Biotechnology, Govt of India. The college has now heralded emerging as the foremost 'Autonomous College', commencing from academic session 2012-13.

2. **EXISTING STRENGTH OF THE UNIVERSITY**

- Innovation activities undertaken
  - RFC - Young Entrepreneurs Incentive Scheme: Rajasthan YuvaUdyamitaProtsahanYojana (RYUPY)
    - To Mr. Ravi Agarwal (2012 – 2013)
  - Association of Biotechnology Led Enterprises (ABLE Award)
    - SachinDube, Usman Khan, Shiva Choudhary (2011-12)
    - AaishwaryaMathur, Shrashti Jain, PoonamYadav (2012-13)
  - Entrepreneurship support initiatives
    - SARV Infotech, Jaipur
    - Hems Infotech, Jaipur
    - Module Innovations, Pune
  - Establishment of innovation centres
    - University Innovation Cluster in Biotechnology (UIC-B) grant awarded by Biotechnology Industry Research Assistance Council (BIRAC), Department of Biotechnology, Govt. of India in the year 2014.

- Achievements of the University of Rajasthan
  - **NAAC Accredited A+ (2004-09).**
  - Identified as **University with Potential for Excellence** (UPE).
  - The University leads among the **top 50 Indian Scientific Institutions** in Citations per paper under International collaboration. (**Inaugural speech of Hon’ble Prime Minister in 99th Indian Science Congress held at Bhubaneswar, 2012**)
  - More than **2900 quality research papers** (in peer reviewed journals) in last 5 years.
  - **CCT has MOU for research collaborations** with Inje University, South Korea; Griffiths University, Australia & RMIT Australia.
  - **MOU with University of Illinois - UC, USA, University of Southern California** is under process.
  - **MOU- SMS Medical College, RUHS, Jaipur, CEERI, Pilani, BISR, Jaipur and DRDO.**
  - **PURSE granted by DST based on highH-index (75) of University.**
  - **All science departments have support under FIST and CAS/DRS**
  - 13 crore grant provided by state DST to CCT for establishing **Centre of Excellence in Nano-Technology. Likely to be increased by 5 crore.**
  - **10 crore – For IPLS Programme** – Funded by **DBT, Govt. of India.**
• University Innovation Cluster grant awarded by Biotechnology Industry Research Assistance Council (BIRAC), Department of Biotechnology, Govt. of India in the year 2014.

• **Patents awarded:**
  ✓ Iridod saccharide compounds and method- **M.P. Dobhal et al. 2004.**
  ✓ Photosensitizers from Bacterio-chlorophyll-A- **M.P. Dobhal et al. 2008.** (Technology transferred to pharmaceuticals company, China 2010)
  ✓ Novel reductase and electrochemical preparation – **D.K.Sharma et al** (Under process)
  ✓ Bimetallic Nano-structured material for catalysis and its sensing – **D.K.Sharma et al.** (Under process)
  ✓ Development of catalytic fuel kit for car- **Y.K.Vijay 2010.**

➢ **Common instrumentation facility existing in the university?**

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<tr>
<th>S.No</th>
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<tbody>
<tr>
<td>1</td>
<td>Scanning electron microscope with EDX</td>
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<td>2</td>
<td>Transmission electron microscope</td>
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<td>3</td>
<td>High Pressure Liquid Chromatography (HPLC)</td>
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<td>4</td>
<td>Quantitative RT-PCR, Thermocycler and Gel documentation system</td>
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<tr>
<td>5</td>
<td>Scanning probe microscope (Atomic force microscope, Scanning tunneling microscope)</td>
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<td>6</td>
<td>XRD (X-ray diffraction)</td>
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<tr>
<td>7</td>
<td>CVD (Chemical Vapor Deposition)</td>
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<td>8</td>
<td>EEG &amp; EMG (Electroencephalography and Electromyography)</td>
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<td>9</td>
<td>Gene Gun</td>
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<td>10</td>
<td>CO₂ Incubators</td>
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<tr>
<td>11</td>
<td>Fluorescence Microscopes</td>
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<td>12</td>
<td>Refrigerated Centrifuges</td>
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<td>13</td>
<td>Deep freezers</td>
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| 14   | **IT Infrastructure**
  | Storage solution, Network server, Web server, Internet with 2 Gbps bandwidth, MATLAB, Computational facility, Access to national/international journals. |
| 15   | **Others:**
  | Low Temperature Storage (- 50° C), Incubators, Laminar Flow Hoods, UV-Vis Spectrophotometer, Fluorescence Spectrophotometer, Plant Tissue Culture Facility |
3. SUMMARY OF THE PROPOSED PROJECT:

- **Abstract of the proposal**

  The proposed project aims towards establishment of a platform for increased participation, interaction and mutual co-operation between academia and industry for design innovation. The focus of the proposal is converging technologies. The project aspires to develop a continuously evolving curriculum for innovation in process, product and system design aligned to meet the needs of the industries in the milieu and society at large. We have presently identified six major thrust areas for DIC in accordance with the industrial requirements in the surrounding region and the existing strengths and assets of the centre. These thrust areas include:

  1. Certificate course in RF planar component test
  2. Diploma course in innovative food designing
  3. Certificate course in computer assisted drug designing
  4. Certificate course in product design employing different types of coatings
  5. Certificate course in product design optimization for artificial limb via soft computing approach
  6. Certificate course in innovation in material sciences for inclusive development

  The proposed courses will be conducted by inviting imminent scholars and innovators from both academia and industry. The program will be facilitated by research inputs from motivated young researchers with an inclination towards innovation and entrepreneurship. These researchers would be mentored by faculty members and experts from the university and the industry. The proposals would be continuously assessed and evaluated and the findings would be used for efficient implementation of the project. The output/outcome of the project would be utilised for an industrial application project and also the potential to develop into a technology or prototype through academic and industrial mentoring. The initiative would aim towards self-sustainability through endowments, royalty, financial support from government funding agencies and industries, consultancy charges and extension services.

**Young entrepreneurs, committed business ventures and innovators in our region currently suffer from the following bottlenecks:**

- Lack of curriculum for design based innovation that integrates needs of the regional industries
- Lack of a platform for industry oriented research and design innovation
- Potential industrial partners and mobilization of resources
- Exposure to various networks in order to understand what it takes to move the research forward and create an entrepreneur
Knowledge sharing mechanisms

- Benefits of establishing DIC at Centre for Converging Technologies, University of Rajasthan

  Courses at Centre for Converging Technologies (CCT), University of Rajasthan were formulated to cater to the needs for innovative research and development. The proposed courses and research facilities under DIC would complement the founding principles of CCT. Due to the absence of a platform where young innovative minds get an opportunity to interact with the industries, the groundbreaking ideas remain nipped in bud. Students passing out from various vocational courses are in quest of a career that values their technical knowhow and provides a platform for translating their innovative designs into viable business ventures. DIC at this centre can bridge the gap between translational research and industrial demand in the ecosystem giving an outlet for creative ideas of budding entrepreneurs. The current interaction with industry at the University of Rajasthan is however, limited at individual or departmental level and hence does not integrate various resources to develop a larger platform for the university and industry partnership. DIC will address this gap by constructing a platform by bringing industry and university together to foster development of design innovation network that nurtures pioneering ideas and translates them into commercially viable initiatives.

  DIC would serve the following purposes in context to the mentioned activities:
  
  2. Guiding students with current needs of the industry and cutting edge research.
  3. Provide training platform for students in order to make them competent for industries.
  4. Ensure financial support for research activities pertaining to present day industrial needs.
  5. Encourage design based innovation which is often neglected in formulating curricula and research.
  6. Multidisciplinary research will be fostered.

  INITIATIVES TO BE UNDERTAKEN UNDER DIC TO FOSTER DESIGN INNOVATION AND ENTREPRENEURSHIP

  1. CREATION OF DIC WEBSITE

  DIC website will be created to facilitate distribution of information regarding activities to be undertaken under DIC. The website will also facilitate interaction of academia with industry. Content will include advertisement for Design Innovation Fellowships, entrepreneurial development program, mentoring group, research database from university and surrounding ecosystem.

  2. FORMATION OF MENTORING GROUPS
Mentoring group needs to be formed to guide the process of design innovation. The process of design innovation involves many different aspects and hence in order to achieve this goal, the group would include members from academia, industry and business schools.

3. **CREATION OF KNOWLEDGE SHARING MECHANISMS INSIDE THE UNIVERSITY**

Sharing of ideas for potential collaborative research projects between different departments of universities or between universities is essential for growth of innovative ideas. This will be accomplished by initially identifying potential innovators, facilitators and would be entrepreneurs from different departments within the university and from other universities. A platform to exchange ideas and build collaborations will be established which would lead to strengthening of existing knowledge and inspire people towards commercially viable design innovation.

4. **FORMATION OF NETWORKING GROUPS**

This would include strategic partnerships with Industry, Academia from within and outside university of Rajasthan, regional development organizations, State-DST and State innovation council.

5. **WORKSHOPS/TRAININGS**

Workshops and trainings will be conducted both to create awareness and encourage individuals from different educational backgrounds for design based innovations. These workshops and trainings will also facilitate individuals to get competent in order to achieve objectives in design innovation. Some probable topics for workshops/trainings are:

- RF component design and optimization
- Employing nanotechnology in design innovation
- Soft-computing for design innovation
- Design of artificial prosthetics
- *In silico* drug designing
- Innovative food product development
- Emerging trends in technologies

6. **FELLOWSHIPS**

*Design Innovation Fellowships:* Innovation fellowships for postdocs/students/entrepreneurs/faculties will be provided. This will be undertaken by inviting proposal from individuals with ideas of design innovation with potential to develop into a technology or prototype. Emphasis will be given to the proposals focusing on current industrial needs.

*Sponsored research projects for design innovation:* In order to undertake sponsored research projects first potential industrial partners with specific design based scientific concerns will be identified. Then scientific concerns of the industry will be understood. A plan of action for solving the problem in collaboration with industry will be formulated. The plan will be executed with the co-operation of all stakeholders. Financial aid in the form of fellowships and facility support to execute sponsored research projects will be provided.
7. **ENTREPRENEURSHIP DEVELOPMENT ACTIVITIES:**

It is important to translate design innovations into commercially viable products or processes. To enable individuals to gain exposure in such entrepreneurial activities workshops will be conducted in collaboration with industry for:

- Workshop on How to Develop Entrepreneurial and Business Skills
- Workshop on Technology Licensing and Technology Transfer
- Workshop on Basic Principles of Product Commercialization
- Workshop on IPR and patenting

**Interactive sessions with achievers in design innovation and corporate.** Previous design innovators and corporate leaders will be invited for interactive sessions with faculty and individuals with ideas in design innovation to help them in formulating a plan to implement their ideas.

**Training and mentoring (technical and business) for fellows:** This will be undertaken to:

- Enable early stage businesses to strengthen strategies and execution for a commercially viable venture.
- Develop close ties with other early stage investors such as state funds and venture capitalists to make larger co-investments
- Train manpower to perform industry-oriented research and regarding how to create an enterprise.

8. **FORMULATION OF COURSES FOR DESIGN INNOVATION:**

The university must be in a continuous state of innovation to ensure that students of today do not emerge from the universities with outdated knowledge and technologies. Courses will be continuously evolved to include the needs of industry and society. Innovation in curriculum would ensure that students have the skills and knowledge to succeed in current market scenario.

9. **COURSES AND RESEARCH ACTIVITIES UNDER DIC**

1) **CERTIFICATE COURSE IN RF PLANAR COMPONENT TEST**

Course aims at training of students in designing planar RF components and their testing looking requirements by industries. Six month training to a batch of 40 students will be provided that will include 60 hours theory and 180 hours of extensive simulation and experimentation.

**I. Structure:**

Modern mobile and wireless communication systems require those components which are smaller in size, may be put inside the handset without protruding outside. One such component in these handsets is a compact planar antenna which must be capable in operating at two or more frequencies at a time while antennas required for satellite communication systems must be
broadband and circularly polarized in nature. Though planar antennas in their conventional form are compact in size but these antennas neither can efficiently operate at more than one frequency at a time nor they provide wideband performance. The testing of these RF planar components requires highly sophisticated instruments with very high precision. These facilities are partly available at a few centres in India but are limited for research activities. Large industries have their own R & D centre and students training programmes as per their requirements. However small industries require trained manpower as well as easy R & D facilities which they are unable to establish at their own. The proposed centre will facilitate both students and small industries in design and testing of RF planar components. Students will be trained in designing and testing planar RF components by trained faculty both from academia and industries. The available design and testing instruments will be used by industries in design and testing of RF planar components. In this way, the centre will provide a common plate form for students and industries. The students will realize the present day requirement of industries while industries will have an opportunity of finding suitable candidates for their work.

The centre will have two prime aims. The first one is to provide an extensive training programme of six month duration for post graduate engineering students in designing and training of planar RF components. This will include 45 hours of lecture programme and 180 hours of extensive simulation and experimentation. The students will also have industrial exposure for realization of industrial requirements. The second aim of this centre will be to provide facilities to industries for design and testing planar components. As per requirement, bigger antennas may also be designed and tested with assembled facilities at this centre. The industries will also have a chance for face to face interaction with this centre. Hence this centre will a common plate form for students and industries in fulfilling their mutual requirements.

II. **Course design:**

(i) The course content of proposed six month course for students will have lecture programme of 60 hrs, 90 hrs for simulation analysis and 90 hrs lab training. The lecture programme will be divided in four modules of approximately 15 hrs each.

(ii) The 90 hrs duration extensive simulation programme will provide proper training to students. For this purpose CST microwave studio simulation software will be applied.

(iii) The 90 hrs duration extensive lab work will include designing of prototype and their lab testing. Some of testing will be carried out in anechoic chamber while other testings will be done through VNA and spectrum analyzer.

III. **Course content:**

The lecture programme will have four modules. These modules will include introduction to scattering parameters, planar passive and active components, design techniques of planar components, measurement techniques, basics of antenna, antenna calculations etc.
The simulation analysis will be done with CST microwave studio simulator. Main emphasis will be given on designing planar antennas and filters components which are applicable in modern communication systems. Outcome of simulation work will motivate them in actual design work of prototype. Training of other simulation softwares is also planned during this course. A brief course of programming language is also planned in this programme.

The lab work will include fabrication of planar components, measurements of return loss, VSWR, input impedance, mutual coupling etc. for filters while return loss, VSWR, input impedance, radiation patterns, axial ration, gain and efficiency measurements of planar antennas. The measured and simulated results will be compared to develop a confidence in workers.

Establishment of RF (Radio frequency) Planar Component Test & Facilitation Centre for Industries at University of Rajasthan, Jaipur is planned with following aims:

Development of “Anechoic chamber for testing of planar RF components” to facilitate mobile and wireless companies to test planar components required in modern communication systems. The centre will have latest test facilities for planar components.

IV. Protocols for outreach
The proposed course aims a rigorous six months long training of students looking present days requirements of RF industries. The minimum qualification of students for this six months training course will be M.Sc. Physics, or B.Tech. in Electrical / Electronics & Communication / IT. In this part of country students are getting sufficient classroom knowledge of RF components and their testing but lacks badly in realization of RF components. Present day industries require properly trained engineers and hence this centre will provide a rigorous training to students looking requirements of industries. This centre will also provide a platform where industry personals will interact directly with students. Industries will be able to mold students as per requirements of RF industries and hence the students will be able to get job opportunities in RF industries, Electronics industries and wireless industries.

**Major equipment and facilities required:**

1. Vector Network analyzer for antenna properties  
   Rs. 35 lakhs
2. Spectrum analyzer  
   Rs. 20 lakhs
3. Signal generator up to 10GHz  
   Rs. 10 lakhs
4. CST microwave studio simulation software (single user)  
   Rs. 10 lakhs
5. LPKF PCB Prototyping Machine Model:  
   Rs. 20 lakhs
6. Computer controlled turn table  
   Rs. 9.5 lakhs
7. Power meter with sensors  
   Rs. 4.5 lakhs

**Total**  
Rs. 109 lakhs
DIPLOMA COURSE ON INNOVATIVE FOOD DESIGNING

Food is the basic need of human being. People of various ages, sexes, physiological conditions, residing in various climatic conditions have different food and nutritional needs. Various disease conditions demand special food considerations. With advancement in technology, working women, migration, tourism etc. demand convenience and ready to eat foods especially traditional foods which are safe. The main aim of this course is to train students who are aiming to work in food sector to develop skills for developing designer foods with added values, using traditional food stuffs, meeting the requirements of specific population, living in various climactic conditions.

I. Objectives:

- To train the students about the processes, methods and environments where food products are processed, distributed and consumed.
- To develop skills in designing food to cater the needs of infants, children, pregnant and lactating mothers, adolescents and elderly.
- To develop skills in designing food for therapeutic purposes.
- To develop skills in designing food which are value added, higher shelf life, traditional convenience and ready to eat.
- To develop skills in designing food from an aesthetic, communicative and representative point of view through shapes, colors and combinations of flavors.

II. Structure:

The course consists of lectures, practical training, design workshops and conferences with leading figures from the world of food and agro-food: chefs, entrepreneurs, managers, journalists, food critics, designers and architects, publishers and manufacturers. The course will also include visits to food companies, retail outlets and concept stores, to places offering innovative forms of catering, and to important fairs and events. To complete the course, internships will be organized in companies, agencies and design studios operating in the food sector. The course will be carried out in collaboration with leading companies and associations in the food sector.

Duration: 1 year (two semesters)

III. Program:

The program includes the following modules:

Semester I

1. Food Science (2th, 4 pr.)

Study of various food groups with respect to their nutritional composition, effects of heat (dry and moist), acid and alkali, Nutritional composition of various types of IFP, Food Spoilage and Preservation, Food Adulteration, Food Additives and Product Development.
Practicals; Learning preparation of basic recipes. Preparation of traditional recipes.

2. Food safety management system and Quality control (2th, 6 pr.)

Food Quality: Sensory quality, nutritional quality, Microbial quality, Food Microbiology and Food Safety, Disinfection and Sterilization, Types of culture media and their utility, Microbial analysis of water, milk, curd and any food products, Patenting, Food Laws and Regulations, HACCP, Shelf life studies.

**Laboratory work**

Practical based on techniques of food quality assessment: Sensory quality, nutritional quality and microbial quality, practical based on shelf life studies of food products, survey of convenience and ready to eat foods available in markets, food list with nutrition composition and food label, systematic development of a new food product and its standardization within the BIS stipulated food standards and regulation and evaluate quality parameters for acceptability, labelling and cost of the finished product, visit to small scale food product unit, preparation of list of common edible permissible and non-permissible food colours and preservatives available used by manufacturers, visit to various food processing units such as dehydration of vegetables, fruits and spices using cabinet drying.

3. Food Processing and packaging. (2th, 4 pr.)

Learning various types of recent food technologies and its utility in Innovative Food Product Development (IFPD) and Food packaging- types and methods.

Practical:

Providing practical training on various food processing and packaging techniques by placement of students in various food industries.

Semester II

4. Food Marketing & Communication. (2 Theory)

Entrepreneurship, trial production, market test (pilot study of IFP), pre-launch business analysis and post launch operational and financial analysis. Communication skill and communication strategy for marketing.

5. Food design for special needs of population (2 Theory, 6 pr.)

Concepts of IFPD, recent technologies in the food industry, nutraceutical or designer foods and innovations in IFPD using novel technologies and designer foods for various groups such as infant formulas, baby foods, packed and healthy foods for children, pregnancy and lactation, adolescents and geriatric group.

6. Innovations in IFPD for therapeutic conditions (2 Theory, 6 pr.)

Innovative food designing for following conditions:
Diabetes, Cardiovascular diseases and Hypertension, Celiac disease and Lactose intolerance, Gastrointestinal disorder, Kidney disease and Liver disease. Designing value added traditional convenience and ready to eat foods which are commercially viable.

Short term workshops to create awareness regarding design innovation
1) Four day workshop to create awareness regarding design innovation among local bakers
2) Four day workshop to create awareness regarding design innovation among local sweet producers
3) Four day workshop to create awareness regarding design innovation among local producers of chikki, gajak and tilpatti makers

Objectives:
1) Local producers will be updated with importance and need for design innovation.
2) Local producers will be encouraged and updated with information regarding ways to design new products to meet the demands for therapeutic purpose, new packaging, innovations in new recipes having new shapes, new combination, with higher shelf life, packaging with biodegradable material.

Types and number of food products to be developed:
1) Value added traditional convenience and ready to eat foods.
2) Value added Indian flavored dairy products.

Major equipment and facilities required:

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<tr>
<th></th>
<th>Establishment of laboratory for Sensory Evaluation(Subjective evaluation)</th>
<th>3 lakh</th>
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<tbody>
<tr>
<td>2</td>
<td>Establishment of laboratory for Sensory Evaluation(Objective evaluation)</td>
<td>5 lakh</td>
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<tr>
<td>3</td>
<td>Cabinet Dryer</td>
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<td>4</td>
<td>Vacuum Dryer</td>
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<td>10</td>
<td>Kjeltec</td>
<td>10 lakh</td>
</tr>
<tr>
<td>11</td>
<td>Fibratech</td>
<td>3 lakh</td>
</tr>
<tr>
<td>12</td>
<td>Socsetl plus</td>
<td>3 lakh</td>
</tr>
<tr>
<td>13</td>
<td>UV-vis spectrophotometer</td>
<td>5 lakh</td>
</tr>
<tr>
<td>14</td>
<td>Deep Freezer</td>
<td>1 lakh</td>
</tr>
<tr>
<td>15</td>
<td>Establishment of cookery lab</td>
<td>5 lakh</td>
</tr>
<tr>
<td>16</td>
<td>Minor equipments for food processing</td>
<td>5 lakh</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>63 lakh</strong></td>
<td></td>
</tr>
</tbody>
</table>
Industry Collaboration:
To provide practical training related to various food processing and packaging techniques which are used at commercial level, students will be placed in various food industries for a short period of time e.g. 2-6 days. Following industries have been identified for training of students:

- Lotus dairy: processing of milk products, spray drying, pouch packaging, bottling and quality control.
- Chokhi Dhani Resort, Jaipur: Retort packaging, canning.
- Morarka Foundation, Jaipur: Solar as well as cabinet drying, manual filling and packaging of tins,
- Pouch packaging, bakery and confectionary, production of traditional foods,
- Sanskriti Foods, Jaipur: Retort packaging, quick freezing, Quantity cookery for commercial purpose.
- Saras Dairy, Jaipur: Processing of milk products, pouch packaging, tetra packaging, quality control
- Ayushraj Enterprises Pvt. Ltd., Jaipur: Laboratory techniques for testing of food for quality analysis.

Department of Home Science, Univ. of Rajasthan, Jaipur: Learning basic cookery, sensory evaluation techniques.

3) CERTIFICATE COURSE ON COMPUTER ASSISTED DRUG DESIGNING

I. INTRODUCTION

Drug discovery is an extremely time consuming and costly process. The research in drug discovery requires a multidisciplinary approach for successful development of novel therapeutic agents. Converging concepts of disciplines such as molecular biology, chemistry, toxicology, pharmaceutical sciences and computational technology are necessary for any drug discovery and development program.

In order to design better drugs, it is essential to utilize technical capabilities from areas such as computational chemistry and biology along with other conventional fields of pharmaceutical sciences. The process of drug design involves structure based and pharmacophore based approaches in lead identification and novel molecular design. Computational tools become
extremely helpful in designing huge library of molecules that are virtually impossible to prepare through synthetic routes. This library of molecules are then tested for their biological profiles using state-of-the-art computational calculation techniques. This process saves a lot of time and money in the overall drug design and discovery process. Once the number of compounds appear to have useful biological profile, they can then be synthesized chemically and tested for their efficacy.

In India, the novel drug discovery industry is in its initial phase and not much work has been done to enhance the capability towards drug development. The use of computer assisted drug & molecular design are essential capabilities for countries like India where computer trained workforce is available. With the use of modern drug designing methods, we can provide training to the aspirants of pharmaceutical R & D sector and to the industry assisted workforce.

II. COURSE DESIGN

This course is designed for the students having Bachelor degree in any science streams like, biology, chemistry, biotechnology, microbiology, pharmacy, who aspire to make a career in the areas of Research and Development of pharmaceutical sciences with an aim to introduce them at an early stage to the modern concept of Drug Designing and the computational tools available. It is expected for the students to have basic knowledge of physical and organic chemistry. Students who have completed second year of Bachelor degree may be permitted to enroll as an ‘add-on’ course.

The course will also be suitable for entry level R&D scientists for training them to use computer based methods of research in Pharmaceutical and Agrochemical Industries.

The objectives of the course are -

- To make students learn the science and art of "Drug Designing"
- To make students learn to design and interpret the results of Molecular Modeling calculations (molecular mechanics and quantum mechanics).
- To have hands on experience with the advanced computational tools available for identifying drug-biomolecule interactions.
- To integrate diverse information into discovery knowledge by exploiting the advantages of emerging fields like bio-informatics, chemo-informatics

The course has been planned to have both theory and computational lab components. Theory modules of 30 hrs duration each will cover the lectures on Basics of Drug action mechanism, theories of drug-receptor interactions, introduction to fundamental concepts behind the molecular
modeling software, structure activity relationship of drug & drug like molecules, molecular docking techniques and logic behind the Drug designing.

Strong focus will be on the practical aspects of molecular modeling and computer-assisted drug design to make students learn about the functioning of molecular modeling software, similarity searching, pharmacophore modeling, QSAR, structure-based drug design, and Molecular docking.

III. CERTIFICATE COURSE CONTENT

Module 1- Fundamentals of Drug Action (30 Hours)


Module 2 - Molecular Modeling Techniques (30 hrs)


Hands on Practical on Module 2 (60 hrs)

Module 3 - SAR and Drug Design (30 Hours)
**Structure Activity Relationships in drug design:** Qualitative versus quantitative approaches. Random screening, Non-random screening, drug metabolism studies, clinical observations, rational approaches to lead discovery. Homologation, chain branching, ring-chain transformations, bioisosterism. Insights into molecular recognition phenomenon. Structure based drug design, ligand based drug design. **QSAR:** Electronic effects, Steric effects. Experimental and theoretical approaches for the determination of physico-chemical parameters, parameter inter-dependence; case studies. Regression analysis, extrapolation versus interpolation, linearity versus nonlinearity. Descriptor calculation. The importance of biological data in the correct form; 2D QSAR; 3D-QSAR. **Molecular docking:** Rigid docking, flexible docking, manual docking. **Molecular dynamics:** Dynamics of drugs, biomolecules, drug-receptor complexes, Monte Carlo simulations and Molecular dynamics in performing conformational search and docking. Estimation of free energy from dynamical methods. **Pharmacophore concept:** Pharmacophore mapping, methods of conformational search used in pharmacophore mapping. Comparison between the popular pharmacophore methods. **De Novo drug design techniques:** Receptor/enzyme cavity size prediction. Predicting the functional components of cavities, designing drugs fitting into cavity. **Informatics methods in drug design:** Informatics methods in drug design: Brief introduction to bioinformatics, chemoinformatics. Their relation to drug design.

**Hands on Practical on Module 3 with case study (60 hrs)**

**Major equipment and facilities required:** (Total cost - 1.4crores)

1. Computer Lab with Networking (Available)
2. Multinode Cluster - parallel computing (70 lakhs)
3. Work stations - higher end Graphics (30 lakhs)
4. Software molecular modeling & chemo-informatics & compound library design. (30 lakhs)
   - SCHRODINGER
   - GAUSSIAN
   - GAUSS VIEW
   - MOE
   - CHEMAXON
   - DISCOVERY STUDIO
   - SCIGRESS
   - VLIFE SCIENCES
   - CHEMBIO OFFICE

4) **CERTIFICATE COURSE ON PRODUCT DESIGN EMPLOYING BY DIFFERENT TYPES OF COATINGS**
The course aims at training of students for:

a. Product design by employing different types of coatings viz. nanolayer coating
b. Quantitative needs of industries with different analytical techniques
c. Design prototype products for eventual commercial applications.

I. Structure:

Coatings are widely used in optoelectronic devices, solar cells and jewellery etc. Nanolayers are typically made of layers of transparent material, with each layer being at least a quarter wavelength of light in thickness. These coatings, could be used to customize the colour of metal surfaces – a phenomenon that could not only be exploited to make pretty jewellery, but also a host of technologically advanced devices, including ultrathin light detectors and filters, displays, modulators and even solar cells. The facilities of product design by employing nanolayer coatings in India are partly available at few centres. Large and small industries require trained manpower as well as easy research and development facility. The course will train students in product design employing multilayer deposition techniques as per the requirement of industries.

Finally, this course will include in total 240 hrs for both lecture programme and broad experimentation. The students will also have industrial exposure for realization of industrial requirements.

II. Course content:

The proposed course of six months will have two parts:

(i) Theory: Lecturer programme of 60 hrs and
(ii) Lab work training of 180 hrs as per Industries requirements. It will include product design of prototype by employing nanolayer coatings using different deposition techniques and their characterization will be done using highly resolved techniques.

The theory papers will include two parts:

i. Introduction to nanomaterials, advantage and application of nanomaterials, nano-scale layers and surfaces, nanotechnology in today products research and presentation activity, Materials overview, solution preparation and calculations.

ii. Overview of nanolayer employment methods: deposition, lithography, PVD, CVD, electro deposition method. Characterization tools, optical microscopy, profilometry, ellipsometry, spectrophotometer, SEM, TEM, XPS.

** Case study via Simulation and Modeling **

The lab training will be divided in two parts:
i. The first part of the lab training is the extensive experimental work and demonstration of the prototype. The main emphasis will be given to train the students in nanolayer deposition using electro deposition methods. The prototype sample will be characterized using characterization techniques like SEM, TEM, XPS etc.

ii. The second part is the product design by employing nanolayer coating for the industrial use.

I. Protocols for outreach

1. Proven technologies will be adopted for both laboratory and industrial use.
2. Prototype technologies development on pilot basis and scaling up the same.

Major equipment and facilities required:

- Electrochemical deposition fabrication Rs. 30 lakhs
- Ellipsometry Rs. 65 lakhs

Total Rs. 95 lakhs

Software for simulation and modeling

- Intelli-suite simulator

5) CERTIFICATE COURSE ON PRODUCT DESIGN OPTIMIZATION FOR ARTIFICIAL LIMB VIA SOFT COMPUTING APPROACH

I. Introduction

Jaipur foot is a non-articulated foot – ankle assembly. It consists of 3 structural blocks simulating the anatomy of natural foot. Forefoot & heel blocks are made up of sponge rubber and Ankle block made up of light wood which are bond together, enclosed in a skin coloured rubber shell. Problem is that Fatigue/cracks develops or starts to develop at 4 major locations: Thumb joint, Middle part of foot, Heel part of foot and Socket joint of foot. The course aims to understand these various issues and try to overcome these problems in terms of simulation and modeling using soft computing approach.

II. Structure

- To understand the basic scientific concepts behind Jaipur foot
- To identify novel materials for design of prosthetics
- To demonstrate ability in a range of soft computing methods, specifically the simulation and modelling tools
- To demonstrate an understanding of some of the most common applications of computational techniques and how these relate to the solution of real world problems in industry
To appreciate the emerging role of information and communication technology in society, the regulatory framework within which it operates and the ethical issues it raises.

III. Course design

- Artificial Limbs
- Soft Computing
- Sensors and Actuators
- Optimization via Simulation and Modeling

** Case study based on real world models **

IV. Course content

Module 1: Artificial Limbs (20 H)
To impart the basic understanding of artificial limb (Jaipur foot), its design, working, need and some historical perspective.

Module 2: Soft Computing (60 H)
To study various soft computing techniques (ANN, SVM etc.), tools (MATLAB, Python etc.), and their applications.

Module 3: Sensors and Actuators (40 H)
To study various sensors & actuators (Gyroscope, Accelerometer, Shock sensor, Surface force sensor, Tilt sensor, Pressure sensor, Navigation system) employed in and to be employed for efficient functioning of artificial limb.

Module 4: Optimization via Simulation and Modeling (120 H)
Optimization of product and process using soft computing techniques.

Case study based on real world models

Protocols for outreach (Applications: Society/Industry)
Embedded Logic helps to replace the role that the CNS would normally play in processing information about changes occurring inside & outside the limb if it was still intact. A high precision actuator delivers motion control & replaces lost function. It is a type of motor for moving or controlling a system operated by a source of energy (electrical, hydraulic, pneumatic) & converts it into a kind of motion. It replaces the mechanoreceptor function – the body cells can
sense a range of mechanical stimuli & communicate information to CNS (memory system of device) that can provide a breakthrough to industry for societal applications.

**Major equipment and facilities required:**

Software for simulation and modelling

- MATLAB (20 users) Rs. 25 lakhs

**Case Studies**

- iWAiK'S Power foot BiOM
- Genium knee Bionic Prosthetic System
- PROPRIO FOOT

6) **CERTIFICATE COURSE IN INNOVATION IN MATERIAL SCIENCES FOR INCLUSIVE DEVELOPMENT**

This one year certificate course is designed for students with fundamental knowledge of Material Sciences / Physical Sciences / Inorganic Material Sciences who have completed undergraduates (such as BSc/ BE/ BTech etc.). The course will comprise two modules (six months each) with specific application focus, such as design, inclusive innovation, assistive technology etc. These modules will focus to spread design education, to imbibe design and innovation culture, harness the creativity and also enhance the R & D activities in design particularly in:

i. Material Sciences;

ii. Modifications and Characterizations of Materials;

iii. Artifacts and Material Conservations; and

iv. Interdisciplinary Collaborative concept for Industries and Society

The course will comprise of broad spectrum of the utilitarian applications of materials and electrochemistry in various industrial sectors: in the design and development of decorative artifacts and jewelry; in medical devices at the interface of biology and electrochemistry; in medical diagnosis; in Bio-electrochemistry and chalcogens; Conductive polymer-based materials for medical electroanalytic applications; Experimental and theoretical issues of nanoplasmonics in medicine; etc.

I. Objectives:

The major objectives of the course will be:

i. To provide integrated knowledge and skills through the inquiry-based teaching modules;
ii. To develop skills in designing and conducting experiments through innovative educational and training programs focused on specializations in material sciences and electrochemistry as per industrial sectors;

ii To develop proficiency in acquiring data, analyzing and interpreting data, problem solving aptitude on a variety of electrochemical technologies and material sciences

iii. To build an understanding of the impact of social, ethical and environmental factors in electrochemistry and material sciences design at global level;

iv. To meet the present and future needs of society and industry by providing state-of-the-art education and research programs to its students; and

v. To develop and strengthen the small scale manufacturers/ industrialists with innovative design and understanding.

In order to achieve its objectives / mission, the centre of innovative programmes will provide all students with:

i. Understanding of the needs of the Industrial Sector and provide solutions by applications of these modules; and

ii. Provide strategic direction and operational support as required in cooperative research with industry

II. Introduction:

During last few years, the science and technology have urbanized to cater the needs of the society and it has undergone enormous changes. Now, the R&D is mainly focused on innovations to play a vital role for sustainability and exploitation of renewable resources instead of depending on the depleting resources has come in focus. In view of the needs of the day on one hand and essential driving forces of growth on the other, this course has been designed on Innovation in Material Science for all Inclusive Growth.

The increasing interest of the stakeholders in novel and sustainable materials has led the science and technology and R&D to develop decorative metallic articles. Rajasthan is known for reservoir of ample industries (metallic and non-metallic), such as, Jewelry, decorative artifacts, ceramics, pottery apart from energy and textile. The procedural decorative coatings on metals are primarily used in the jewelry industry, in handicrafts, and in devices of specific usages to make them more visually attractive, decorative and colourful. Some time these coatings don’t have all-round high dimensional stability and durability.

The object of this course is to provide academic and technical knowledge and to develop a creative and innovative mind to find the solutions of the basic problems seen in these industries. This course will certainly create an open space to develop desire to design and manufacture the advanced high strength novel materials / metallic articles having more durability with broad colour spectrum. Apart from innovations and material designing, this course include application aspects with the whole trajectory, ranging from: developing an insight view to find newer ways to protect the material from wear and tear and seek its longevity (coating / paints / varnishes / adhesives / material characterization & analysis etc.); to hunt for novel and smart materials for food-packing
industry, bio-materials; industrial on-demand R&D in surface technology; renewable energy sources i.e. development of alternative materials derived from renewable resources; waste to wealth, waste water purification and waste management (i.e. environmental concerns) etc.

III. Structure:

This course will consist of modules (theoretical as well as experimentation) to build an understanding of Materials and Physical Sciences with specific focus on electrochemical techniques. It will also have workshops and conferences on design and practical hand-on trainings from eminent established R&D electrochemists, material scientists, entrepreneurs, industrialists and vendors/suppliers (to know user-end practical problems). It will be focused to build product design, industrial design and process design with the outcome to cater the needs of industries as well as small scale manufacturers. The ratio of theory and practical will be 1:2 (approximately 60 hours theory and 120 hours practical for each module).

IV. Program:

Course duration: 1 year with two semester/modules IMSID-101 and IMSID-102 (six months each).

IMSID-101: First Module (I Semester)

(Theory: 3Hrs and Practicals: One session of 3Hrs / per day)

The first module will deal with the designing Innovative Working Modules & Models to explain Concepts of Materials; Physical Chemistry and their Industrial Applications. It will comprise:

i. The Basic Introduction to Materials (metals, ceramics, polymers, composites etc.); structure of materials; their physical, chemical and mechanical properties (and applications. It is also needed to understand their preparative/manufacturing as well as service defects so as to open up window for innovations and design.

ii. Some of the general manufacturing processes, specifications and performance of the materials will also be considered, such as components of metallic, ceramics and glass, polymers/plastic, composites.

iii. Conceptual understanding of various Electrochemical Techniques and their significant applications with specific focus in materials and environmental sciences.


v. Laboratory modules: Practicals to know-how the usages of electrochemical and other fundamental techniques employed for design, production as well as characterization, identification and purification of materials.

IMSID-102: Second Module (II Semester)

(Theory: 3Hrs and Practicals: One session of 3Hrs / per day)

This will be inclusive of theory as well as laboratory work of an Advanced Modules of designing innovative materials; Industrial applications and other aspects of Electrochemical techniques
(electrowinning; electroplating; Restoration of Artifacts; Electrochromism; removal of pollutant and waste management etc).

vi. Electrochemical technology and modern techniques for material sciences: electrosynthesis;

vii. Understanding and documentation of the electrodes and membranes;

viii. Remediation of polluted sites- soil remediation by electrodialysis; monitoring and removal of pollutants; removal of contaminants- metal ion, organics, and inorganics removal from water (treatment of waste water/wastes); energy devices etc.

ix. Recycling of valuable materials- precious metal deposition;

x. Avoidance of wear and tear/corrosion- choice of materials/protective coatings.

V. Major Equipments:

The course has interlinking with the other courses proposed by our center. Major instrumentation required to carry out will be Spectroelectrochemical/Electrochemical Workstation costing approximately Rs. 20 Lacs.

The other necessary instruments are since already covered under above courses proposed by our centre, hence this module (certificate) course will be a cost effective module.

VI. Collaborations:

To have collaboration with industrial sectors and entrepreneurs, besides, it is also planned to collaborate with the CSIR-CECRI.

VII. Deliverables:

The deliverables of the proposed course will include Certificate in Innovations and Design in material sciences and also e-Content for teaching/learning; a 2 – 3 day workshop/training/conference for innovation and design faculty from other institutions and local industrial sectors and vendors.

The integration of knowledge and skills acquired through the inquiry-based teaching methods will enable the students to achieve the following educational outcomes: The broader fields (industries) which will be benefitted as an outcome of this course can be listed as: polymer and chemical; metal and material; paint and coating; jewelry; glass and ceramics etc. Besides this, the more important is the generation of the creative manpower with R&D temperament. This course could potentially play a significant role in economic development, employment generation and exports in future. Design ensures the efficient utility and durability of the novel materials/products under the socio-environmental legal constraint.

The minor integrates skill sets in fundamentals of materials (polymers/metals/ceramics), electrochemistry (e.g. chemistry, physics, mathematics, thermodynamics, and chemical kinetics), instrumentations and electrochemical applications (electro analysis, electrochemical synthesis and material protection) will ensure successful career opportunities and growth within industries,
government agencies, and academia. The curriculum will allow students to be better prepared for careers in clean and future green technologies.

As an outcome of this course, it expected to have some innovation and design in new materials with high durability and strength as well as in protective coatings especially in the domain of Jewelry, ceramics and other industrially used materials.

➢ SUSTAINABILITY MODEL FOR DIC

Committed leadership will ensure that DIC will continue even after the lapse of direct financial support from Department of Higher Education. Continual financial support from industries will be explored by identifying common research problems. Royalty generated from breakthroughs will be used for sustenance of the project. Endowment will be sought from philanthropic organizations and individuals. Exploring new industrial partners and Government support under various schemes including state innovation council and planning board. Revenue will be also generated from training and extension of services to private institutions and individuals. Consultancy charges in executing specific industrial problems by way of turnkey solutions.

➢ DELIVERABLES

<table>
<thead>
<tr>
<th>Activities</th>
<th>Indicative Timelines</th>
<th>Deliverables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Website creation for DIC</td>
<td>0-6 months</td>
<td>Dissemination of information for innovation fellowships, workshops, seminars, training programs, entrepreneurial development program, mentoring group, research database from university and surrounding eco system.</td>
</tr>
<tr>
<td>Formation of mentoring groups for different courses</td>
<td>0-6 months</td>
<td>Identification of faculty and individuals for course development and industrial partnerships</td>
</tr>
<tr>
<td>Formations of Networking group</td>
<td>0-12 months</td>
<td>Development of strategic partnerships for resource mobilization.</td>
</tr>
<tr>
<td>Research/Technology Database management</td>
<td>7-18 months</td>
<td>Database development of ongoing industry oriented research in universities in and around Jaipur, surrounding clusters and industries.</td>
</tr>
<tr>
<td>Creation of knowledge sharing mechanisms inside the University</td>
<td>7-18 months</td>
<td>Interdisciplinary collaborative research will get a boost and this may lead to further innovative solutions for industrial problems.</td>
</tr>
</tbody>
</table>
Interactive session with achievers in design innovation and corporate

Research by Design Innovation Fellows

<table>
<thead>
<tr>
<th>Bimonthly</th>
<th>Development of entrepreneurial skills of innovators.</th>
</tr>
</thead>
</table>

- Improvement in devices used for communication technology.
- New food products including food for various therapeutic needs.
- Identification of novel drugs.
- Prototype products with nanolayer coatings for eventual commercial applications.
- Improvement in the design of prosthetics.
- Innovation and design in new materials with high durability and strength as well as in protective coatings especially in the domain of jewelry, ceramics and other industrially used materials

5. Budget requirement:

I. Equipments and facility:

<table>
<thead>
<tr>
<th>S. No</th>
<th>Proposed Courses</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Total INR in Lakhs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Certificate course on RF planar component test</td>
<td>109</td>
<td>-</td>
<td>-</td>
<td>109</td>
</tr>
<tr>
<td>2.</td>
<td>Diploma course on innovative food designing</td>
<td>63</td>
<td>-</td>
<td>-</td>
<td>63</td>
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<tr>
<td>3.</td>
<td>Certificate course on computer assisted drug designing</td>
<td>130</td>
<td>-</td>
<td>-</td>
<td>130</td>
</tr>
<tr>
<td>4.</td>
<td>Certificate course on product design employing by different types of coatings</td>
<td>95</td>
<td>-</td>
<td>-</td>
<td>95</td>
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<tr>
<td>5.</td>
<td>Certificate course on product design optimization for artificial limb via soft computing approach</td>
<td>25</td>
<td>-</td>
<td>-</td>
<td>25</td>
</tr>
<tr>
<td>6.</td>
<td>Certificate Course In Innovation In Material Sciences For Inclusive Development</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>20</td>
</tr>
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<td></td>
<td>Total</td>
<td>442</td>
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II. Operational costs and others

<table>
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<tr>
<th>S. No</th>
<th>Heads (Common budget for all courses)</th>
<th>First Year INR in lakhs</th>
<th>Second Year</th>
<th>Third Year</th>
<th>Total INR in lakhs</th>
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<tbody>
<tr>
<td>1.</td>
<td>Refurbishing and Renovation cost and furnishing</td>
<td>10</td>
<td>10</td>
<td>2</td>
<td>22</td>
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<tr>
<td>2.</td>
<td>Fellowships (6 innovation fellows @35,000/month )</td>
<td>25.2</td>
<td>25.2</td>
<td>25.2</td>
<td>75.6</td>
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<tr>
<td>3.</td>
<td>Manpower (5 Lab Assistants/Technicians @10,000/month )</td>
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<td>6</td>
<td>6</td>
<td>18</td>
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<tr>
<td></td>
<td>Description</td>
<td>Amount 1</td>
<td>Amount 2</td>
<td>Amount 3</td>
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<td>------------------------------------------------------------------------------</td>
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<tr>
<td>4</td>
<td>Manpower (2 Office Assistants @10,000/month )</td>
<td>2.4</td>
<td>2.4</td>
<td>2.4</td>
<td>7.2</td>
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<tr>
<td>5</td>
<td>Workshops/Trainings</td>
<td>12</td>
<td>15</td>
<td>15</td>
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<td>7</td>
<td>Travel grant</td>
<td>3</td>
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<td>4</td>
<td>10</td>
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<td>8</td>
<td>Consumables (chemicals, glasswares, kits, raw/plant materials, etc.)</td>
<td>26</td>
<td>30</td>
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<td>Stationary</td>
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<td>Total</td>
<td></td>
<td></td>
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<td>257.8</td>
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### III. Budget for Satellite Centres (Spokes): INR 300 Lakhs

Grand Total Budget requirement: INR 442 Lakhs + 257.8 + 100 + 100 + 100 = INR 999.8 Lakhs (Rs. 9.998 crores) (Rs. Nine crore ninety nine lakhs and eighty thousand only)
A Project Proposal for "Design Innovation Centre" with special emphasis on Bio-Design

Submitted to
Ministry of Human Resource Development,
Department of Higher Education
Shastri Bhavan, New Delhi-110115

By
Prof. K.N. Singh Yadav
Vice-Chancellor
R. D. University, Jabalpur
Presented
by
Prof. S.S. Sandhu
Project Co-ordinator
Department of Biological Sciences,
Rani Durgavati University, Jabalpur (M.P.) India

Hub Institute for DIC
Department of Biological Sciences
The university has a good congenial environment to start Design Innovative Centre with special emphasis on Bio-Design. The Department of Biological Sciences which is one of the leading University Teaching Department will be the DIC Hub and three esteemed colleges of the university will be its satellite institute as hub and Spoke model. All the required facilities for the project work will be provided by the DIC hub. (~1000 Research papers, Citation Index (Since 2009) ~ 1749, SNIP ~ 54.685, SJR ~ 37.356, Impact Factor (Since 2009) ~ 112.687, H-Index ~ 72, i-10 ~ 42 (Since 2009), 9 patents are filed.)
### Details of the spokes institute

**Government M.J.I. College of Home Science & Science for Women**
- Jabalpur
- The college was established by Lady Geeta Singh Charitable Society, Jabalpur, in memory of her parents. The college is affiliated to the University of Jabalpur. It is accredited by the National Assessment and Accreditation Council (NAAC).
- The college has been recognized with grade A by the National Assessment and Accreditation Council (NAAC).

**Mata Gujri Mahila Mahavidyalaya**
- Jabalpur
- The college is affiliated to the Jabalpur University and is recognized by the UGC.

**St. Aloysius’ College and St. Aloysius Institute of Technology**
- Jabalpur
- St. Aloysius College was founded in 1921 and the Institute of Technology was established in the campus in 1980.
- The college has been recognized with grade A by the National Assessment and Accreditation Council (NAAC).
- The college has been accredited by the National Assessment and Accreditation Council (NAAC).

### Names of course which will be offered

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course / programme</th>
<th>Diploma / Certificate</th>
<th>No. of Seats</th>
<th>Duration</th>
<th>Timeline</th>
<th>Hub &amp; Spokes institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Designing of sustainable product via Mushroom cultivation</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td>Hub institute (Dept. of Biological Sciences) with spokes</td>
</tr>
<tr>
<td>2.</td>
<td>Molecular biology and creation of potential transformants</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Advanced microbial techniques in generation of Eco-friendly products</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Bioprospecting of fungal Biodiversity</td>
<td>Certificate</td>
<td>40</td>
<td>3 month</td>
<td>July - September</td>
<td>Mata Gujri Mahila Mahavidyalaya, Jabalpur in collaboration with Hub</td>
</tr>
<tr>
<td>5.</td>
<td>Inventive waste Management Technique</td>
<td>Certificate</td>
<td>40</td>
<td>3 month</td>
<td>July - September</td>
<td>St. Aloysius College, Jabalpur in collaboration with Hub</td>
</tr>
<tr>
<td>6.</td>
<td>Integrated Pest Management</td>
<td>Certificate</td>
<td>40</td>
<td>3 month</td>
<td>July - September</td>
<td>Govt. M.I. College of Home Science, Jabalpur in collaboration with Hub</td>
</tr>
</tbody>
</table>

7. Bio-Designing and IPR will also be added as an elective paper in Master Degree programmes in different streams of life Sciences in Hub and Spokes institutes. DIC will also conduct Workshops and Seminars on these issues.
Prototypes

**Eco-Cradle:** This material is made from mycelium; a structural part of it is characteristically rigid and dense.

**Latro Lamp:** Nanosized gold electrodes inserted into algae (*Pyrocystis fusiformis*) to draw an electric current from the process of photosynthesis.

**Fermentation lab:** Tribes from the Central India were regularly making the fermented beverages and some fermented foods. These beverages are found to have full of all essential amino acids necessary for the body.

**Mushroom House:** It will be used in production of nutriceuticles, Medicine and other novel product which are useful for agriculture and pharmaceutical industries.

**Incubation centre:** This organizes, synergize and leverage the various strands of excellence driving innovation and entrepreneurship. In the start up of Design Innovation centre, an incubation centre is necessary in order to bring it in proper shape.

**Microbial Home:** It comprises several integrated appliances that heat, refrigerate and generate food, as well as digest waste products using living microorganisms. For example, the Methane bio-digester microorganism.

**BIRAC Centre:** BIRAC an Indian govt. organization initiated several schemes that help to bridge the gaps between academics and industry. This focused mandatory to initiate, strengthen and empower innovative research to facilitate novel, high quality affordable biologically designed products development.

### Tentative Budget

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particular</th>
<th>Three Years Plan</th>
<th>Total Approx. cost (In Lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>I^th Year</td>
<td>II^th Year</td>
</tr>
<tr>
<td>1.</td>
<td>Non Recurring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Infrastructure:</td>
<td>2,05,66,832.00</td>
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</tr>
<tr>
<td>1.</td>
<td>Building</td>
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<td></td>
</tr>
<tr>
<td>1.</td>
<td>Required Instruments</td>
<td>1,90,50,000.00</td>
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</tr>
<tr>
<td>1.</td>
<td>Teaching Posts</td>
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<td>60,60,000.00</td>
</tr>
<tr>
<td>1.</td>
<td>Required</td>
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<td></td>
</tr>
<tr>
<td>2.</td>
<td>Recurring</td>
<td>17,16,000.00</td>
<td>17,16,000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Non-teaching Posts</td>
<td>1,00,00,00.00</td>
<td>1,00,00,00.00</td>
</tr>
<tr>
<td>2.</td>
<td>Posts Required</td>
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<td></td>
</tr>
<tr>
<td>2.</td>
<td>Satellite institutes</td>
<td>1,85,056.00</td>
<td>1,85,056.00</td>
</tr>
<tr>
<td>2.</td>
<td>Maintenance/</td>
<td>8,33,333.33</td>
<td>8,33,333.33</td>
</tr>
<tr>
<td>2.</td>
<td>Renovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Chemicals</td>
<td>15,33,333.33</td>
<td>15,33,333.33</td>
</tr>
<tr>
<td></td>
<td>Contingency</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand total in rupees</td>
<td>5,97,44,554.66</td>
<td>1,79,39,723.33</td>
</tr>
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</table>
Prototype Budget

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Prototype</th>
<th>Timeline</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eco-Cradle</td>
<td>July '15 - Dec. '15</td>
<td>50,000</td>
</tr>
<tr>
<td>2.</td>
<td>Latro-Lamp</td>
<td>July '15 - Dec. '15</td>
<td>35,000</td>
</tr>
<tr>
<td>3.</td>
<td>Fermentation lab.</td>
<td>July '15 - Dec. '15</td>
<td>5,00,000</td>
</tr>
<tr>
<td>4.</td>
<td>Mushroom House</td>
<td>July '15 - Dec. '15</td>
<td>5,00,000</td>
</tr>
<tr>
<td>5.</td>
<td>Incubation Centre</td>
<td>July '15 - July '16</td>
<td>5,00,000</td>
</tr>
<tr>
<td>6.</td>
<td>Microbial Home</td>
<td>July '15 - July '16</td>
<td>10,00,000</td>
</tr>
<tr>
<td>7.</td>
<td>BIRAC Centre:</td>
<td>July '15 - July '16</td>
<td>Will be applied</td>
</tr>
</tbody>
</table>

Deliverable for Society

By the end of this project we would deliver following facilities to the society:

- Creative Bio-design skills to the students.
- Eco-friendly products for human use.
- Employment oriented programs.
- Training and awareness programs for the Tribal.
- Novel environment management strategies through innovative waste treatment methods.
- IPR workshop by Hub
- Mushroom lab
- Eco friendly things like MSW
- BIRAC
- Incubation center

Thanks.....
<table>
<thead>
<tr>
<th>Rooms</th>
<th>Area (per room) in m²</th>
<th>Number</th>
<th>Total area in m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director/Principal office</td>
<td>50</td>
<td>1</td>
<td>50.00</td>
</tr>
<tr>
<td>Teaching Staff rooms</td>
<td>35</td>
<td>6</td>
<td>210.00</td>
</tr>
<tr>
<td>Non-teaching Staff rooms</td>
<td>35</td>
<td>2</td>
<td>70.00</td>
</tr>
<tr>
<td>Class rooms</td>
<td>78</td>
<td>6</td>
<td>468.00</td>
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<tr>
<td>Intellectual Property Right centre</td>
<td>78</td>
<td>1</td>
<td>78.00</td>
</tr>
<tr>
<td>Instrumentation lab</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Fermentation lab</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Incubation centre</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Research lab</td>
<td>60</td>
<td>2</td>
<td>120.00</td>
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<tr>
<td>Computer centre</td>
<td>78</td>
<td>1</td>
<td>78.00</td>
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<tr>
<td>Wash room</td>
<td>15</td>
<td>4</td>
<td>60.00</td>
</tr>
<tr>
<td>Strong room</td>
<td>35</td>
<td>1</td>
<td>35.00</td>
</tr>
<tr>
<td>Total area in m²</td>
<td>719</td>
<td>27</td>
<td>1424.00</td>
</tr>
<tr>
<td>Total area in sq. feet</td>
<td></td>
<td></td>
<td>15828.64</td>
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</table>
List of Required Equipments

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Equipment Description</th>
<th>Approx. cost in Rupees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Atomic Absorption Spectrophotometer</td>
<td>15,00,000.00</td>
</tr>
<tr>
<td>2</td>
<td>Double Beam Scanning U.V. Vis Spectrophotometer P.C. based</td>
<td>20,00,000.00</td>
</tr>
<tr>
<td>3</td>
<td>2-D Gel Documentation System (nanoart-band)</td>
<td>10,00,000.00</td>
</tr>
<tr>
<td>4</td>
<td>MALDI-TOF</td>
<td>25,00,000.00</td>
</tr>
<tr>
<td>5</td>
<td>Cryo-photometer</td>
<td>7,00,000.00</td>
</tr>
<tr>
<td>6</td>
<td>Flow Cytometer and Cell Sorter</td>
<td>7,00,000.00</td>
</tr>
<tr>
<td>7</td>
<td>Fluorescence Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>8</td>
<td>CHNS Analyzer</td>
<td>4,00,000.00</td>
</tr>
<tr>
<td>9</td>
<td>GC-MS</td>
<td>10,00,000.00</td>
</tr>
<tr>
<td>10</td>
<td>CO2 Incubator</td>
<td>2,50,000.00</td>
</tr>
<tr>
<td>11</td>
<td>Gel Electrophoresis</td>
<td>1,00,000.00</td>
</tr>
<tr>
<td>12</td>
<td>ROCO DO Dissolver</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>13</td>
<td>5 piece Digital pH meter</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>14</td>
<td>5 piece Vacuum evaporator</td>
<td>6,20,000.00</td>
</tr>
<tr>
<td>15</td>
<td>5 piece Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>16</td>
<td>5 piece UPS CRYA</td>
<td>4,00,000.00</td>
</tr>
<tr>
<td>17</td>
<td>2 pieces Laminar air flow apparatus</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>18</td>
<td>2 pieces Tablet packing machine</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>19</td>
<td>2 pieces of Autoclave</td>
<td>30,00,000.00</td>
</tr>
<tr>
<td>20</td>
<td>2 pieces Deep freezer</td>
<td>1,00,000.00</td>
</tr>
<tr>
<td>21</td>
<td>Fourier transform-Infrared Spectroscopy</td>
<td>20,00,000.00</td>
</tr>
<tr>
<td>22</td>
<td>UV-Vis Spectrophotometer</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>23</td>
<td>Nano Drop Spectrophotometer</td>
<td>22,00,000.00</td>
</tr>
<tr>
<td>24</td>
<td>Fluorescence Spectrophotometer</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>25</td>
<td>Scanning Probe Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>26</td>
<td>Deep Freezer with CO2 backup</td>
<td>1,50,000.00</td>
</tr>
<tr>
<td>27</td>
<td>Atomic Force Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>28</td>
<td>RT-PCR</td>
<td>5,00,000.00</td>
</tr>
<tr>
<td><strong>Total in Rupees</strong></td>
<td><strong>1,90,50,000.00</strong></td>
<td></td>
</tr>
</tbody>
</table>

Requirement of teaching Staff

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Staff</th>
<th>Required</th>
<th>Salary/Year</th>
<th>Salary for three Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Professor</td>
<td>1</td>
<td>11,40,000.00</td>
<td>34,20,000.00</td>
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<td>2.</td>
<td>Reader</td>
<td>2</td>
<td>18,00,000.00</td>
<td>54,00,000.00</td>
</tr>
<tr>
<td>3.</td>
<td>Assistance Prof.</td>
<td>4</td>
<td>31,20,000.00</td>
<td>93,60,000.00</td>
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<td><strong>Total in Rupees</strong></td>
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<td></td>
<td>60,60,000.00</td>
<td>1,81,80,000.00</td>
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</tbody>
</table>

Requirement of non-teaching Staff

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Staff</th>
<th>Required</th>
<th>Salary/Year</th>
<th>Salary three Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Technical Asst.</td>
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<td>9,60,000.00</td>
<td>28,80,000.00</td>
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<td>2.</td>
<td>Clerk</td>
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<td>4,32,000.00</td>
<td>12,96,000.00</td>
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<td>3.</td>
<td>Peon</td>
<td>3</td>
<td>3,24,000.00</td>
<td>9,72,000.00</td>
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<td><strong>Total in Rupees</strong></td>
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<td></td>
<td>17,16,000.00</td>
<td>51,48,000.00</td>
</tr>
</tbody>
</table>

*As per AICTE norms*
1. Rani Durgavati University

Rani Durgavati University also known as University of Jabalpur is a public University in Jabalpur, Madhya Pradesh, India. It was named after the queen Rani Durgavati. Rani Durgavati was born on 5th October 1524 A.D. in the family of famous Chandel Emperor Keerat Rai. Rani Durgavati’s was a personality with varied facets. She was valiant, beautiful brave and a great leader with administrative skills. Her self-respect forced her to fight till death rather than surrender herself to her enemy.

It is the main University of this city and has been graded as B++ by the National Assessment and Accreditation Council (NAAC).

The University was constituted and established on 12 June 1956. In the year 1983, the Government of Madhya Pradesh renamed the University of Jabalpur as Rani Durgavati Vishwavidyalaya in her memory. Government of India paid its tribute to the valiant Rani by issuing a postal-stamp commemorating her martyrdom, on 24th June 1988.

The University campus is spread over 99.63 acres (403,200 m²) of scenic beauty and environment-friendly surrounding. It accommodates:

- An Administrative Block
- Art Faculty building
- A Central Library
- Computer Centre
- University Institute of Computer Science and Application (UICSA).
- University Institute of Management (UIM).
- University Law Department and other facilities like one boy’s and one girl’s hostel.
- University Health Centre, University Guest House, Canteen and Residential quarters.
Other facilities like post office, bank and printing press are on the campus. It is, therefore, possible to say that the University campus is a city within the city of Jabalpur.

2. Department of PG Studies & Research in Biological Science, R.D. University as hub for Design Innovation Centre (DIC)

The Department of Post Graduate Studies & Research in Biological Sciences, Rani Durgavati University, Jabalpur (M.P.) envisages successful participation in postgraduate teaching and creative research in order to acquire the highest academic goals. The training is imparted by the experienced teachers who are also actively involved in research in their respective areas of specialization. The Department is working hard to educate more students, align programs and services to improve post-graduation learning outcomes and chart courses to expand research and creative endeavors. Multidisciplinary and interdisciplinary teaching and research in life sciences have established permanent roots. The uniqueness of the department essentially lies in the fact that within the department’s faculty there are experts and active researchers representing almost all areas of modern biology. The assignment of Department of Post Graduate Studies & Research in Biological Science, Rani Durgavati University, Jabalpur, is to be an up-to-date, excellent quality, comprehensive, and multidisciplinary centre of life sciences that supports design, innovation, research, education, technology transfer and applications for the benefit of human society. Fostering scientific development and innovative research skills in the young minds, conquering new altitudes in biotechnology research, to inspire the next generation to acquire innovations and transform society's expectations by generating sustainable knowledge.

Faculty Specialization

Besides this, the Department possesses a well-equipped Central Instrumentation Lab (CIL) that houses a good number of advanced instruments viz. HPLC, UV/VIS Spectrophotometer, Ultracentrifuge, PCR, Electrophoretic Units, Gel Doc system, Deep freezer, Ice making machine, Binocular microscopes, ELISA Reader, Orbital Shaker, Incubator, Bacteriological incubator.
Research Activities

Quality teaching requires ongoing research activities which needs a good deal of financial support. While it is our national mandate to provide training of the highest quality of life sciences, university system due to its own constraints, provides little intramural support for the research programmes.

The Department is fortunate to bring in research funds through national and international agencies in the form of research projects. National funding agencies like Department of Bio-Technology (DBT), Department of Science & Technology (DST), Madhya Pradesh Council of Science & Technology (MPCST), Madhya Pradesh Bio-Tech Council (MPBC), University Grant Commission (UGC), Minister of Environment & Forest (MOEF), United Nations Educational Scientific and Cultural organization (UNESCO), Indian Council of Forestry Research & Education (ICFRE), Council of Scientific and Industrial Research (CSIR) etc. have generously supported the ongoing researches of the Department.

The Department has been recognized by the Department of Biotechnology (DBT), Govt. of India for strengthening of training and research in Microbiology in Madhya Pradesh. The different faculty members of the department funded by Govt. of India and Madhya Pradesh have successfully completed more than 150 research projects. Currently 10 projects are ongoing in the
department. With well-established Microbiological and Biotechnological base, the Department is in a position to provide consultancy service to many areas of Microbiology/Biotechnology as Food analysis/Water Quality Examination/Bacterial taxonomy/Fungal taxonomy/Bio-fertilizer/Spirulina cultivation. Students trained in the Department have always been in demand. Almost all the students completing Ph.D. degrees get jobs in relevant fields and opportunities for post-doctoral work abroad, and a great many return to serve the country.

Department's faculty and students have substantially contributed and published research work in the diverse areas of Biotechnology such as Bio fertilizers, Plant Tissue Culture, Human Mycotic Infections, Biopesticides, Bio-diversity conservation, Enzymologist of Fungi, Bacteria and Cyanobacteria, Microbial Genetics and Biochemistry of Cyanobacteria, Pollution management, and Aerobiology extensively in reputed national and international journals. To date, Department has to its credit, over 1000 research publications. These research efforts have resulted in numerous awards, honours and recognitions to the students and the faculty of Department.

The university has a good congenial environment to start Design Innovative Center with special emphasis on Bio-Design. The Department of Biological Sciences which is one of the leading University Teaching Department will be the DIC Hub and three esteemed colleges of the university will be its satellite institute and Spoke model. All the required facilities for the project work will be provided by the DIC hub. The details of Satellite Centers are as following:

**Satellite Institute 1: Government M. H. College of Home Science & Science for Women (Autonomous), Jabalpur,**

The idea of establishing an Educational Institute for women was conceived by Mr. Parmanand Bhai Patel, a renowned industrialist of Jabalpur. The proposal was welcomed by Pandit Ravi Shankar Shukla, the then Hon. Chief Minister of Madhya Pradesh. On July 15, 1954 Govt. M H College of Home Science and Science for Women came into existence with only Home Science classes. Mr. Parmanand Bhai Patel's, firm Mohanlal Hargovinddas donated Rs. One Lakh for the establishment of the college. On April 27, 1956 the foundation stone was laid down on 11 acres of land, situated in the heart of Jabalpur city, by the chief minister of MP.
The college building is a beautiful piece of architectural work. Facilities such as Hostel, Sports complex, Canteen etc. are available in the college premises. The hostel accommodates about 650 girls. This is the biggest girl’s hostel of MP. The college is affiliated to Rani Durgavati Vishwavidyalaya, Jabalpur which awards degrees to the students. University Grants Commission, New Delhi implemented the Autonomous Scheme in 1979. The M H College is one of the pioneering institutions of Madhya Pradesh that adopted the autonomous system in the Higher Education in 1988-89. On the recommendation of UGC peer team the Autonomous status of the college has been extended up to the year 2012 - 2013. NAAC accredited the college with “A” grade in 2012. The college was selected in the UGC scheme “Colleges with Potential for
Excellence” in 2004. That time M H College of H Sc & Science for Women was the only Women College of the M P to be selected with 73 other colleges from all over the country. The college caters to the educational needs of young women coming from different strata of society by providing equal opportunities in conventional & various vocational courses in Science & Home Science faculty. To keep pace with the changing scenario, the courses are restructured to include basic as well emerging interdisciplinary and application – oriented areas. The courses offered are adequately strengthened to develop appropriate skills, which are significant not only to the students, but also to the local, regional and national needs. Sufficient freedom is allowed to the students to choose the courses best suited to their interests and capabilities. The college also emphasizes on value based education to inculcate soft skills. The student is considered not as a consumer of the system but the customer of the system.

The college is various departments of science, home science and vocational courses, and these departments are present well developed and equipped laboratory for scientific education and research. The college is fortunate to bring in research funds through National and International agencies in the form of research projects. The different faculty members of the department funded by Govt. of India and Madhya Pradesh have successfully completed more than about 95 research projects. Currently above 8 projects are ongoing in the department. College faculty and students have substantially contributed and published research work in the diverse areas of home science, science and vocational subject (Biotechnology and Biochemistry,
Microbiology and other) extensively in reputed National and International journals. These research efforts have resulted in numerous awards, honours and recognitions to the students and the faculty of Department.

**Satellite 2: Mata Gujri Mahila Mahavidyalaya (Autonomous), Jabalpur**

The year 1994 witnessed the birth of Mata Gujri Mahila Mahavidyalaya, a college, named after Mata Gujri ji, the honourable wife of the Ninth Guru, Guru Teg Bahadur ji and the mother of the Tenth Guru, Guru Gobind Singh ji. The college was established by Guru Gobind Singh Education Society, Jabalpur, a pioneer in the field of education with the objective of providing education to women in an epoch of revolutionary changes in every sphere of life with a staunch belief, that if you educate a man, you educate an individual, but if you educate a woman, you educate a family, and in turn you contribute to nation building and the society at large. Duly recognized by UGC under section 2F and 12B, the college is affiliated to Rani Durgawati Vishwavidyalaya, Jabalpur, and has been re-accredited with grade ‘A’ by the National Assessment and Accreditation Council (NAAC) Banglore. The college has gained further impetus after the conferment of Autonomous status by UGC from w.e.f. April 2012.

The college offers a vista of conventional and professional courses in the six faculties of Science, Arts, Commerce, Computer Science, Management Studies and Education. Complementing regular studies is the IGNOU Regular Study Center and Programme Study Centre for B. Ed and M. Ed Education. With 8 Major and 52 Minor projects to our credit, research is taken to grass root levels, i.e., the class rooms, our enthusiastic teachers are committed to fostering genuine intellectual partnership with our students. The bottom line is, here you can look forward to rigorous preparations for your future career in the stimulating setting of a great urban centre for lifelong learning. Over a period of time, Guru Gobind Singh Educational Society has founded eight schools including English and Hindi medium schools and today, it has strength of around 8,500 students. It was amongst the aims of society to provide education to worthy, irrespective of their caste and creed. Because of this, the schools were established at remote corners of the city also, with all amenities.
After consolidation of schools, Guru Gobind Singh Educational Society addressed the burning need of providing college education to girls of Jabalpur and nearby areas. This became the genesis of an all girl’s college, Mata Gujri Mahilla Mahavidyalaya in 1994. Over the period of time, number of disciplines and number of students kept on increasing and today, Mata Gujri Mahilla Mahavidyalaya is offering courses in graduate and post graduate disciplines in 4 faculties of Arts, Science, Commerce & Management and Education. Mata Gujri Mahilla Mahavidyalaya has recognized IGNOU centre. Mata Gujri Mahilla Mahavidyalaya is re-accredited with Grade ‘A’ by NAAC. Mata Gujri Mahilla Mahavidyalaya also has a hostel for more than 500 girls and major extension of hostel is being planned in near future. As on date, around 5,500 girl students are shaping their future in Mata Gujri Mahilla Mahavidyalaya & getting admission in this college is being considered as a status of Intellect.

In the year 1999, Guru Gobind Singh Educational Society established Guru Ramdas Khalsa Institute of Science & Technology (MCA), which was again the first technical private college not only in Jabalpur, but in Mahakaushal, Vidyanchal and Bundelkhand region. In the year 2002, the society introduced Guru Ramdas Khalsa Institute of Science & Technology (Pharmacy) which was again the first private pharmacy college in Jabalpur as well as Mahakaushal, Vindyanchal and Bundelkhand regions.

**Advanced Departmental Equipment Facilities**

- HPLC
- Gel Doc Machine
- PCR Thermocycler
- UV Visual micro plate spectrophotometer
- ELISA Reader
- CO₂ Incubator
- Plant Tissue Culture Set up with AC Facility
- -20°Deep Freezer
- Trinocular Research Microscope with micro photographic attachment with motic software
- Cooling Centrifuge
- Rotary Shaking Incubator
• Tissue Homogenizer
• BOD Incubator
• Spectrophotometer
• Fermentor
• Bio safety cabinets

Research Activities

There are a number of research projects in the College with different faculty members funded by national agencies such as UGC, M.P. Council of Biotechnology, and M.P. Council of Science and Technology. More than 20 research projects have been successfully completed and over 10 projects are ongoing. Approximately 10 research scholars are associated with these projects and research programmes. Every year, a few students qualify NET & GATE examinations.

The teachers and research scholars of the Department have published approximately 130 research papers in the journals of national and international repute and have also authored/edited
more than 05 books dealing in various subjects of Life Sciences. The National symposia/seminar on various subjects of Life Sciences is also regularly held. Workshops for training in advanced techniques in Microbiology, Molecular Biology & Biotechnology are organized from time to time for the students. At present, Department has 20 sanctioned permanent teaching posts, where faculty members have distinction in various disciplines. Such a large group of teachers with rare combination of various expertises is unique in Madhya Pradesh. In addition, Department engages many renowned visiting expert faculty from other Universities/Institutions of India to fortify the specific needs of students. The College has got well facilities in the campus: 100% Wi-Fi campus, smart class rooms-03, Seminar Hall-01, computer Labs-02, Libraries-3, Seminar Hall-1, Computer labs-2, Bio - Tech labs-2, Botany labs-2, Zoology labs-2, Microbiology labs-1, Physics lab-01, Electronics lab-1, Bio-Chemistry lab-1, Drawing & Painting Workshop-1, Girls Common Room-1, Cafeteria-2, Medical Room-1.

Satellite 3: St. Aloysius' College (Autonomous) and St. Aloysius institute of Technology, Jabalpur

St. Aloysius College and St. Aloysius Institute of Technology (SAIT), are Christian institutes owned and established by the Catholic Diocese of Jabalpur, which belongs to the minority community of Catholics. They are administered through The Diocesan Corporation of Jabalpur. St. Aloysius College is the pioneer educational institution in the town as well as the state is affiliated to the Rani Durgavati Vishwavidalaya, Jabalpur. It was founded in 1951 and is situated in the Jabalpur Cantonment area. The college is named after St. Aloysius Gonzaga, the Patron Saint of the college, who harboured a burning desire to serve God and his fellowmen.

The Golden Jubilee Year (2001) of the College commenced on a momentous note with the introduction of two new Vocational Courses i.e., Industrial Microbiology and Computer Application. Moreover, it witnessed the setting-up of new laboratories for Computer Science, Industrial Microbiology, Botany, Zoology, Electronic Equipment Maintenance, Electronics and Biochemistry as well as a renovated well-furnished Library. In 2004, the College introduced Biotechnology at the Under-Graduate level and Microbiology at the Post-Graduate level. In the same year another milestone was achieved by starting the Faculty of Education in the college. In
the same year the New College Extension Building having a reading room, Internet centre, conference room, microbiology and biotechnology laboratories were dedicated to the service of humankind.

The first assessment by NAAC in 2005 with A+ Accreditation opened the doors for several new initiatives and also became a point for introspection which urged the Aloysian family to give a revised thrust to the holistic education of students. It is a matter of great privilege that Rani Dugawati Vishwavidyalaya, Jabalpur, with the approval of the UGC, has granted “Autonomous status” to the college vide order no. Com./2007/270 dated 13.02.2007 for a period of 5 years, i.e., from 2007-08 to 2012-13.

Different committees are made as per the UGC guidelines to enhance the effective functioning of autonomy. As a result of the constant onward march of the college, UGC has selected the institution for “College with Potential for Excellence” in 2007. St. Aloysius College has held an undisputed top ranking position in the state of Madhya Pradesh consistently for the past three years- 2008, 2009 and 2010 as per the survey conducted by Hello Hindustan. The institution has also received a certificate of Appreciation from MP State Women Commission Bhopal. The latest accolade received by the College was an award by Adult and Continuing Education State Resource Centre, Bhopal for its Contributions under Literacy under Saakshar Bharat Programme.

St. Aloysius Institute of Technology (SAIT), started with a dream that our students shall have holistic development and shall serve the nation and make India proud by their innovative ideas, technological pursuits and entrepreneurship. The College caters to the needs of the student's development for wholesome growth of the country. SAIT epitomizes excellence in technology-centric education, ensuring entre and opportunity for all, upholding rigorous academic standards, advancing innovation, strengthening respect for diversity, and serving as a catalyst for learning, exploration and discovery of eco-friendly technology for sustainable development of humanity.

The Principal Dr. Fr. Davis George is the recipient of three national awards: “Best Educationist Award” March 2009, by Indian Solidarity Council, “Jewel of India Award” and
“Certificate of Excellence” for outstanding achievements (2010) and “Eminent Educationist Award” by International Institute of Education and Management, 2010. The aim of the institution is to facilitate use of ICT, skill-development, development of global competencies, and ultimately to make the learners exceed their potential to be of service to self and society. The motto of the college Virtus in Arduo – ‘Strength through Striving’ propels the Aloysian fraternity to overcome barriers through constant perseverance.

VISION

"Provide knowledge that is relevant in the present time and helpful in pursuit of successful career". Efforts are made to give the students latest information about the subject available from various sources like Electronic and Paper media"

MISSION

“To create an environment where all-round development of the student in different fields (academics and personal) is possible to make them better citizens of the nation”. Achieving this is made possible by improving their results at University exams. This is done by justifying their performance in class tests and seminars, which are evaluated and discussed giving reasons.

OBJECTIVES

Make students pursue patiently, make extra efforts and achieve the goal. Maximum interaction between students and teachers brings an informal environment in the department, which helps them become more confident. They are encouraged to get all their doubts cleared, which helps them in the quest of knowledge. Various Assignments and Projects contribute towards increasing the knowledge as well as the habit of teamwork. The use of Internet, Library and News media further helps them in achieving the goals.

DEPARTMENTS

- Science:
- Arts
- Commerce
- Management
- Education
FACILITIES

- Library
- Sports
- Hostel
- IT Infrastructure
- Reading Room
- Counselling Cell

Advanced departmental equipments

- PCR Thermocycler
- UV Visual microplate spectrophotometer
- ELISA Reader
- CO₂ Incubator
- Plant Tissue Culture Set up with AC Facility
- -20°C Deep Freezer
- Trinocular Research Microscope with micro photographic attachment with motic software
- Cooling Centrifuge
- Rotary Shaking Incubator
- Tissue Homogenizer
- BOD Incubator
- Spectrophotometer
- Fermentor
- Laminar Air Flow Cabinets
- Biosafety cabinets

Research activities and achievements of the department

The college is fortunate to bring in research funds through national and international agencies in the form of research projects. National funding agencies like Department of Biotechnology (DBT), Department of Science & Technology (DST), Madhya Pradesh Council of
Science & Technology (MPCST), Madhya Pradesh Bio-Tech Council (MPBC), University Grant Commission (UGC), Minister of Environment & Forest (MOEF) and Council of Scientific and Industrial Research (CSIR) etc. have generously supported the ongoing researches of the Department. College faculty and students have substantially contributed and published research work in the diverse areas of science and biological sciences extensively in reputed National and International journals. These research efforts have resulted in numerous awards, honors and recognitions to the students and the faculty of Department.

3. Infrastructure Required for DIC

3.1. Fermentation Lab

Fermentation is the breakdown of complex molecules to simpler ones through the action of some microorganism. In India, basically the Central India is known for Tribal’s and their handmade products. On using the principles of fermentation, tribes from the Central India were regularly making the fermented beverages like alcohol (Tadi). These beverages were full of all essential amino acids necessary for the body. This is because the utensils (clay pot) they were using contain lot of fermenting which were gained from their ancestors. By following this approach in Biodesign, fermentation lab is to be established so that we get new and improved fermented foods which are designed biologically.
3.2. BIRAC Centre

BIRAC (Biotechnology Industry Research Assistance Council) is an Indian government organization. It is a new industry-academia interface, focused mandatory to strengthening and empowering the innovation research. It has initiated several schemes that help to bridge the gaps between academics and industry. BIRAC initiates, innovative research to facilitate novel, high quality affordable products development through cutting edge technologies.

3.3. Intellectual Property Right Center

The Intellectual Property Right Center (IPRC) is handling all issues relating to intellectual property. The intellectual property (IP) right is vital for creating jobs, saving lives, and advancing global economic growth. It aims to:

- Strengthen the protection and enforcement of IP rights.
- Promote and defend the system of IP rights norms and multilateral forums,
- Increase support for IP rights as a driver of innovation and creativity
- Promote Intellectual Property awareness among students, faculties through streamlined awareness campaigns.
- To organize short-term Intellectual Property modules, seminars, workshops and conferences.
3.4. Incubation Centre

The aim of the incubation centre is to organize, synergize and leverage the various strands of excellence driving innovation and entrepreneurship in a thriving ecosystem consisting of research at the cutting edge of science and technology. When a baby is born, he/she is kept in the incubator for first few hours and maybe days – this gives them a chance to adjust to outside environment, and grow stronger before they face the outside world! In a similar way, a startup is incubated in Incubation Center, which gives them a chance to bring their business in shape, before they reach out to the world. In India, most incubation centers are hosted by an academic institute, and funded by DST (Department of Science and Technology), which gives them access to government agencies, as well as easy reach to professors and students in the college. Overall, there are more than 50 incubation centers across India.

3.5. Gross area

<table>
<thead>
<tr>
<th>Rooms</th>
<th>Area (per room) in m²</th>
<th>Number</th>
<th>Total area in m²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director/Principal office</td>
<td>50</td>
<td>1</td>
<td>50.00</td>
</tr>
<tr>
<td>Teaching Staff rooms</td>
<td>35</td>
<td>6</td>
<td>210.00</td>
</tr>
<tr>
<td>Non-teaching Staff rooms</td>
<td>35</td>
<td>2</td>
<td>70.00</td>
</tr>
<tr>
<td>Class rooms</td>
<td>78</td>
<td>6</td>
<td>468.00</td>
</tr>
<tr>
<td>Intellectual Property Right centre</td>
<td>78</td>
<td>1</td>
<td>78.00</td>
</tr>
<tr>
<td>Instrumentation lab</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Fermentation lab</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Incubation centre</td>
<td>85</td>
<td>1</td>
<td>85.00</td>
</tr>
<tr>
<td>Research lab</td>
<td>60</td>
<td>2</td>
<td>120.00</td>
</tr>
<tr>
<td>Computer centre</td>
<td>78</td>
<td>1</td>
<td>78.00</td>
</tr>
<tr>
<td>Wash room</td>
<td>15</td>
<td>4</td>
<td>60.00</td>
</tr>
<tr>
<td>Strong room</td>
<td>35</td>
<td>1</td>
<td>35.00</td>
</tr>
<tr>
<td><strong>Total area in m²</strong></td>
<td><strong>719</strong></td>
<td><strong>27</strong></td>
<td><strong>1424.00</strong></td>
</tr>
<tr>
<td><strong>Total area in sq. feet</strong></td>
<td><strong>15820.64</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 3.6 Required of teaching Staff

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Staff</th>
<th>Required</th>
<th>Salary/Year</th>
<th>Salary for three Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Professor</td>
<td>1</td>
<td>11,40,000.00</td>
<td>34,20,000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Reader</td>
<td>2</td>
<td>18,00,000.00</td>
<td>54,00,000.00</td>
</tr>
<tr>
<td>3.</td>
<td>Assistance Prof.</td>
<td>4</td>
<td>31,20,000.00</td>
<td>93,60,000.00</td>
</tr>
<tr>
<td><strong>Total in Rupees</strong></td>
<td></td>
<td></td>
<td><strong>60,60,000.00</strong></td>
<td><strong>1,81,80,000.00</strong></td>
</tr>
</tbody>
</table>

*As per AICTE norms

### 3.7 Required of non-teaching Staff

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Staff</th>
<th>Required</th>
<th>Salary/Year</th>
<th>Salary three Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Technical Asst.</td>
<td>4</td>
<td>9,60,000.00</td>
<td>28,80,000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Clerk</td>
<td>2</td>
<td>4,32,000.00</td>
<td>12,96,000.00</td>
</tr>
<tr>
<td>3.</td>
<td>Peon</td>
<td>3</td>
<td>3,24,000.00</td>
<td>9,72,000.00</td>
</tr>
<tr>
<td><strong>Total in Rupees</strong></td>
<td></td>
<td><strong>7</strong></td>
<td><strong>17,16,000.00</strong></td>
<td><strong>51,48,000.00</strong></td>
</tr>
</tbody>
</table>

*As per AICTE norms

### 3.8. List of Required Equipments

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Equipments</th>
<th>Approx. cost In Rupees</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Atomic Absorption Spectrophotometer</td>
<td>15,00,000.00</td>
</tr>
<tr>
<td>2.</td>
<td>Double Beam Scanning U.V. Vis. Spectrophotometer P.C. Based</td>
<td>20,00,000.00</td>
</tr>
<tr>
<td>3.</td>
<td>3-D Gel Documentation System (software based)</td>
<td>10,00,000.00</td>
</tr>
<tr>
<td>4.</td>
<td>MALDI-TOF</td>
<td>25,00,000.00</td>
</tr>
<tr>
<td>5.</td>
<td>Cytophotometer</td>
<td>7,00,000.00</td>
</tr>
<tr>
<td>6.</td>
<td>Flow Cytometer and Cell Shorter</td>
<td>7,00,000.00</td>
</tr>
<tr>
<td>7.</td>
<td>Fluorescence Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td></td>
<td>Equipment</td>
<td>Cost in Rs.</td>
</tr>
<tr>
<td>---</td>
<td>------------------------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>8</td>
<td>CHNS Analyzer</td>
<td>4,00,000.00</td>
</tr>
<tr>
<td>9</td>
<td>GC-MS</td>
<td>10,00,000.00</td>
</tr>
<tr>
<td>10</td>
<td>CO₂ incubator</td>
<td>2,50,000.00</td>
</tr>
<tr>
<td>11</td>
<td>Gel Electrophoresis</td>
<td>1,00,000.00</td>
</tr>
<tr>
<td>12</td>
<td>NO/CO Detector</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>13</td>
<td>5 pieces Digital pH meter</td>
<td>5,00,000.00</td>
</tr>
<tr>
<td>14</td>
<td>5 pieces Vacuum evaporator</td>
<td>6,00,000.00</td>
</tr>
<tr>
<td>15</td>
<td>5 pieces Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>16</td>
<td>5 pieces UPS 4KVA</td>
<td>4,00,000.00</td>
</tr>
<tr>
<td>17</td>
<td>2 pieces Laminar air flow apparatus</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>18</td>
<td>2 pieces Tablet punching machine</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>19</td>
<td>2 pieces of Autoclave</td>
<td>50,000.00</td>
</tr>
<tr>
<td>20</td>
<td>2 pieces Deep freezer</td>
<td>1,00,000.00</td>
</tr>
<tr>
<td>21</td>
<td>Fourier transform-Infrared Spectroscopy</td>
<td>20,00,000.00</td>
</tr>
<tr>
<td>22</td>
<td>UV-Vis Spectrophotometer</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>23</td>
<td>Nano Drop Spectrophotometer</td>
<td>22,00,000.00</td>
</tr>
<tr>
<td>24</td>
<td>Fluorescence Spectrophotometer</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>25</td>
<td>Scanning Probe Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>26</td>
<td>Deep Freezer with CO₂ backup</td>
<td>1,50,000.00</td>
</tr>
<tr>
<td>27</td>
<td>Atomic Force Microscope</td>
<td>3,00,000.00</td>
</tr>
<tr>
<td>28</td>
<td>RT-PCR</td>
<td>5,00,000.00</td>
</tr>
<tr>
<td><strong>Total in Rupees</strong></td>
<td><strong>1,90,50,000.00</strong></td>
<td></td>
</tr>
</tbody>
</table>
## 4. Names of course offered

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Course/programme</th>
<th>Diploma/Certificate</th>
<th>No. of Seat</th>
<th>Duration</th>
<th>Timelines</th>
<th>Contribution of Hub and Spoke institution</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Designing of sustainable product via Mushroom cultivation</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td>Hub institute (Dept. of Biological Sciences) with spokes</td>
</tr>
<tr>
<td>2.</td>
<td>Molecular biology and creation of potential transformants</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Advanced microbial techniques in generation of Eco-friendly products</td>
<td>Diploma</td>
<td>40</td>
<td>6 month</td>
<td>July - December</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Bioprospecting of fungal Biodiversity</td>
<td>Certificate</td>
<td>40</td>
<td>3 month</td>
<td>July - September</td>
<td>Mata Gujri Mahila Mahavidyalaya, Jabalpur in collaboration with Hub</td>
</tr>
<tr>
<td>5.</td>
<td>Inventive waste Management Strategies</td>
<td>Certificate</td>
<td>40</td>
<td>3 month</td>
<td>July - September</td>
<td>St. Aloysius College, Jabalpur in collaboration with Hub</td>
</tr>
</tbody>
</table>

## 5. “DESIGN INNOVATION CENTRE” WITH EMPHASIS ON BIO-DESIGN

**What is Bio-Design?**

Bio-Design is the integration of design with biological systems, often to achieve better ecological performance. In contrast to a design that mimics nature or draws on biology for
inspiration, Bio-Design incorporates living organisms into design as building blocks, material sources, energy generators, digital storage systems and air purifiers, just to name a few possibilities. Bio-Design is both opportunistic and logical in recognizing the tremendous power and potential utility of organisms and their natural interaction with larger and ever changing ecosystems around them. Bio-Design can also be a means of communication and discovery, a way to provoke debate and explore the potential opportunities and dangers of manipulating life, particularly through synthetic biology, for human purposes.

This new approach is often a response to the growing urgency to build and manufacture more sustainably in light of the climate crisis. This, in turn, leads to unprecedented collaborations between designers and life scientists, such as biologists who increasingly understand how organisms function to the molecular level. The recent proliferation of such cross-disciplinary activity is occurring in schools, labs and even in garage work benches around the world. One important outcome of this new approach to design has been the development of critical and narrative objects that blur the border between art and design and which envision the effects of new technologies and scientific research on human behavior and culture.

Why Bio-Design?

1. There is an urgency to develop and implement cleaner technologies.
2. For example, Microbes have been found within nuclear reactors that have developed the ability to continually protect and repair their own DNA. Harnessing such a mechanism might inform a future cancer treatment to retard growth.
3. The potential for designers and scientists to develop new and useful applications with this previously unknown form of life is significant.
4. This convergence of fields is ultimately necessary to alleviate the negative impacts of the legacies of the Industrial Revolution.
5. And it will lead to the preconceptions of the primary design principles of value generation, growth and sustainability.
VISION AND STRATEGY

The vision for a Design of innovation centers envisages the following:

1. Preparation of a platform for creative design development, design promotion and partnerships across many sectors, states, and regions for integrating design with traditional and technological resources.
2. Raising Indian design education to global standards of excellence.
3. Conduct programs for continuous evaluation and development of new design strategies.
4. Involving Industry and professional designers in the collaborative development of the design profession
5. To facilitate interdisciplinary design-focused education, research, and entrepreneurial activities in order to create commercial opportunities and build partnerships between academics and industry.
6. Assist industries to engage the services of designers for their existing and new products.
7. To create an ecosystem facilitating students and faculty to take their innovative ideas from classrooms/labs to market/people.
8. Encourage and facilitating a culture for creating and protecting intellectual property in the area of designs.

6. Products Design in Future by Institute

New techniques of Bio-Design are being created rapidly. Recent highlights include:

Bio Concrete: Robust bacterium that naturally secretes limestone in specific conditions are mixed with nutrients in concrete before it dries and, as wear and age form cracks in the concrete, the bacteria animate and secrete limestone, effectively repairing the cracks.
**Building with trees:** It utilizes growing trees as load bearing materials, most often aggressive rooting and fast growing species such as willow. This highlights the adaptability and beauty of incorporating natural systems. The supporting branches and trunks actually strengthen over time in response to stress, as would a human muscle.

**EcoCradle:** This material is made from mycelium; a structural part of it is characteristically rigid and dense. A competitive alternative to petroleum polymer foam used for packing –
material that typically lasts hundreds or thousands of years, represents 25% of waste landfill sites by volume and often contains toxins such as benzene.

**Microbial Home:** It comprises several integrated appliances that heat, refrigerate and generate food, as well as digest waste products using living microorganisms. The individual units are designed to work as a cycle that resembles an ecosystem and utilize bacteria, fungi and other naturally occurring organisms to enable each process. For example, the Methane bio-digester accepts food craps and generates gas to power the stovetop.
Latro Lamp: Nanosized gold electrodes inserted into algae to draw an electric current from the process of photosynthesis suggest how we might develop algae-powered light sources in the future. Thus, we may keep communities of contained organisms as symbiotic pets, caring for them in return for their energy and illumination.

Moss Table: Moss Table makes use of the small electrical charge produced when bacteria consume organic compounds released by moss; here, a battery supplements that power to light the lamp.
7. TENTATIVE BUDGET

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Particular</th>
<th>Three Years Plan</th>
<th>Total Approx. cost (In Lakhs)</th>
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<tbody>
<tr>
<td></td>
<td></td>
<td>1st Year</td>
<td>2nd Year</td>
</tr>
<tr>
<td>1.</td>
<td>Non Recurring</td>
<td>Building</td>
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<td>2.</td>
<td>Recurring</td>
<td>Teaching Posts</td>
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<td>Non-teaching Posts</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Required</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Satellite institutes</td>
<td></td>
</tr>
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<td></td>
<td></td>
<td>Maintenance/Renovation</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chemicals</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Contingency</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Grand total in rupees</td>
<td>5,97,44,554.66</td>
<td>1,79,39,723.33</td>
</tr>
</tbody>
</table>
1. Designing of Sustainable Products via Mushroom Cultivation

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.

2. Molecular Biology and Creation of Potential Transformants

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.
Isolation of plasmid DNA from bacteria, Isolation and quantification of fungal and plant DNA. Transformation techniques and selection of transformants. Agarose gel electrophoresis, SDS-PAGE Restriction digestion of DNA, DNA amplification by PCR and Designing of primers. General introduction to designing and biosynthesis, characterization and biomedical applications of nanoparticles.

3. Advanced Microbial Techniques in Generation of Eco-Friendly Products

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.
Advanced sterilization techniques, culture and purification of useful and rare microbes, replica technique, and Different anaerobic culture techniques. Biologically designed methods for identifying bacteria: susceptibility test. Designing of fermentation technology: Bio-design fermentation media, biologically designed fermentation products (fermented rice roughage), intensified fermentation process: immobilized cell technology, down streaming process: Designed cell separation techniques; broth clarification, polyethersulfone (PES) and microfiltration (MF) membrane techniques. Development of bio-designed fertilizers from leguminous plants.

4. Bioprospecting of Fungal Biodiversity

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.
Fungi: Introduction; General characteristics; Comparative account of morphology, physiological specialization; asexual and sexual reproduction; evolution and phylogenetic affinities; Structural, functional and ecological specialization of fungal mycelia and spores; Taxonomy and Nomenclature. Production of useful compounds from fungi; Preparation of media, Screening for bioactivity (antimicrobial and pharmacologically active agents of fungal origin), Bioprospecting for novel industrial enzymes. Production of alcohols fermented foods from fungi.

5. Innovative Waste Management Techniques

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.
Prologue, sources and kinds of waste, basics of waste management’s and Innovative methods for biodegradation of waste by using Microorganisms. Need of waste management’s. Application and utilization- Bodesigning of Microorganisms for Biodegradation of polythene, Heavy metals, chemical fertilizers and other xenobiotics, Co-processing of plastic waste in cement preparation, Interdisciplinary use of waste into biofuel by using anaerobic Bacteria, Microbial home synthesis.

6. Integrated Pest Management

Introduction to Bio-design: Definition of Design, Evolution of design, Terminology of design and bio design, Bio design product life cycle. Types; classic design, user centered design (UCD). Design technology in society, product analysis.
An introduction to Integrated Pest Management (IPM): Concepts, principles, development and application of IPM. Discuss the differences between IPM and conventional pest control, Designing of IPM for making decision making process. Designing of IPM strategies and equipment to prevent, suppress, or eliminate the pest.
Deliverable for society

By this project we would deliver following facilities to the society:

1. Creative Bio-design skills to the students.
2. Eco-friendly products for human use.
3. Employment oriented programs.
4. Training and awareness programs for the Tribals.
5. Novel environment management strategies through innovative waste treatment methods.
**Annexure - IV**

20-01-2015

This page contains a diagram portraying the Banaras Hindu University (BHU) and IIT (Indian Institute of Technology). The diagram outlines the various institutes, faculties, and more than 100 patents in different fields from the last 20 years.

- **Institutes**
  - Agriculture Sciences
  - Medical Sciences
  - Environment and Sustainable Development

- **Faculties**

- **More than 100 patents in different fields from the last 20 years**

**Role of BHU in DIC as a HUB position**

BHU will be taking care of the multidimensional Design & Innovation projects and spaces respectively in the area of Agriculture, Food processing, Art & Culture, Health, Humanities, Fashion for Apparel - Handicraft, Aesthetics, Ethics, Values, Content development, Print Media, Web, and content management support.

**Role of IIT (BHU) in DIC as a HUB position**

IIT (BHU) will specifically be taking care of Technological and Engineering aspect related to Design and Innovation projects, course and further, will be mainly involved in Processing and Final developmental of the projects.
### Deliverables

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Deliverables</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Patent and Design Registration</td>
<td>4 3 7</td>
<td>6 6 12</td>
<td>8 8 17</td>
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<td>2</td>
<td>Prototype</td>
<td>1 3 7</td>
<td>6 6 12</td>
<td>8 8 17</td>
</tr>
<tr>
<td>3</td>
<td>Innovative Ideas (Conceptual)</td>
<td>4 6 10</td>
<td>8 8 16</td>
<td>8 8 17</td>
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</tbody>
</table>

### Financial assistance required for 3 years

Recurring and Non Recurring Grants (in Lakhs)
- **for HUB institutions**: 760 lakhs
- **for Spoke institutions**: 300 lakhs

**Recurring Grants for HUB**

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Budget Head</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Consumable materials for realization of projects</td>
<td>10</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>(Chemical and Biochemical materials, Electrical, Electronic, Mechanical Component, Instrument and Medical Devices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Staff requirement</td>
<td>10</td>
<td>30</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>(Technician, NonTechnical Staff, Research Associate, Ministerial on contract basis for 3 years) Electrical - 2, Non-Tech - 5, Field - 3, Ministerial - 3, Other Assistant - 2 (wherever necessary is an outlier for non-section/Division and cannot staff will be incentive)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>Resource Persons for IRC</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>(Adjunct Faculty, Guest Faculty, Invited lectures, Entrepreneur, Industry/Research)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4</td>
<td>Training, Travel and Workshops</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>5</td>
<td>Fixing and Renovation</td>
<td>30</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>Sub Total</td>
<td>150</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>7</td>
<td>Total</td>
<td>390</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Financial assistance required for 3 years

#### Non Recurring Grants for HUB

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Budget Head</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>ICT Equipment (Computer workstation, display, network infrastructure, servers)</td>
<td>75</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td>LABS, Publication Lab, PCD Readers, Printing Lab, CNC, 3D printer etc., Simulation Lab</td>
<td>50</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>HIRS, AMITLAB etc., Innovation Gallery, Display (Display stands, Upgrades)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Graphics and Digital Media Lab, Video Studio (Editing, Camera, Video Editing, etc.)</td>
<td>20</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>4</td>
<td>Contingency / recurring expenses</td>
<td>20</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>Sub Total</td>
<td>145</td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>6</td>
<td>Total</td>
<td>310</td>
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#### Required Financial Assistance SUMMARY

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Budget Head</th>
<th>2015-16</th>
<th>2016-17</th>
<th>2017-18</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Recurring Grant</td>
<td>150</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>2</td>
<td>Non Recurring Grant</td>
<td>145</td>
<td>95</td>
<td>80</td>
</tr>
<tr>
<td>3</td>
<td>Spokes (Recurring and Non Recurring Grants)</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>4</td>
<td>Sub Total</td>
<td>395</td>
<td>305</td>
<td>300</td>
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<tr>
<td>5</td>
<td>Total (Rupees one thousand lakhs)</td>
<td>1000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Proposed Course Outline

(As per approval of IIC project by NRRAI at NRRAI, all proposed courses will be widely discussed at different academic forums of the centres involved and after approval by NRRAI academic and administrative experts. Academic Council, Executive Council, Senate, etc.)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Institute Name</th>
<th>Course Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Banaras Hindu University</td>
<td>Design and Innovation in Agriculture and Food Technology</td>
</tr>
<tr>
<td>2</td>
<td>Indian Institute of Technology (BHU)</td>
<td>Design and Development of Instrumentation and Sensor Technology</td>
</tr>
<tr>
<td>3</td>
<td>BHU &amp; IIT (BHU) DIC</td>
<td>Design and Innovation in Handicraft Technology</td>
</tr>
<tr>
<td>4</td>
<td>Mahatma Gandhi Kashi Vidyapeeth - Varanasi</td>
<td>Design and Innovation for Regional Food (Sweets) Industries</td>
</tr>
<tr>
<td>5</td>
<td>Motilal Nehru National Institute of Technology - Allahabad</td>
<td>Innovation in Transnational Health and Bio-Entrepreneurship</td>
</tr>
<tr>
<td>6</td>
<td>Indian Institute of Information Technology - Allahabad</td>
<td>Innovation and Design in Language Technologies</td>
</tr>
</tbody>
</table>

All proposed courses will be under existing educational structure which may be one of the following formats:

- Open ended courses (starting in the winter season)
- Certificate/Courses for specific skills and knowledge (using engineering programmes and IIC's PG courses offering specialisation in Design and Innovation)
- Certificate Course for Students who have completed their degree courses in engineering disciplines (specialising in Design and Innovation)

PG UG Diploma 2 years of duration each, with one year as pre-exposure and one year as a course for the final year of UG.
Thanks for your time and consideration and providing us an opportunity.
Project proposal for BHU and IIT (BHU) Design Innovation Centre
Project proposal for the setup of
Design and Innovation Centre

at

Banaras Hindu University
and
Indian Institute of Technology (BHU)
Varanasi 221005, UP, INDIA

with Spokes

Mahatma Gandhi Kashi Vidyapeeth (MGKVP), Varanasi
(State University)

Indian Institute of Information Technology (IIIT), Allahabad
(Centrally funded Technical Institutes)

Motilal Nehru National Institute of Technology (MNNIT) Allahabad
(Centrally funded Technical Institutes)
Banaras Hindu University and Indian Institute of Technology (BHU) –
BHU the ‘Capital of Knowledge’ and IIT (BHU) with mantra ‘Education is Character’

‘Being university and technical institute we are having very good platform to support multidisciplinary approach of Design and Innovation.’

Banaras Hindu University was conceived as a residential university, keeping in view its objective of complete character development and through mentoring of students. Perhaps this is the only university in the world where courses ranging from Nursery and primary school up to Doctoral/ Post-doctoral degrees are taught and pursued within a walled campus spread over 550 Hectares (1360 acres) with majestic buildings of great architectural delight. It enshrines within its precincts, a phenomenal range of teaching disciplines incorporating almost all conceivable subjects under 4 Institutes, 18 faculties and more than 180 departments, different Centres and labs of Science, Engineering & Technology, Medical Education, Environment studies, Humanities, Social Science, Commerce, Law, Education, Visual Arts, Performing Arts, Sanskrit Vidya Dharam Vigyan, Agriculture, Library Science, Journalism and a large number of Indian and Foreign Languages.

Existing setup and efforts in the direction of Design and Innovation
BHU and IIT (BHU) have already been contributing in various dimensions of Research, Design development and Innovation from the grass root level to higher end projects. For the last 20 years there have been more than 100 patents in different disciplines.

BHU: Institute of Agricultural Sciences is Nodal Centre for Agricultural Innovation Partnership under USAID programme with several US Universities - Cornell, Georgia, Buffalo, UC Davis, Ohio, Tuskegee, Purdue and Illinois. Institute of Medical Sciences has contributed in some of the major health research and innovation areas from last more than 50 years.

IIT (BHU): IIT (BHU) has already started working on the concept of “Practice Theory Practice”. Project Varanasi a multi-dimensional project is also in process and further IIT (BHU) lead Malaviya Centre for Innovation, Incubation and Entrepreneurship – MSIIIE has also been actively addressing the design and innovation requirement.

Existing facilities and Infrastructure available at BHU and IIT (BHU) for Realization of DIC : The existing infrastructure available at BHU and IIT (BHU) will also be of great help in the facilitation of DIC.

(some of the labs which will be associated with DIC)
IIT Workshops  IIT Chemical & Biochemical labs  IIT Electronics labs
BHU Computer Center  Science Labs  Prototype Lab
Modeling Lab  Technology Centre  Faculty of Visual Arts
Faculty of performing Arts  BHU Press  Science Labs
Different Studio, Lab and Classrooms from the BHU and IIT (BHU) as per requirement will be used by DIC as per norms.

Apart from the existing setup we need some minimum setup exclusively for DIC to create and sustain the environment of Design and Innovation.
Structure of Proposed BHU – IIT (BHU) Design Innovation Centre

Design Innovation Centre (DIC) is a joint proposal of the Banaras Hindu University (BHU) and collaboration with Indian Institute of Technology – IIT (BHU) to be funded by Department of Higher Education, Ministry of Human Resource Development, Government of India.

Role of BHU in HUB position: BHU will be taking care of the multidimensional Design & Innovation projects and courses respectively in the area of Agriculture, Food processing, Art & Culture, Health, Humanities, Branding for Artisans - Handicrafts (Aesthetics, Ethics, Values, Print Media, Web and management support).

Role of IIT (BHU) in HUB position: IIT (BHU) will specifically will be taking care of Technological and Engendering aspect related to Design and Innovation projects and course and further, will be mainly involved in Prototyping and final development of the projects.

OBJECTIVES

The BHU - IIT (BHU) Design Innovation Centre is to provide a platform to students and faculty members having zeal for learning and creativity, and passion to convert their creative ideas into significant, more viable design innovations.

At present it felt that there is need of Design Innovation Centre at BHU - IIT (BHU) campus the motive for same is "To assist design and development of feasible projects at the department and DIC itself", of course the other benefits derived from same will be enhanced with hands on experience and realization of good working projects.

The basic purpose of setting up BHU - IIT (BHU) Design Innovation Centre is to promote:
- Culture of innovation and creative problem solving.
- Knowledge sharing and collaboration amongst industry, academia, government Institutions, research laboratories, etc.
- To focus interdisciplinary design focused innovation and creativity.
- To facilitate evolution of new models of academia - industry interactions as well as academia-social interactions and develop institutional networks for innovations in the thematic areas.

Besides above said parameters DIC will also work for its sustainability.
- Coordination for Intellectual Property Rights (IPR) works.
- Establish an Innovation gallery where earlier, current and future works (Patents, Prototypes, Ideas generation) of Design and Innovation will display for further research.
- Provide Digital Media facility for Students, Faculty and Artisans of local area including Web Design, Short Films, Animation films and educational contents, E-content development, Mobile Applications, Branding and Marketing for its innovative works.
- Facilitate to Artisans and local entrepreneur about Design and Innovation.

MAIN FOCUS: The present DIC is planned with multidisciplinary approach, and will be focusing mainly on the following key areas of social and national importance.

Agriculture, Art & Culture, Energy, Environment, Language and Computing, Science and Technology
Hub and Spoke model

Indian Institute of Information Technology (IIIT) Allahabad

Existing DICs

Open Design School

BHU & IIT(BHU)
Design Innovation Centre

Science & Technology

Art and Culture

Language and computing

Energy

Health

Environment

Motilal Nehru National Institute of Technology (MNIT) Allahabad

Mahatma Gandhi Kashi Vidyapeeth (MGKVP) Varanasi

IIT-BHU Design Innovation Centre. A proposal by BHU – IIT(BHU), Varanasi 221005, UP, INDIA
Deliverable
It is focused on providing current tools related to qualitative and ethnographic research, interdisciplinary and design thinking geared toward innovation processes applicable to society and industry. We see innovation as a process of continually addressing users’ real and changing needs in order to improve quality of life through products, services, experiences and new tools.

Year wise details for Deliverable of DIC from HUB and Spokes (expected)

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Deliverables</th>
<th>2015-16 Spoke</th>
<th>2016-17 Spoke</th>
<th>Total</th>
<th>2015-16 HUB</th>
<th>2016-17 HUB</th>
<th>Total</th>
<th>2017-18 Spoke</th>
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<tr>
<td>1</td>
<td>Patent and Design Registration</td>
<td>4</td>
<td>3</td>
<td>7</td>
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<td>12</td>
<td>8</td>
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<td>2</td>
<td>Prototype</td>
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<td>12</td>
<td>8</td>
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<tr>
<td>3</td>
<td>Innovative Ideas (constructive)</td>
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<td>10</td>
<td>8</td>
<td>8</td>
<td>16</td>
<td>8</td>
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<td>3</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

*(as per university/institute/UGC/ MHRD and other government norms)

Sustainability: After 3rd year Centre will generate revenues with Small and Medium Scale Industries, Self Entrepreneurs and Academia through facilitating design in prototyping of different projects, and consultancies.

USP of the Centre
We will create a fast moving system for design registration through Indian Patent Office and best place of innovation for everyone.

BUDGET: BHU-IIT (BHU) Design Innovation Centre (DIC) will be established as ‘Hub and Spoke’ model with the lead institution identifying 1-3 partner institution(s). The partnership would be based on the objectives being pursued by the institution(s).

As this is a joint proposal by two institutions BHU and IIT(BHU), the funds (50% shared equally) will be managed by the two institutions with its Spoke partners as per the guideline provided by MHRD, but a single consolidated utilization certificate will be submitted. Expenditure of the same will be done through BHU and IIT (BHU) mechanism. This is to take care of financial procedures. Planning and execution will be done on projects as outlined here in coordinated way.

Major requirements for the establishment of DIC
Present Place: BHU or IIT (BHU) Workshop/ Lab
Require Labs:
1. Digital Computer Lab (Software)
2. Rapid Prototype Lab (Experiment)
3. Brainstorming/ Idea Generation Lab (Discussions)
4. Conference Lab (Idea Sharing through Virtual and Social world)
5. Digital Imaging and Graphic Lab (Design)
6. Fabrication Lab - PCB Lab etc.
7. Simulation Lab - HPRO, MATLAB etc.
8. Innovation Gallery – Display
Recurring and Non Recurring Grants for 3 Years
700 lakhs for HUB (50% equally shared)
300 lakhs for Partner Institutes (Spokes)

Recurring Grants (Rs. In Lakhs)

<table>
<thead>
<tr>
<th>Budget head</th>
<th>2014-15</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumable materials for realization of projects</td>
<td>30</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>(Chemical and Bio-chemical materials, Electrical, Electronics Mechanical Components, Biomedical and Medical devices)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Staff requirement</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>(Technical, Non Technical, Field, Research Associates, Ministerial) on contract basis for 3 years (Technical - 2, Non-Technical - 3, Field – 3, Ministerial – 3, Office Assistant – 2 (these number may increase as subject for requirement) Students and current staff will be involve (Stipend, Fellowship and Scholarship).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resource Persons for DIC</td>
<td>30</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>(Adjunct Faculty, Guest Faculty, Invited Lectures, Entrepreneur, Industry Resource)</td>
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</tr>
<tr>
<td>Training, Travel and Workshops</td>
<td>30</td>
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</tr>
<tr>
<td>Furnishing and Renovation</td>
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<td>Sub Total</td>
<td>150</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>390</td>
</tr>
</tbody>
</table>

Financial Assistance: Non-Recurring Grants (Rs. In Lakhs)

<table>
<thead>
<tr>
<th>Budget head</th>
<th>2014-15</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT Equipment</td>
<td>75</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>(Computer, workstations, display, network infrastructure, storage infrastructure, plotter, printers, photocopiers etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LABS</td>
<td>50</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Fabrication Lab - PCB Lab etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prototyping Lab - CNC, 3D printer etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simulation Lab - HPRO, MATLAB etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovation Gallery - Display (Display tables, lights etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Graphic and Digital Media Lab – Audio-Video editing etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Camera (Still and Video, Editing Tables, Audio and Video lab etc.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contingency/ enforcing expenses</td>
<td>20</td>
<td>20</td>
<td>15</td>
</tr>
<tr>
<td>Sub Total</td>
<td>145</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td>310</td>
</tr>
</tbody>
</table>
Summary

<table>
<thead>
<tr>
<th>Type</th>
<th>First Year</th>
<th>Second Year</th>
<th>Third Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recurring Grant</td>
<td>150</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Non Recurring Grant</td>
<td>145</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>Partner Institutes (Spokes)</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>(Recurring and Non-Recurring Grant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>395</td>
<td>305</td>
<td>300</td>
</tr>
<tr>
<td>Grand Total</td>
<td></td>
<td></td>
<td>1000</td>
</tr>
</tbody>
</table>

(Rupees one thousand lakhs)

Proposed Course Outline

(After approval of DIC project by MHRD all proposed courses will be widely discussed in different academic forums of the concern Institutes (HUB and Spokes) and duly approved by our academic and administrative bodies (Academic Council, Executive Council, Senate and others) and there be a chance of minor to major changes in these course, but all courses will be discussed and approved as per the guideline of UGC/ MHRD).

Proposed Six Courses structure to be run by Hub and Spokes

1. **Banaras Hindu University** (HUB)
   Design and Innovation in Agriculture and Food Technology

2. **Indian Institute of Technology - BHU (HUB)**
   Design and Development of Instrumentation and Sensor Technology

3. **BHU - IIT (BHU) DIC**
   Design and Innovation in Handicraft Technology

4. **Mahatma Gandhi Kashi Vidyapeeth (MGKVP), Varanasi (Spoke)**
   Design and Innovation for Regional Food Industries (Sweet and Street Foods)

5. **Indian Institute of Information Technology (IIIT), Allahabad (Spoke)**
   They will be running course and projects in the Designing and Innovations in Language Technologies.

6. **Motilal Nehru National Institute of Technology (MNIIT) Allahabad (Spoke)**
   They will be contributing in the area of Medical Diagnostics and Research with aim to providing routine and critical diagnostic services as well as to develop skills of scientific research to solve complex medical issues with advanced diagnostic facility under stringent ethical regulation and good laboratory practices. Course by them will be run in the area of ‘Translational Health and Bio-Entrepreneurship’.

All proposed courses will run under existing educational structure which may be in one of the following formats:

- Open credit courses leading to minor area *(will be implementing immediately in the existing engineering programmes in UG & PG levels by offering courses on Design and Innovation)*
- Certificate Course plan for Summer and Winter workshops and trainings.
• Short term course of duration 2-4 weeks *(Especially targeting teaching and technical staff.*
• PG Diploma (One to one & half year) – *proposed programme will be run by DIC for its sustainability and it’ll start from the 2\textsuperscript{nd} year of DIC.*
• Ph. D. thesis
  (These courses will run as per UGC/MHRD/University and Institutes norms).

**Course Format:** Core Courses, Elective Course, Thesis and Prototyping

**Intake** - 40 students
Intake will be come from HUB, Spokes, existing DICs and their spokes and open to all as per rules.

**Contact person from HUB:**

**Director**  
Indian Institute of Technology  
Banaras Hindu University  
Varanasi 221005  
E: director@iitbhu.ac.in

**Nodal Persons:**
Banaras Hindu University  
**Dr. Manish Arora**  
Assistant Professor  
Department of Applied Arts  
Faculty of Visual Arts  
Banaras Hindu University  
Varanasi 221005  
E: rmanish1973@yahoo.co.in  
M: 09307627818

IIT (BHU)  
**Dr. Neeraj Sharma**  
Associate Professor  
School of Bio-Medical Engineering  
Indian Institute of Technology  
Banaras Hindu University  
Varanasi 221005  
E: neeraj.bme@iitbhu.ac.in  
M: 09235633730

**Contact person from Spokes:**
MGKVP – Varanasi  
**Professor Om Prakash Singh**  
Director, Madan Mohan Malaviya Institute of Hindi Journalism  
Mahatma Gandhi Kashi Vidyapeeth  
Varanasi 221002, UP, INDIA  
M: 9415694457  
E: opmg7@hotmail.com

IIIT – Allahabad  
**Professor Sudip Sanyal**  
Dean (Faculty Affairs)  
Indian Institute of Information Technology (IIIT)  
Deoghat, Jhalwa  
Allahabad – 211012  
UP, INDIA  
M: 09415235180  
E: ssanyal@iiita.ac.in

MNIIT - Allahabad  
**Dr. Shivesh Sharma**  
Associate Professor  
Department of Biotechnology  
Motilal Nehru Institute of Technology (MNIIT)  
Allahabad – 211004  
UP, INDIA  
T: 0532 – 2271232 (O), 2271749 (R)  
M: 09005688273  
E: ssnvsharma@gamil.com
Sample course outline
Art and Culture
(one topic or combination from followings)
2. Tribal and Adivashi cultural aspects with language and aesthetics.
3. Innovations in Handloom Designs including Aesthetics and ethical values. (Weaving, Handicrafts, Textile, Carpet, Wooden Toys, Pottery etc.)
4. Ethics and Human values in Innovation and Design.
5. Language relationship and innovation in Literature (Hindi, Urdu, Bhojpuri, Tribal (Adivashi) and Awadhi)
6. Rural languages and its Cultural phenomena during Festivals and functions (marriage, birth etc.)
7. Architecture, Hospitality, Exhibition, Retail, Display, Tribal Art, Culture, Language, Handicrafts with Technological innovations to relate with Society or Tribal Agricultural innovation challenges
8. Design and Innovation in Visual Arts and Performing Arts
9. Frugal Innovation in Art, Culture, Science and Technology with aesthetics and ethical values aspects.

Design
Core Courses may be:
1. Human-Cantered Design
2. Design Research
3. Design Communication and Methods
4. Design Strategy
5. Embedded system based design
6. Engineering system design

Elective Courses may be selected on the basis of area of specialization:
1. Industrial Design
2. Visual Communication
3. Animation
4. Interaction Design
5. Automotive Design
To,
The Director
IIT(BHU),
Varanasi

Sub: for Design Innovation centre (DIC).

Sir,

This is to inform you that Dr. Manish Arora nodal person for Design innovation centre (DIC) For IIT(BHU) has discussed on above program me on the behalf of you. As per consent of Vice - chancellor, M.G. Kashi vidyapith for spoke partner in above scheme and MM Institute of Journalism MGKVP Now agree for Design innovation centre. Our thrust area mentioned bellow:-

1. Traditional Centres.
2. Consumer requirements.
3. Sweets / Traditional foods
4. Social Need

We are sending the letter for necessary action

Thanking to you

copy for

1. VC, MGKVP, Varanasi
2. drmanish1973@yahoo.co.in

Date: 12/01/2015

(Prof. Om Prakash Singh)
Professor & director
Prof. Rajeev Sangal  
Director   
IIT (BHU), Varanasi

Subject: Invitation as participating Institute for the setup of Design Innovation Centre (DIC).

Dear Sir,

With reference to your letter Number BHU-IIT (BHU)/DIC/SSV-VNS/2014-15/10/26310 dated 10th June, 2014 regarding setting up of Design Innovation Centre (DIC), it is to inform you that the Institute is willing to participate as a spoke partner of this centre for the betterment of education and society. This effort will also help in knowledge sharing, inculcate the culture of innovation among students and others stockholders to take their ideas from the lab to people.

The Institute has constituted the following committee to work as spoke partner in the area of Science & Technology, Health & Medicine and other allied discipline:

- Dr. Shivesh Sharma (Chairman)
- Dr. Rajeev Srivastava (MED)
- Mr. Ritesh Sahu (Dy. Librarian), Central Library
- Medical Officer, (Health Centre)

For any further details, Dr. Shivesh Sharma (Mob. 9415014457; Email: shivesh@mnit.ac.in) may be contacted.

With regards,

(P. Chakrabarti)
To
Professor Rajeev Sangal
Director, IIT BHU
Varanasi

Subject: Regarding – Partnering in of IIIT Allahabad & IIT BHU in the ‘Project on Innovation & Design’

Dear Professor Sangal,

Greetings for the New Year 2015……!

It is a matter of pleasure to be informed that IIIT Allahabad & IIT BHU are partnering in the ‘Project on Innovation & Design in the area of Language Technologies’. I hope that this collaborative initiative between our two institutions will pave the way for future work in frontier areas of technology.

The Indian Institute of Information Technology, Allahabad will extend full cooperation and support to this project, Prof Sudip Sanyal will be coordinating along with his team from our side.

With Best regards,

Yours Sincerely,

(Somenath Biswas)
Director, IIIT Allahabad

CC:

- Dr. Manish Arora
  IIT BHU, Varanasi
- Prof. Sudip Sanyal
  Dean (Faculty Affairs)
A Project Proposal
for
Design Innovation Centre

Submitted To
Department of Higher Education, MHRD, GOI
Shastri Bhavan, New Delhi- 110 115

Under
'National Initiative for setting up of 20 Design Innovation Centre (DIC), Open Design School (ODS) and National Design Innovation Network (NDIN) during XII five year plan'

Prof. Wasudeo N. Gade
The Vice Chancellor
Savitribai Phule Pune University,
(Formerly University of Pune)
Pune- 411 007

Prof. Dilip D. Dhavale, P. A. Sc. F. N.A.Sc.
Coordinator, Design Innovation Centre
Head, Department of Chemistry
Savitribai Phule Pune University
Pune- 411 007

13th January, 2015

SAVITRIBAI PHULE PUNE UNIVERSITY
(Formerly University of Pune)

❖ Established on 10th February, 1949, Comprises 46 academic departments (CAS 08; SAP 14;
DST-FIST 08), 307 recognized research institutes and 689 affiliated colleges offering graduate and under-graduate courses to 720,000 students.
❖ NAAC accredited with 'A'-Grade and Re-accredited with 'A' Grade in 2011
❖ Recognized as 'University with Potential of Excellence' (UPE Program)
❖ Received special funding from DST- INSPIRE, DST-PURSE program and UGC -12th Plan
❖ Recognized as 'Centre for Excellence in Renewable Energy' (MNRE, GoI)
❖ Received 'e-Governance Award' from Govt., of Maharashtra.
❖ Obama –Singh 21st Century award for 'Women Studies and Development'
❖ International collaboration: Erasmus Mundus, Gottingen, Penn state University etc.,
❖ Largest number of international students from 105 countries.
❖ Signed MoU with NSDS - introduced skill based program
❖ Implemented credit and grading system
**Spoke Centers**

**Vigyan Ashram – Pabal, District Pune**
- Spoke center located in a drought prone village (70 km from Pune)
- Focus area: Energy, Agriculture and Post Harvest Technology
- Network of farmers and SHG (Self Help Group especially for women)
- Training to rural youths in establishing small enterprises
- Implementing diploma in basic rural technology and digital fabrication
- Conducting pilot testing of the developed technologies

**Ahmednagar**
- Zilla Maratha Vidya Prasarak Samaj Building, A. Nagar
- Sub center located in drought prone area (120 km from Pune)
- 100 hectares of land under development for this activity
- Established network with farmers and students through NSS program
- Running Community college and Vocational Courses
- Support to Conduct Pilot Testing for proposed technology

**Nashik**
- Municipal Corporation Building, Nasik
- Sub center located in tribal area (250 km from Pune)
- 100 hectares of land under development for this activity
- Established network with farmers and students through NSS program
- Running Community college and Vocational Courses
- Support to Conduct Pilot Testing for proposed technology

---

**NEW INTERDISCIPLINARY COURSES PROPOSED**

<table>
<thead>
<tr>
<th>No.</th>
<th>Course Titles</th>
<th>Course Details</th>
<th>Crop/Time</th>
<th>Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Introduction to basics of rural development technology</td>
<td>Energy: energy audit of home, technology for LED, solar energy for PUC; Agriculture: soil properties and testing, approaches for improving soil quality, agricultural tools &amp; techniques; Food processing: food preservation techniques, equipments, importance of hygiene, cost control, quality and nutritional control, technology to small scale food vendors and SHG (Vigyan Ashram, Pabal)</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>II</td>
<td>Introduction to Digital fabrication and Robotics</td>
<td>Computer-aided design, manufacturing and modelling, tools for digital fabrication, electronic design and production (Practical based training); Introduction to robot; Designing, assembling, testing and installation skill development and creating manpower for working on robot (Vigyan Ashram, Pabal)</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>III</td>
<td>Primer to Drug Discovery and Development</td>
<td>Methods and process involved in discovery of new drugs and pharmaceutical development</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>IV</td>
<td>Application methods in Geosciences</td>
<td>Develop skills in handling equipment related to survey of water, soil, rocks, create manpower in Geology and Geological Surveying and Mapping</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>V</td>
<td>Industrial safety and general Awareness</td>
<td>Understanding awareness for and developing manpower related to industrial safety and general Awareness (Nashik)</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>VI</td>
<td>Environmental audit</td>
<td>Awareness of Environment quality; skills in Environmental and Water Auditing; occupational safety; creating manpower in Air and water pollution monitoring</td>
<td>4</td>
<td>6 months</td>
</tr>
<tr>
<td>VII</td>
<td>Introduction to Applications of Plant Biotechnology</td>
<td>Plant growth promoting organisms, food processing, Micropropagation and commercial Cultivation, create manpower related to this (Ahmednagar)</td>
<td>4</td>
<td>6 months</td>
</tr>
</tbody>
</table>

Contribution of spoke centers: The courses will be conducted with the help of expertise at the spoke centers.
### Prototypes To Be Developed: Innovative Research Areas

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>13 months</td>
<td>Preparation of Low weight solar panels &amp; Testing of life span</td>
<td>Collection, isolation of plant grown promoting microbes (PGNM) with abiotic stress tolerance (heat stress) &amp; Identification and characterization of PGNM</td>
<td>Synthesis of precursors and stabilizing material A trimolecular conjugated polymer using biocompatible lipids</td>
</tr>
<tr>
<td>24 months</td>
<td>Prototype e-bicycles with solar charging backup</td>
<td>Culture, mass multiplication, formulation development, green house trials for PGM</td>
<td>Induction of single and multivalent vaccine antigens encapsulated nanoparticles with crosslinking agents and their characterization using SEM, NIR, FTIR etc. &amp; In vitro study in vitro release of encapsulated vaccine, and its release kinetics mechanisms in artificial gastric and intestinal medium</td>
</tr>
<tr>
<td>18 months</td>
<td>Generating a DPR by making a survey of potential buyers of such bicycles &amp; identifying different potential manufacturers</td>
<td>Field testing at different geographical locations involving ‘Spoke Centre’</td>
<td>To determine drug permeation in target cell, in vitro cell cytotoxicity, cellular uptake and stability In-vivo study (study of immune response, antibodies action and potency of multivalent vaccine) using suitable animal models</td>
</tr>
<tr>
<td>Industry partner: PV Energy Experts</td>
<td></td>
<td>Industry Partner: Swan Enterprises, Mumbai</td>
<td>Industry Partner: Serum Institute of India</td>
</tr>
</tbody>
</table>

**Energy**

![Energy](image)

**Environment**

![Environment](image)

**Health**

![Health](image)

### Staff Salary for DIC functioning and honorarium for visiting faculty for PG courses (Breakup of Cost)

<table>
<thead>
<tr>
<th>Staff (Salary per month)</th>
<th>I Year (Rs)</th>
<th>II Year (Rs)</th>
<th>III Year (Rs)</th>
<th>Total Amount (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director @1,60,000/- pm</td>
<td>12,00,000/-</td>
<td>12,00,000/-</td>
<td>12,00,000/-</td>
<td>36,00,000/-</td>
</tr>
<tr>
<td>Coordinator @60,000/- pm</td>
<td>7,20,000/-</td>
<td>7,20,000/-</td>
<td>7,20,000/-</td>
<td>21,60,000/-</td>
</tr>
<tr>
<td>Technical Assistant @25,000/- pm</td>
<td>3,00,000/-</td>
<td>3,00,000/-</td>
<td>3,00,000/-</td>
<td>9,00,000/-</td>
</tr>
<tr>
<td>Clerk @15,000/- pm</td>
<td>1,80,000/-</td>
<td>1,80,000/-</td>
<td>1,80,000/-</td>
<td>5,40,000/-</td>
</tr>
<tr>
<td>Peon @10,000/- pm</td>
<td>1,20,000/-</td>
<td>1,20,000/-</td>
<td>1,20,000/-</td>
<td>3,60,000/-</td>
</tr>
<tr>
<td>Honorarium For Visiting Faculties (As per UoP norms)</td>
<td>11,50,000/-</td>
<td>11,50,000/-</td>
<td>11,50,000/-</td>
<td>34,50,000/-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36,70,000/-</strong></td>
<td><strong>36,70,000/-</strong></td>
<td><strong>36,60,000/-</strong></td>
<td><strong>110,00,000/-</strong></td>
</tr>
</tbody>
</table>
Total Estimated cost of indicative principal components of one Design Innovation Centre
(Year wise breakup of cost)

<table>
<thead>
<tr>
<th>S. No</th>
<th>Budget Heads</th>
<th>1 Year (Lakhs)</th>
<th>II Year (Lakhs)</th>
<th>III Year (Lakhs)</th>
<th>Total Amount (Lakhs)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(A) Non-Recuring: Equipments for the Innovation Research Proposals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Proposal (A)</td>
<td>13.0</td>
<td>-</td>
<td>-</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Proposal (B)</td>
<td>55.60</td>
<td>-</td>
<td>-</td>
<td>55.60</td>
</tr>
<tr>
<td></td>
<td>Proposal (C)</td>
<td>97.0</td>
<td>-</td>
<td>-</td>
<td>97.0</td>
</tr>
<tr>
<td></td>
<td>Total (A) Non-recuring</td>
<td>165.6</td>
<td>-</td>
<td>-</td>
<td>165.6</td>
</tr>
<tr>
<td></td>
<td>(B) Recurring</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Students Fellowships/Internships, Consumables, Contingency and Other Recurring Expenses For Research Proposals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposal (A)</td>
<td>17.20</td>
<td>11.40</td>
<td>8.40</td>
<td>57.00</td>
</tr>
<tr>
<td></td>
<td>Proposal (B)</td>
<td>25.32</td>
<td>25.32</td>
<td>25.32</td>
<td>75.96</td>
</tr>
<tr>
<td></td>
<td>Proposal (C)</td>
<td>20.16</td>
<td>20.16</td>
<td>21.32</td>
<td>61.44</td>
</tr>
<tr>
<td></td>
<td>Total (B) Recurring</td>
<td>62.68</td>
<td>56.88</td>
<td>54.84</td>
<td>174.4</td>
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<tr>
<td></td>
<td>(C) Other Recurring Expenses</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>3.</td>
<td>Concept Development, mock-up models and prototyping expenses</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>60.00</td>
</tr>
<tr>
<td>4.</td>
<td>Staff salary and Honorarium for visiting faculty</td>
<td>36.70</td>
<td>36.70</td>
<td>36.60</td>
<td>110.00</td>
</tr>
<tr>
<td>5.</td>
<td>Travel &amp; Field Trial related expenses</td>
<td>20.00</td>
<td>15.00</td>
<td>15.00</td>
<td>50.00</td>
</tr>
<tr>
<td>6.</td>
<td>Workshops, Training &amp; Outreach</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>60.00</td>
</tr>
<tr>
<td>7.</td>
<td>Creation of Innovation at partner institute under Hub &amp; Spoke model</td>
<td>140.00</td>
<td>120.00</td>
<td>120.00</td>
<td>380.00</td>
</tr>
<tr>
<td></td>
<td>Total (C)</td>
<td>236.70</td>
<td>211.70</td>
<td>211.80</td>
<td>660.00</td>
</tr>
<tr>
<td></td>
<td>Total Amount in Lakhs (A+B+C)</td>
<td>3000.0 Lakhs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total Amount in Crore (Rs)</td>
<td>30.00 Crore (Rs)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Acknowledgement

- We are grateful to Department of Higher Education, Ministry of Human Resources and Development.
- Review Committee members for valuable suggestions and inputs.

THANK YOU!
A Project Proposal

for

Design Innovation Centre

at

Savitribai Phule Pune University

Submitted To

The Government of India
Ministry of Human Resource Development
Department of Higher Education,
Shastri Bhavan, New Delhi- 110 115

Under

‘National Initiative for setting up of 20 Design Innovation Centre (DIC), Open Design School (ODS) and National Design Innovation Network (NDIN) during XII five year plan’

Submitted by

Savitribai Phule Pune University,
Pune- 411 007, Maharashtra, India

July, 2014
PROPOSAL FOR THE DESIGN INNOVATION CENTRE

Introduction:

The Savitribai Phule Pune University (SPPU) is one of the most distinguished Universities in India with student strength of over 6.5 lakhs, studying in more than 53 PG Departments, 668 Affiliated colleges, 259 Recognized institutes and more than 200 Recognized research centers. It is one of the largest universities in the world. University is re-accredited with “A” grade by NAAC and recognized as “University with Potential for Excellence (UPE)”. In addition to regular Arts, Science and Social science departments, University has the interdisciplinary State of the Arts Research Centre like, Centre for Women studies, Centre for Social Science and Humanities, Department of Technology (in collaboration with Industries) and Skill Development Centre.

The SPPU runs number of courses for post-graduate programme in the area of basic sciences, social sciences, humanities, arts and languages. In addition, the SPPU runs under graduate programme in Biotechnology and Bio-informatics. There are number of certificate and diploma courses that are being conducted for under graduate studies.

The SPPU is one of the largest universities in Maharashtra. It is spread over three districts namely Pune, Ahmednagar and Nashik with more than 660 affiliated colleges. This gives opportunity to the Savitribai Phule Pune University to act as a ‘HUB’ with ‘SPOKES’ at three sub - centers at Ahmednagar, Nashik and Pune rural area (Baramati) as mentioned below:

The ‘SPOKE’ Centers Identified are:

1. Ahmednagar Centre
   The Director,
   Ahmednagar Sub-Centre of Savitribai Phule Pune University
   Ground Floor, Zilla Maratha Vidya Prasarak Samaj Building,
   Lal Taki Road, Ahmednagar- 414 003
2. **Nashik Centre**
   
   The Director,
   
   Nashik Sub-Centre of Savitribai Phule Pune University
   
   3rd Floor, Municipal Corporation Building,
   
   Near HDFC Building
   
   Nashik- 422 002

3. **Pune Rural area Centre at Baramati**

   The Director,
   
   BCUD, Savitribai Phule Pune University,
   
   Pune- 411007

These ‘SPOKES’ are now recognized as sub-centers under SPPU. The Government of Maharashtra, has given land of about 100 acres for the development of these centers.

The Savitribai Phule Pune University has a credential to be of Excellence in Teaching and Research. Recent DST, New Delhi report indicates its H-index more than sixty. The SPPU has also shown ways in leading number of courses in all discipline. The courses can be taken by students of all affiliated colleges of SPPU. These courses will be more practical oriented. This will help students to think independently. In the practical sessions students will execute some new ideas along with the theory guidance. The courses will help to develop innovative ideas in flexible manner while developing a holistic and well groomed graduate. The same courses will be offered at the three ‘SPOKES’ at Ahmednagar, Nasik and Pune rural Area (Baramati). The Savitribai Phule Pune University is willing to take a lead in this respect.

The Proposed courses have been approved by the Academic Council of the University. Affiliated colleges and Campus Departments of all Sub Centers will run this activity. In every academic year, the SPPU will review the feasibility of courses with the ‘SPOKES’ and will introduce some new courses as per the need of the hour. Thus, sub-centers and affiliated colleges are well prepared to run these courses. With this scenario, we intend to be a highly productive DIC.
The SPPU proposes following areas under DIC:

(1) INNOVATION AREAS FOR RESEARCH:

A. Development of Low Weighing Solar Panels for Electric Bicycle

B. Development of Bioinoculants for Application in Agricultural Soils of Maharashtra

C. Development of Receptor Targeted Vaccine Delivery System against Diphtheria, Tetanus, Pertussis, *Haemophilus influenzae* and Hepatitis b Infections’

(2) NEW INTERDISCIPLINARY COURSES PROPOSED

I. Introduction to Applications of Plant Biotechnology (4 credits)

II. Primer to Drug Discovery and Development (4 Credits)

III. Application methods in GeoSciences (4 Credits)

IV. Industrial safety and general Awareness (4 credits)

V. Environmental audit (4 credits)

VI. Analytical Techniques (Chromatography) (4 credits, 60 hours)

VII. Robotics (4 Credits)
PROPOSALS FOR INNOVATIVE RESEARCH AREAS

(A) Development of Low Weighing Solar Panels for Electric Bicycles

Introduction:

The Battery operated vehicles have been sought after to substitute the fossil fuel based ones. The development of cars energized by batteries as well as hybrid solutions including both fossils and batteries have been advanced for the alternate source of transport. Smaller vehicles like electric bikes (e-bikes) and e-rickshaws were also developed to reduce the pollution and save the fossils. However, these vehicles could not popularize in India due to various reasons. In cycle rickshaws the purpose is mainly to ease the work load on the driver who is using biological energy to drive the rickshaw. The e-bikes are mainly in the form of a scooter such as Yo-Yo bike. The maximum drive length is limited by the battery energy density and speed by the power density. The economy is decided by the type of battery used. Typically the lead – acid batteries or Nickel- cadmium batteries take a long time for recharging. This reduces the confidence of driver in terms of vehicle’s readiness. For any reason, if the battery is not properly charged, there is a risk of vehicle getting immobile on the road leading to inconvenience of the driver. A relatively simple solution is e- bicycles. In this case, the speed is relatively low (between 15 to 25 km/hr) but in case of battery discharge while driving, there is always the option of manual cycling. However, a typical battery operated cycle will cost around 20000- 25000 Rs, while a scooter is available around 42000 Rs. Most of the potential buyers therefore prefer petrol driven vehicles instead of such a cycle. This observation has motivated us to work on a solution where by making some value addition to additional cost it is expected that the buyers may find e-cycle as a competitive alternative for the petrol driven vehicles.

Work done: We built an e-cycle using a 200 W BLDC motor along with cycle kit and tested it with a regular lead- acid battery pack with 24 V and 14 Ah ratings. It provided a total distance between 25 -30 Km for full charged battery. A disc brake is needed to stop the cycle in short distance. After every discharge, the battery charging took about 7-8 hrs.
Many car users were curious on the road to know about this bike. It seemed that from their curious questions that the charging cycle was a demotivating factor. We have started searching for a solution to this problem. On the internet, there are many e-tricycles which carry solar panels to charge the batteries. However, this increases the size of the vehicle and tricycles are not stable while turning. The stability of moving vehicles is due to the principle that the angular momentum remains constant unless acted upon by torque. While turning angular momentum must change. This is achieved in a tilted bicycle by redistributing the mass while turning. For a tricycle with wheel size same as cycle, this is not easily possible. For a bicycle, for charging batteries a solar panel of 70 to 100 W is needed. The weight of such panel is 10 Kg for silicon solar cells. Many of the enthusiasts have fitted these to the carrier and/or in front. This looks very odd and unwieldy. It was therefore decided that a lightweight solar panel to be obtained. It may be noted that there are flexible solar panels which cost between 250 to 400 Rs/ Wp. These are too costly compared to silicon based panels which cost around 45 Rs/Wp. One of the solar cell manufacturers has come forward to develop such a panel and developed a technique which is promising. It has reduced the weight to 4.8 Kg of the 100 Wp panel. This will help modify the bicycle, which can be charged during motion and when not in use under the sun. Our calculations show that for a person who goes every day to the office within 15 Km from his/her abode can use such a cycle without any risk of power shortage. The fully charged battery can take the person 15 Km and the cycle should be kept in open under the sun during office hours. After 6-8 hrs the battery is fully charged and the person can reach home. The remaining charge on the battery can take him to the office the next day where the battery is charged again. Thus, by avoiding the hassle to charge the battery the person can enjoy the bike ride and also save fuel and the environment.

**Proposed work:** We are proposing to develop the lightweight silicon solar panels and need to test their life span. Research is needed for this purpose. A budgetary requirement of Rs. 1500,000 is anticipated. Note that the solar panel testing costs are very high which the main chunk of the budget is. We propose to take mini conferences by inviting various industries that would be interested in developing different products using such lightweight solar panels. Each such idea can be conceptualized and developed for a
prototype. These mini conferences will be held in Pune, Nashik and Nagar region to encourage the local manufacturers.

**Social Relevance:**

As mentioned earlier, in urban areas the traffic of vehicles has become a serious problem, both in terms of transportation and pollution. The work stress is high which does not allow the office going population to handle the physical stress of paddling a bicycle. Typically, one has to travel on an average a distance of about 10 to 15 Km one way to the office. A battery operated cycle can offer a solution to this requirement. However, charging time of 8 to 10 hours for a battery is inconvenient for every other day. High energy density batteries can be used which increase the cost too much. Hence, the present solution of charging the batteries using solar energy may popularize the bicycle driving useful and fun filled. This will reduce the pollution and also the fossil fuel consumption.

**Output- Industrial Collaboration and Sustainability:**

A company ‘PV developers’ is already associated with this project. We look forward to further collaborative efforts in developing solar based vehicles for various purposes. This has inherent sustainability in terms of the new ideas and concepts. The royalty available from this venture is expected to finance the day to day running of the center. For DIC, a core staff of 5 is suggested. There should be an industry experienced director, four staff with background from biotech, chemistry, electronics and physics with industrial collaboration experience. An independent office with store keeper, Clarke and accountant is needed for administration.

**Deliverables:**

1. Low weight, longer lifetime silicon solar panels.
2. Prototype e-bicycles with solar charging backup.
3. Field testing of such bicycles in different geographical locations for comparison.
4. Generating a DPR by making a survey of potential buyers of such bicycles.
5. Incubating different potential manufactures for this particular product.
## Summary of Budget Estimates (In Rupees)

<table>
<thead>
<tr>
<th>Item</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(A) Non-recurring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Equipments: Hub motors and cycles</td>
<td>8,00,000/-</td>
<td>-</td>
<td>-</td>
<td>8,00,000/-</td>
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<tr>
<td>2. Other Non-recurring costs</td>
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<td>-</td>
<td>5,00,000/-</td>
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<td><strong>Total (A)</strong></td>
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<td>-</td>
<td>13,00,000/-</td>
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<td><strong>(B) Recurring</strong></td>
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<tr>
<td>1. Salaries Research fellow (1) @ 15,000/- per month</td>
<td>4,20,000/-</td>
<td>4,20,000</td>
<td>4,20,000/-</td>
<td>12,60,000/-</td>
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<td></td>
<td>Engineer (1) @20,000/- per month</td>
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<td>2. Consumables Poly crystalline silicon solar cells, base, EVA/PET, UV stabilizing epoxy, two component epoxy, junction box, charge controller etc.</td>
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<td>4,00,000/-</td>
<td>1,00,000/-</td>
<td>13,00,000/-</td>
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<td>3. Travel</td>
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<td>50,000/-</td>
<td>50,000/-</td>
<td>1,50,000/-</td>
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<td>4. Consultancy</td>
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<td>2,00,000/-</td>
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<td><strong>TOTAL (A+B)</strong></td>
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<td>11,40,000/-</td>
<td>8,40,000/-</td>
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</table>
(B) Development of Bioinoculants for Application in Agricultural Soils of Maharashtra

Origin of Problem:

Abiotic stresses like drought, salt, water logging, cold are one of the major causes of decline in agricultural productivity. From Indian agricultural point of view drought and salt affected soils are the major concern for farmers. This stress not only affects growth of the crop, but is detrimental to the microbial flora of the soil. Many agricultural areas in India particularly in Maharashtra are rainfed and not irrigated. The variability in rainfall every year causes drought conditions in some parts of India.

Microflora of agricultural soils is one of the major contributors to fertility of the soil. Decline in agricultural productivity is because of many factors like reduced microflora, nutrient profile, biotic stress (pest) and abiotic stress (drought, salt, cold etc.) related to soil.

Plant microbe interaction play very important role in growth of plant as well as adaptation to harsh condition and stresses and protection from pathogens. One of the solutions to address the problem of reduced fertility is to restore the microflora of the soil. Many types of micro-organisms are used as biofertilisers like nitrogen fixers, phosphate solubilisers, sulphate metabolisers etc. Microbial inoculants such as plant growth promoting microbes (PGPM) are plant symbionts, associated with the plants. It helps the host plant with uptake of various nutrients essential for metabolic activities. PGPM contributes a combination of nutritional, physiological and cellular effects on the overall growth of the host plant under stress conditions, thereby improving stress tolerance. PGPM has ability to tolerate physical and chemical properties of soil, thereby executing variable effectiveness in improving plant growth.
Strategy for solution of the problem:

The type of microflora to be used depends on various factors of the soils like pH, salt content, moisture, nutrient composition, host plant and its physiology.

So, it is very important to use indigenous micro-organisms for its application as biofertilisers in local soil. Also, the type of crops grown in a particular region, the plant diseases commonly occurring in that area and other aspects decide which micro-organism is to be used as a biocontrol agent.

Through this project we envisage to develop a laboratory devoted to understand the microflora of local (regional) soils and then isolate various PGPR micro-organism like bacteria, fungi (AM fungi). The indigenous isolates will be characterized, tested for their efficacy (growth promoting activity and biocontrol ability). The isolates can be used singly or as a consortium for any synergistic effect. After that the inoculum will be standardized, optimized for growth condition and scaled up for production by using cost effective medium.

So in this project, we aim to develop a facility for cultivation of and formulation of Bioinoculant and its cost effective mode of mass cultivation which will be made available to the farmers at economic rate.

Proposed plan of work:

- The study area selected is part of Ahamednagar District of Maharashtra which belongs to the Savitri Bai Phule Pune University jurisdiction.
- Collection of soil sample from selected sites and its physicochemical and biological analysis.
- Isolation and culturing of microbes from various agricultural zones. These isolates in combined inoculation could be used as biofertilizer for crop growth improvement.
- Identification and characterization of microorganism for further studies.
- Media optimization for growth studies of the isolate at flask level.
- Mass production of PGPM for further field trial.
- Selection of test crops for growth efficacy studies.
- Preliminary pots trials will be done in green house condition to test the efficacy of the culture accessing various plant growth parameters.
- Consortium of PGPM (Plant growth promoting Microbes) to check synergistic effect.
- Field trial with – in collaboration with Vasantdada Sugar Institute (VSI), Pune and MPKV Rahuri, Maharashtra. Trials will be conducted in various seasons as per the standard agricultural trial methodology followed by statistical evaluation.
- The developed technology will be delivered to the beneficiaries.
- Awareness and training programme will be conducted at satellite centers for needy and interested farmers.

**Expected Deliverables:**

- **1st year**
  - Collection and isolation of PGPM from soils of various agricultural field.
  - Identification and characterization of PGPM.
- **2nd year**
  - Culture and mass multiplication of PGPM under laboratory condition.
  - Preliminary field trials of PGPM.
- **3rd Year**
  - Development of formulation suitable for the farmers.
  - Field trials of PGPM with test crops.
  - Technology delivered to the farmers.
  - Interaction with the farmers at the spoke centers, counselling and advise related to use of appropriate biofertilizers will be carried out in the next phase.
  - The developed technology for biofertilizer preparation may be taken to NGO’s and industry for its dissemination.

**Figure:** Preliminary studies - using AM fungi on growth performance of Groundnut
G1 + G2 : Mycorrhizal, NM: Non-Mycorrhizal Treatment

Social relevance:

- Rehabilitation of drought affected agricultural fields.
- The propagation of this cost effective technology up to farmer level for production & usage at grass root level. This will help to use agricultural field which are being abandoned for cultivation.
- Enhanced agricultural yield in the rainfed regions mainly for non irrigated agricultural areas.
- The training of mass cultivation technology for PGPM production can be given to the interested agricultural and life science students to initiate Self Entrepreneurship.
- Overall this strategy will benefit low income farmers who have non fertile drought prone piece of small agricultural land.

Output and Anticipated benefits:
• Our strategy of using bioinoculant to enhance the agricultural yield. This will help farmers to grow crops in such soils which otherwise are offering poor agricultural yield.

• The combination PGPM will be utilized in this programme, which will be beneficial to target group of farmers.

• The consortium will be beneficial for farmers’ fields which have stress prone history for longer periods and not irrigated.

• Agriculture Biotechnology cell will be established for providing guidance to the farmers regarding soil analysis and accordingly the selection of biofertilizer as per the soil type.

• Nodal (Satellite) centers for propagation of this mass production technology will be established at selected tehsils in A. Nagar, Nashik which are part of University jurisdiction.

Academia-industry and Academia- social interaction involved:

• Following investigators (faculty of Pune University) will participate in executing this project
  1. Prof. W.N. Gade
     Professor and Ex-Head, Department of Biotechnology
     And Vice Chancellor, Savitribai Phule Pune University
  2. Prof. M.V. Kulkarni
     Division of Biochemistry, Department of Chemistry
     Savitribai Phule Pune University
  3. Dr. Mahesh Borde
     Department of Botany, Savitribai Phule Pune University

• The package for mass multiplication of PGPM will be transferred to biofertilizer manufacturer unit, like Swan enterprises, Miraj, Maharashtra.

Collaboration: MPKV Rahuri an Agricultural University and Vasant Dada Sugar Institute, Pune for field trials.
### Budget: Project period for three years

<table>
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<th>Sr. No</th>
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<th>2\textsuperscript{nd} year (Lakhs)</th>
<th>3\textsuperscript{rd} year (Lakhs)</th>
<th>Total (Lakhs)</th>
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<td>10.00</td>
<td>10.00</td>
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<td>04.32</td>
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<td>Field trial expenses (Labor, field preparation, plantlets etc.)</td>
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<td>15.00</td>
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<td>25.32</td>
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<td>2.</td>
<td>Nanodrop spectrophotometer</td>
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<td>3.</td>
<td>Trace metal analyzer (Metrohm, Switzerland)</td>
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<td>4.</td>
<td>Multimode Plate reader</td>
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<td>20.00</td>
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<td>5.</td>
<td><strong>Minor equipments</strong>: Soil analysis Kits, Rotary Shaker Incubator (Cooling, Heating, Illumination), Deep freezer - 20°C, Laminar air flow, Cooling Micro centrifuge etc., as per project requirement</td>
<td>10.10</td>
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<td></td>
<td><strong>Total B</strong></td>
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<td><strong>Total expenditure (A+B)</strong></td>
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Development of Receptor Targeted Vaccine Delivery System against Diphtheria, Tetanus, Pertussis, Haemophilus influenzae and Hepatitis b Infections

Introduction

Immunization is one of the most effective public health tools, leading to reduced infant and childhood morbidity and mortality, caused by vaccine preventable diseases worldwide (American Academy of Pediatrics, 2012; ECDC; 2011; CDC-MMWR, 2012; CDC-MMWR, 2012). However, outbreaks of vaccine preventable diseases continue to occur in developed countries, and this may be attributed to unimmunized or under-immunized subpopulations despite high overall vaccination coverage (Anil et al., 2009; Lopalco and Martin, 2010; Walker et al 2011). Several underlying factors for suboptimal vaccine uptake have been described, but are complex and present diversities among different countries and population groups (Falagas and Zarkadoulia 2008; Torun SD, Bakirci, 2006; Muhsen et al., 2012; Ughade et al., 2000; Prislin et al 1998). According to a national survey performed in 2006 among 6- year olds, various socioeconomic factors, rather than parental attitudes and beliefs towards vaccines, were identified as predictors for incomplete and delayed immunizations (Danis et al., 2010). It is, therefore, essential to develop appropriate strategies to address the needs of susceptible populations. Combination vaccines, those that protect against multiple diseases, are one of the solutions of pandemic infections offered by Diphtheria, Tetanus, Pertussis, Haemophilus influenza Type b and Hepatitis B. They offer the advantage of simplifying vaccination schedules, decreasing the number of injections and the health-related costs.

Drug delivery system

Particulate drug delivery has received a great deal of attention and generally considered as the key technology of the 21st century is predicted to be worth up to USD 1 trillion by 2020. In past few decades particulate systems such as microparticles have been widely used to deliver a wide range of macro or small molecules to improve their pharmacokinetic and pharmacodynamics in human body. As drug delivery systems, they have the advantages of protecting drug from quick digestion and damage by body fluid,
localizing at desired spots and releasing encapsulated drugs. These advantages remarkably enhance drug bioavailability and efficacy, reduce undesired side effects, and consequently improve patient’s comfort and compliance. Recently, microparticles have been well developed as effective immune adjuvants. Several important factors like particle size, morphology, particle surface properties, antigen loading and release kinetics of microparticles dramatically affect the induced immune responses in the sense of antigen stability, antigen release, particle interaction with APCs, antigen presentation and processing by APCs (Tobio et al. 1998). Microsphere-encapsulated antigens offer several potential advantages as mucosal vaccines. It is possible to encapsulate antigen in rapidly degrading microspheres of different sizes which favor either rapid uptake across the epithelium or prolonged retention over the mucosal lymphoid tissue and/or epithelium and have been found to prime systemic immune responses more effectively than free antigen and have the potential to disseminate antigens to various systemic lymphoid tissues, depending upon the size of the microsphere.

**Metabolite as receptor sensing molecules**

G protein-coupled receptors (GPCRs), constitutes the largest receptor family in mammals and are involved in the regulation of virtually all cellular and physiological functions in the body (Oldham and Hamm, 2007). Owing to their ability to bind to ligands with a high specificity and affinity, GPCRs are preferentially targeted for the development of new therapeutics and account for about 20% of the currently exploited drug targets (Rask-Andersen et al 2011). The modular structure of the signaling system mediated by GPCRs and G proteins allows a large functional versatility. Carbohydrate or lipid metabolites can act as ligand for activating GPCRs on specific target organs.

Conventional alum-type vaccines (e.g. Diphtheria, Pertussis, Tetanus, *Haemophilus influenzae* and Hepatitis B) requires multiple recall injections at appropriately timed intervals in order to obtain long lasting and optimal immune response. Therefore, development of more efficient and safe organ targeted vaccine delivery systems requiring minimized administration to obtain high and long lasting immune responses is of primary importance.
Work experience in the relevant field

Presently, in our laboratory at Department of Chemistry, Savitribai Phule Pune University, we are working on a UGC-sponsored major project (2013-2016) entitled ‘Development of multivalent oral vaccine by micro and nanoencapsulation of antigens using biodegradable chitosan’ in collaboration with Serum Institute of India Ltd. Works was emphasized on extraction of chitosan from shrimp shells and investigate their potential to encapsulate tetanus toxoid as a monovalent model vaccine under. The physicochemical and functional characterization of placebo and tetanus toxoid encapsulated chitosan microspheres showed significantly higher toxoid encapsulation, antimicrobial and antioxidant properties compared to commercially available chitosan. Prepared chitosan microspheres showed good structural morphology, functional potential and specified interactions for microspheres preparation for mucosal vaccination. The work got published in *International journal of pharmaceutical science review and research (2014)*.

In addition, we also implemented the use of various single cross linksers such as gluteraldehyde, sodium tri polyphosphate (STPP), citrate, vanillin and dual cross linkers in combination such as citrate and STPP, vanillin and STPP for synthesis of chitosan microspheres. The formulated microspheres were characterized by using technique such as FT-IR, SEM, XRD and TGA as well as the *in vitro* drug release was determined by ELISA. The studies confirmed that the microspheres were showing good structural morphology, maintaining the protein structural integrity. Both cross-linker encapsulation system has shown its own significance for drug entrapment efficiency, controlled drug release and mucoadhesive properties, claiming it as a suitable cross-linkers for polymeric vaccine delivery system (*data under communication*).

Thus, considering the suitability of metabolite as a ligand for targeting G protein coupled receptor (GPCRs) which is distributed throughout lymphoid organs, the present study proposes to synthesis of metabolite conjugated biocompatible polymers, and using this conjugate to formulate multivalent vaccine delivery system using Diphtheria, Tetanus, Pertussis, Haemophilus Type b and Hepatitis-B antigens with the help of various nontoxic crosslinkers.
**Collaborating Industry:** Serum Institute of India Ltd., is the internationally reputed highest producer of Diphtheria, Tetanus, Pertussis, HIB, BCG, Hepatitis B, Measles, Mumps, Rubella vaccines. It is estimated that about 60% of the children in the world receive at least one vaccine manufactured by Serum Institute of India Ltd. Serum Institute of India Ltd., is also a manufacturer of PENTAVAC- PFS (Diphtheria, Tetanus, Pertussis (Whole Cell), Hepatitis B (rDNA) and Haemophilus Type b Conjugate Vaccine. This vaccine is supplied in a single dose pre-filled syringe (PFS) is a homogeneous liquid containing purified diphtheria and tetanus toxoids, inactivated whooping cough (pertussis) organisms, highly purified, non-infectious particles of Hepatitis B surface antigen (HBsAg) and Hib component as a bacterial subunit vaccine containing highly purified, non-infectious *Haemophilus influenzae* type b (Hib) capsular polysaccharide chemically conjugated to a protein (Tetanus Toxoid). Surface antigen of the Hepatitis B virus (HBV) is obtained by culturing genetically engineered *Hansenula polymorpha* yeast cells having the surface antigen gene of the Hepatitis B virus. The Hepatitis B surface antigen (HBs Ag) expressed in the cells of *Hansenula polymorpha* using recombinant DNA procedures is purified through several chemical steps. The Hib polysaccharide is prepared from capsular polysaccharide of *H. influenzae* type b strain and after activation is coupled to Tetanus Toxoid. The vaccine meets the requirements of WHO when tested by the methods outlined in WHO, TRS 786 (1989) and 800 (1990).

**Proposed plan of work (Specific Objectives)**

- Synthesis of metabolite conjugated polymer using following compounds:
  - Metabolites: 3-hydroxybutyrate, 3- hydroxyoctanoate, succinate, linoleic acid, oleic acid, lactate etc.
  - Biocompatible polymers: chitosan, polyethyleneamine, gelatin, polyurethane, poly-(amidoamine) dendrimer.
- Investigating the potential of nontoxic cross-linkers of ionic nature (Sodium potassium tartrate, Sodium borate, Sodium tripolyphosphate, Sodium citrate etc) and covalent nature (vanillin, genipin etc.) alone and in combination as co-crosslinkers.
- To study the mechanism of interaction of cross-linkers and co-crosslinkers with polymer using instrumentation technique like NMR, FTIR etc.
- Fabrication of plain and multivalent vaccine antigens (Diphtheria, Tetanus, Pertussis, Haemophilus Type b and Hepatitis-B) encapsulated microparticles by using different types of GPCR metabolite conjugated polymer via microencapsulation techniques like spray drying, ionic tropic gelation, emulsification followed by post encapsulation characterization.
- Standardization of various dependent and independent variables of encapsulation, like polymer concentration, vaccine to polymer ratio, stirring speed, vaccine to polymer interaction, pH sensitivity and concentration of cross linkers to give stable and reproducible formulation. Instrumental and Bioanalytical characterization like crosslinking degree, external and internal surface morphology, elemental composition, particle size distribution, functional group interaction, phase transformational, thermal stability, particle size distribution, zeta potential, porosity, swelling index, encapsulation efficiency for maintaining therapeutic levels of vaccines in polymeric delivery system.
- Standardization of ELISA technique for individual antigen in multivalent vaccine composition for entrapment efficiency and in vitro release studies.
- Optimization for maximum dose of multivalent vaccine in encapsulated system and screening of different stabilizers (like Trehalose, BSA, Sucrose, Maltose and Dextran) which helps in maintaining protein antigen integrity in optimized formulation.
- To study In-vitro release kinetics of encapsulated vaccine, and its release kinetics mechanism in artificial gastric and intestinal medium.
- To determine In-vitro cell cytotoxicity, cellular uptake and stability in stimulated gastric and intestinal fluid of various formulations.
- To study drug permeation in targeted cell lines and evaluation of monolayer integrity by measuring sodium fluorescein transport and transepithelial electrical resistance.
- In-vivo studies involving immune response, antibody estimation and potency of multivalent vaccine using suitable animal models.
Details of Technical Characterization

- **Spray drier**: For preparation of vaccine antigens encapsulated microparticles.
- **Nuclear Magnetic Resonance**: To find out mechanism of interaction between metabolite and polymer conjugate and confirmation of crosslinking reaction.
- **Fourier transforms Infra-red Spectroscopy (FT-IR)**: To study the functional group interaction between at the time of conjugation, crosslinking and vaccine encapsulation.
- **X-Ray Diffraction**: To evaluate the phase transformation after crosslinking reaction as well as determination of lattice structure of crosslinked product.
- **Field Emission Scanning Electron Microscopy (FE-SEM)**: To study the surface morphological characteristics of formulated microparticles.
- **Thermogravimetric Analysis (TGA) and Differential scanning colorimetry (DSC)**: To study the thermal stability of vaccine delivery system and encapsulation study of vaccines.
- **Transmission Electron Microscopy (TEM)**: To study the internal structure of microparticles and confirmation of dispersion of vaccine in delivery system.
- **Brunauer–Emmett–Teller (BET)**: To study total surface area, pore volume and pore size distribution of microparticles.
- **Particle size and Zeta potential**: Evaluation of mean particle size and charge density on the delivery system.
- **HPLC**: Quantification of vaccine during entrapment efficiency calculation of multivalent vaccine.
- **ELISA**: To study the structural integrity of antigens after encapsulation, *in-vitro* release and antibody estimation in animal blood samples.
- **Fluorescence Microscope**: To study the cellular uptake of formulation in cell model system.
- **In-vitro Drug permeation studies**: Evaluation of monolayer cell integrity by measuring sodium fluorescein transport and transepithelial electrical resistance using Animal tissue culture.
- **In-vivo study**: To study of immune response and potency of multivalent vaccine using suitable animal models.
<table>
<thead>
<tr>
<th>Work Target</th>
<th>Period of achievement of targets</th>
<th>Achievable Target Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>T1</td>
<td>6 Months</td>
<td>Hiring research personnel, collection of recent literature. Procurement of equipment, chemicals and glassware. Synthesis of precursors and starting material.</td>
</tr>
<tr>
<td>T2</td>
<td>12 Months</td>
<td>Synthesis of metabolite conjugated polymer using following compounds: Metabolites: 3-hydroxybutyrate, 3-hydroxyoctanoate, succinate, linoleic acid, oleic acid, lactate etc. Biocompatible polymers: chitosan, polyethylamine, gelatin, polyurethane, poly- (amidoamine) dendrimer etc.</td>
</tr>
<tr>
<td>T3</td>
<td>18 Months</td>
<td>Fabrication of plain and multivalent vaccine antigens (Diphtheria, Tetanus, Pertussis, Haemophilus influenza Type b and Hepatitis-B) encapsulated microparticles by using different types of GPCR metabolite conjugated polymer via microencapsulation techniques like spray drying, ionic tropic gelation, emulsification followed by post encapsulation characterization. To find out mechanism of interaction of crosslinkers and co-crosslinkers with polymer using instrumentation technique like NMR, FTIR etc.</td>
</tr>
<tr>
<td>T4</td>
<td>24 Months</td>
<td>Standardization of various dependent and independent variables of encapsulation, like polymer concentration, vaccine to polymer ratio, stirring speed, vaccine to polymer interaction, pH sensitivity and concentration of crosslinkers to give stable and reproducible formulation. Instrumental and Bioanalytical characterization like crosslinking degree, external and internal surface morphology, elemental compositional, particle size distribution, functional group interaction, phase transformational, thermal stability, particle size distribution, zeta potential, porosity, swelling index, encapsulation efficiency for maintaining therapeutic levels of vaccines in polymeric delivery system.</td>
</tr>
<tr>
<td>T5*</td>
<td>30 Months</td>
<td>Standardization of ELISA for individual antigen in multivalent vaccine composition for entrapment efficiency and in vitro release studies. Optimization for maximum dose of multivalent vaccine in encapsulated system and screening of different stabilizers (like Trehalose, BSA, Sucrose, Maltose and Dextran) which helps in maintaining protein antigen integrity in optimized formulation. To study in-vitro release of encapsulated vaccine, and its release kinetics</td>
</tr>
</tbody>
</table>
To determine In-vitro cell cytotoxicity, cellular uptake and stability in stimulated gastric and intestinal fluid of various formulations.

To study drug permeation in targeted cell lines and evaluation of monolayer integrity by measuring sodium fluorescein transport and trans-epithelial electrical resistance.

<table>
<thead>
<tr>
<th>Time (months)</th>
<th>3</th>
<th>6</th>
<th>9</th>
<th>12</th>
<th>15</th>
<th>18</th>
<th>21</th>
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<td><strong>T6</strong></td>
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</tbody>
</table>

* The data obtained under the targets achieved will be prepared for publication and presentations at different conferences/symposia.
Social relevance: Global immunization coverage has greatly increased since WHO's Expanded Programme on Immunization began in 1974. In 2003, global DTP3 (three doses of the diphtheria-tetanus-pertussis combination vaccine) coverage was 78% — up from 20% in 1980. However, 27 million children worldwide were not reached by DTP3 in 2003, including 9.9 million in South Asia and 9.6 million in sub-Saharan Africa. An estimated 2.1 million people around the world died in 2002 of diseases preventable by widely used vaccines. This toll included 1.4 million children under the age of five. Among these childhood deaths, nearly 400,000 by Hib; nearly 300,000 by pertussis; and 180,000 by neonatal tetanus. Those who miss out on routine vaccination programmes tend to be people living in remote locations, urban slums and border areas. They also include indigenous groups, displaced populations, those lacking access to vaccination because of various social barriers, those lacking awareness or motivation to be vaccinated and those who refuse.

In India, immunization services are offered free in public health facilities, but, despite rapid increases, the immunization rate remains low in some areas. According to the National Family Health survey (NFHS-3), in India only 44% of children aged 1-2 years have received the basic package. Very commonly, the low coverage is related to high dropout rates for receiving booster vaccine doses leaving significant fractions of people not fully immunized. Despite the overall improvement in vaccination coverage during the past few decades, routine vaccination programs need to be strengthened globally, especially in countries with the greatest numbers of unvaccinated children (CDC; MMWR, 2011).

Therefore, it is important to develop more effective vaccine formulations for a better immunological response since the first shot. Vaccines that are required to be given in multiple divided doses are not efficacious if only one dose is given without boosting. In developing countries, the drop-out rates from individuals receiving the first dose, but not successive doses are high. Among the various tentative for improving the administration of vaccine antigens, the microencapsulation into biodegradable polymers with receptor targeting represents a practical and promising approach.
ACADEMIC-INDUSTRIAL COLLABORATIONS: Serum Institute of India Ltd.,
Hadapsar Pune- 411028

INVESTIGATING GROUP FROM ACADEMIC INSTITUTION

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name and Designation</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Prof. (Dr.) W. N. Gade Hon’ble Vice-Chancellor, Professor of Biotechnology serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Savitribai Phule Pune University, Ganeshkhind, Pune 411008. <a href="mailto:puvc@unipune.ac.in">puvc@unipune.ac.in</a> 020 25693868</td>
</tr>
<tr>
<td>2.</td>
<td>Prof. (Dr.) Dilip Dhavale Head, FASc., FNASC. Department of Chemistry, serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Savitribai Phule Pune University, Ganeshkhind, Pune 411007 (India) Ph. No. : (020) 25691727 Fax. No. : (020) 25691728 Email : <a href="mailto:ddd@chem.unipune.ac.in">ddd@chem.unipune.ac.in</a></td>
</tr>
<tr>
<td>3.</td>
<td>Dr. Pooja J. Doshi Assistant Professor (stage II) Serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Department of Chemistry, Savitribai Phule Pune University, Ganeshkhind, Pune 411007 (India) <a href="mailto:pdoshi@chem.unipune.ac.in">pdoshi@chem.unipune.ac.in</a> Mobile: 9545588772</td>
</tr>
</tbody>
</table>

INVESTIGATING GROUP FROM INDUSTRIAL ORGANIZATION

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Name and Designation</th>
<th>Address</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Dr. S D Ravetkar Executive Director Serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Serum Institute of India Ltd., Hadapsar, Pune- 411028 <a href="mailto:sdr@seruminstitute.com">sdr@seruminstitute.com</a> 020 26602386</td>
</tr>
<tr>
<td>2.</td>
<td>Dr. Rakesh Kumar Senior Director Serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Serum Institute of India Ltd., Hadapsar, Pune- 411028 <a href="mailto:rakesh.kumar@seruminstitute.com">rakesh.kumar@seruminstitute.com</a> 020 26602375</td>
</tr>
<tr>
<td>3.</td>
<td>Dr. Jignesh B Doshi Production Manager Serum Institute of India Ltd., Hadapsar Pune- 411028</td>
<td>Serum Institute of India Ltd., Hadapsar, Pune- 411028 <a href="mailto:jignesh.doshi@seruminstitute.com">jignesh.doshi@seruminstitute.com</a> 020 26602587</td>
</tr>
</tbody>
</table>
**Expected deliverables/ outcomes**

Development of targeted organs specific polymeric system which leads to controlled release of multivalent vaccine antigens without loss, illustrates the science of specific interaction between G protein-coupled receptor present in the organs to its ligand. Polymeric coating enhances the absorption, distribution, metabolism and elimination (ADME) properties. Vaccine within polymer, allow much less active agents to be used for the desirable activity with extended half-life, thus providing patient compliance treatment by reducing dosing frequency. Thus, the development of new receptor targeted vaccine delivery systems for selected infections may allow effective utilization of vaccine antigens that will be helping in reducing cost and enhancing immunization coverage.

**Model for sustainability / revenue generation after 3 years**

Immunization is considered among the most cost-effective of health investments. Immunization programmes may be aimed at adolescents or adults — depending on the disease concerned — as well as at infants and children. There is a well-defined target group; contact with the health system is only needed at the time of delivery; and vaccination does not require any major change of lifestyle. On successful completion of project on small scale with required bioactivity, the project will be patented. The project will be subsequently optimized for the pilot scale depending up on market demand. This will fetch revenue to the participating institutes in future.
## Budget Required For Three Years

<table>
<thead>
<tr>
<th>Item</th>
<th>BUDGET (Amount in Rupees)</th>
<th>1st Year</th>
<th>2nd Year</th>
<th>3rd Year</th>
<th>Total (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>[A] Recurring</strong></td>
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</tr>
<tr>
<td><strong>Man Power: Project Fellows (two)</strong> @ Rs 16,000/- pm for first two years followed by 18,000/- pm for third year</td>
<td>3,84,000/-</td>
<td>3,84,000/-</td>
<td>4,32,000/-</td>
<td>12,00,000/-</td>
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</tr>
<tr>
<td><strong>Senior Research Fellow (two)</strong> @ Rs 18,000/- pm for first two years followed by 20,000/- pm for third year</td>
<td>4,32,000/-</td>
<td>4,32,000/-</td>
<td>4,80,000/-</td>
<td>13,44,000/-</td>
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<tr>
<td><strong>Consumables</strong></td>
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</tr>
<tr>
<td>Chemicals, Reference standards, Analytical kits, ELISA kits, purified antibodies for different antigens, Solvents, Glass and plastic wares</td>
<td>7,00,000/-</td>
<td>7,00,000/-</td>
<td>7,00,000/-</td>
<td>21,00,000/-</td>
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<tr>
<td><strong>Contingency</strong></td>
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<tr>
<td>Hiring services, Travel, Miscellaneous Purchase, Equipment accessories, maintenance and Repairs, Postage, Journals/Books purchase and research communication etc.</td>
<td>5,00,000/-</td>
<td>5,00,000/-</td>
<td>5,00,000/-</td>
<td>15,00,000/-</td>
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<tr>
<td><strong>Total [A]</strong></td>
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<tr>
<td>20,16,000/-</td>
<td>20,16,000/-</td>
<td>21,12,000/-</td>
<td>61,44,000/-</td>
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<tr>
<td><strong>[B] Non-recurring (Equipments)</strong></td>
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</tr>
<tr>
<td>1. <strong>Spray dryer</strong> (For micro/nano spheres formulations)</td>
<td>20,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
<td>20,00,000/-</td>
<td></td>
</tr>
<tr>
<td>2. <strong>Dissolution apparatus (two)</strong> (Required for drug in vitro release studies)</td>
<td>7,50,000/- x2= 15,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
<td>15,00,000/-</td>
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<tr>
<td>3. <strong>Microfluidizer/Particle size deagglomerator (Homogeinizer)</strong></td>
<td>05,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
<td>05,00,000/-</td>
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<tr>
<td>4. <strong>Freeze Dryer system (with inbuilt prefreezing system) / Lyophilizer</strong></td>
<td>15,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
<td>15,00,000/-</td>
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<tr>
<td>5. <strong>Refrigerated Centrifuge</strong></td>
<td>08,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
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<tr>
<td>6. <strong>Rotary evaporators (three)</strong></td>
<td>3,00,000/- x3 = 9,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
<td>09,00,000/-</td>
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<tr>
<td>7. <strong>Other Minor Equipments:</strong> Fuming hoods, Franz diffusion cell, Deep freezer (-80 °C), Volt- Ohm meter (TEER meter), Weighing balance, Laminar air flow hood, Lab. Air conditioner, Orbital shaker incubator (benchtop), Rocker, Microplate shaker, Cyclomixer, Centrifuge (ambient temp.), Sonicator, Water bath, Dry bath, Multichannel micropipette, Magnetic stirrer, pH meter, etc., required for project.</td>
<td>25,00,000/-</td>
<td>Nil</td>
<td>Nil</td>
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<tr>
<td><strong>Total [B]</strong></td>
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<td>Nil</td>
<td>Nil</td>
<td>97,00,000/-</td>
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<td><strong>Grand Total [A+B]</strong></td>
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<td>20,16,000/-</td>
<td>21,12,000/-</td>
<td>1,58,44,000/-</td>
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</table>
(2) NEW PG COURSES TO BE INTRODUCED

(I) Introduction to Applications of Plant Biotechnology (4 credits)

Eligibility: Bachelor’s degree in any Faculty

Objectives: To create understanding of Plant growth promoting organisms, food processing, Micropropagation and commercial Cultivation

To create General Awareness of Environment

To create manpower related to this

Course Structure: The course is equivalent to 4 credits. The course can be run in any of the four semesters.

Syllabus:

1. Plant growth promoting bacteria and fungi (1 credit)

Theory 5L of 1h duration

1. Introduction to bacteria and fungi that are beneficial to plant growth and health
2. Mycorrhizal fungi, Trichoderma – their role in nutrient acquisition and biocontrol
3. Plant growth promoting rhizobacteria – their role in nutrient acquisition, plant growth regulator secretion, plant protection
4. Isolation of beneficial organisms, identification, mass production and bioassays
5. Selection of carriers for application to plant roots

Practicals: (10 h)

1. Isolation of AM fungal spores from soil and development of soil-based inoculum 3h
2. Isolation of plant growth promoting bactreia from rhizosphere 2h
3. Identification, preparation of pure cultures and inocula using carriers 3h
4. Assays on plant growth promoting activity 2h
2. Post harvest technology and food processing (1 credit)

Theory - 5 lectures of 1h duration each

1. Post harvest handling of agricultural crops to reduce losses - Optimum harvest factors
2. Reduction of losses in handling, packaging, transportation and storage
3. Use of thermal processing, low temperature, drying, chemical and biological preservation techniques to extend shelf-life.
4. Fruits and vegetables processing – primary, secondary and tertiary processing
5. Food grain processing – Milling, oil extraction

Practicals – 10 h

1. Post harvest handling of grain, fruits and vegetables – Case studies 3h
2. Processing of vegetables and fruits – Case studies 3h
3. Value addition – Fruit pulps, juices, jams etc.- Case studies 4h

2. Micropropogation Course (1 Credit)

Theory - 5 lectures of 1h duration each

1. Introduction to theory of plant tissue culture behind propogation
2. Laboratory setup, media, surface sterilization of explants maintenance of aseptic conditions
3. Handling plants through 5 stages of micropropagation.
4. Scaling up and cost-related aspects during commercialization
5. Export potential and related assays for quality control

Practicals – 10 h

1. Preparations for experiments (Glassware and media)
2. Gerbera/Dianthus/Gladiolus/Carnation micropropogation
3. Banana/sugarcane micropropogation
4. Hardening and transfer to green house.

3. **Commercial Cultivation and processing of Medicinal /Aromatic Plants**

4. **(1 Credit)**

Theory- 6 L of 1 h duration each

1. **Raising of plants:** Cultural practices for nursery raising, transplantation, hoeing, weeding, irrigation, fertigation, plant protection etc. 2

2. **Harvesting and Post-harvest Management:** Harvesting at optimum stage, drying, garbling, grading, packing and storage. 2

3. **Primary Processing and Value Addition:** Chemical extraction processes, distillation of essential oils, preparation of powders, tinctures, extractives etc. 2

**Practicals- 3P of total 9h duration**

- Nursery Techniques and raising of any one commercially important plant. 3
- Distillation of essential oils from any one commercially important plant 2
- Value addition-preparation of different herbal products like kalpa, oils, herbal biscuits, etc 4

**Methodology:** Lectures supplemented with case studies that may include visits.

**Assessment:** Final assessment by written and group discussion. Skill based assessment will be as per the case study.
II) Primer to Drug Discovery and Development (4 Credits)

Background:
Despite technological advances in genomics, high throughput screenings, combinatorial and asymmetric synthesis, the pharmaceutical industry is facing serious innovation deficit with less and less number of new chemical entities capable of resulting in safer and effective drugs. The drug discovery pipelines are not only drying but also becoming extremely expensive, riskier and critically inefficient. This is an interdisciplinary field where chemistry, biochemistry, microbiology, cell and molecular biology, biotechnology, animal, pharmaceutical and medical sciences need to work together. There is a growing interest to explore traditional knowledge from Ayurveda and other systems to address present target to lead bottleneck, which can reduce time, money and toxicity - the three main hurdles in the drug development.

Objectives: To give overview of various approaches, methods and process involved in discovery of new drugs and pharmaceutical development.

Unit1 (Credits 2)
2. Introduction to Pharmacy and Pharmacology, history of pharmacology and drug development, pharmacopoeia, regulations.
3. Bioavailability, bioequivalence therapeutic index, potency, efficacy, risk benefit ratio, selective toxicity, plasma half-life, dose response curve, area under curve, volume of distribution.
5. Administration Topical route, Oral route, Buccal/Sublingual route, Parenteral route, Rectal route, Inhalation route
6. Drug discovery pipeline, target identification, lead optimization, preclinical development, safety and efficacy studies and clinical research. Innovation deficit, innovative models, traditional knowledge
7. Reverse pharmacology, multi-target and systems biology approaches. High throughput screening, Combinatorial chemistry, QSAR, Activity guided fractionation, bioinformatics and in silico methods.

Unit 3 (Credits 2)
1. Animal pharmacology: Use of laboratory animals, Experimental animal models, Use of animal experiments for safety and toxicology studies, drugs toxicity studies in vivo and in vitro
2. Pharmaceutical medicine, Clinical pharmacology, clinical trials, pharmacoepidemiology, adverse drug reaction, pharmacovigilance
3. Pharmacokinetics and Toxicokinetics: Drug solubility and passage of drugs across body membranes, plasma concentration of drugs and various factors affecting it, Factors affecting absorption, distribution, biotransformation and excretion (ADME). Introduction to toxicology
4. Pharmacodynamics: Drug receptors and theories, Mechanism of drug action, Specificity of drug action, and factors modifying the action
5. Quality control and Quality assurance in pharmaceutical industry, Good Laboratory Practices, Good Manufacturing Practices, Good Clinical Practices, ICH
6. Overview of Indian and foreign Drug Regulations, Schedule Y, IND, ANDA, NDA, FDA, EMEA.
7. Role of WHO, Clinical Ethics, Intellectual Property, Innovation, WIPO.
Reading resources:
(III) Application methods in GeoSciences (4 Credits)

Eligibility: Bachelor’s degree in any Faculty

Objectives: To create awareness of Environment quality

To develop skills in handling equipment’s related to survey of water, soil, rocks

To create manpower in Gemology and Geological Surveying and Mapping

Course Structure: The course is equivalent to 4 credits. The course can be run in any of the four semesters.

Syllabus: I

1. Industrial Mineralogy (1 credit)
   • Study of physical properties of industrial minerals and materials in hand specimens with respect to industrial specifications

2. Gemmology
   • Introduction to Gems
   • Identification of gemstones
   • Jewellery Designing Skills – Use of Jewel CAD

3. Thin Section Making, Polishing and Mineral Identification

II. 1. Introduction to Survey Methods (1 credit)
   • Geological Surveying and Mapping – Plane Table, Magnetic Compass etc
   • Site Survey
   • Rock Stability
   • Rock Mechanics and
   • Slope Stability

2. Engineering aspects of Soil and Water conservation Structures and its relevance in Watershed Management
III 1. Exploration Methods  
(1 credit)
- Resistivity Method
- GM Counter Method
- Related Softwares

2. Logging Methods

- Core Logging

3. Water Budgeting, Rain Water Harvesting Techniques and Well Hydraulics

IV 1. Analytical Methods  
(1 credit)
- Ore Analysis and Ore Dressing
- Analytical Methods of Geomaterials (Water, Soil and Rock samples)
- RS-GIS methodologies and related softwares

Methodology: Lectures supplemented with case studies that may include visits.

Assessment: Final assessment by written and group discussion. Skill based assessment will be as per the case study.
(IV) **Industrial safety and general Awareness (credits 4)**

**Eligibility:** Bachelor’s degree in any Faculty

**Objectives:**
- To create understanding of the Industrial safety
- To create awareness of the Industrial safety
- To create manpower related to Industrial safety and general Awareness

**Course Structure:** The course is equivalent to 4 credits. The course can be run in any of the semesters.

**Syllabus:**

**Characterization Techniques**  
(2 credits)

Introduction to emission and absorption spectroscopy: Nature of electromagnetic radiation, electromagnetic spectrum, atomic, molecular, vibrational and X-ray energy levels, Nuclear and Electron spin behavior,

UV-VIS spectroscopy: Radiation sources, wavelength selection, Cells and sampling devices, Detectors, readout modules, data analysis. IR spectrometry, Quantitative Analysis

X-ray methods: Production of X-rays and X-ray spectra, Instrumentation, Direct X-ray methods, X-ray absorption, fluorescence and diffraction methods, Energy dispersive X-ray Analysis (EDAX) Auger

Emission Spectroscopy: Electron Spectroscopy for Chemical Analysis (ESCA), interpretation of spectra.

Mass Spectrometry: Sample flow in mass spectrometer, inlet sample system, ionization methods, mass analyzers, ion collection systems, data handling, vacuum system, correlation of mass spectra with molecular structure, secondary ion mass spectrometry (SIMS)

Microscopic Techniques: optical microscope, Scanning Electron Microscope (SEM), Transmission Electron microscope (TEM), Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM),

Other measuring techniques: XPS, NMR, Zeta potential, FTIR, ICP-MS, CD, MALDI-TOFF
**Softwares for Analysis**  
*(2 credits)*

Chemoffice: Introduction to Chemoffice, Use of chemoffice for Analysis  
ACD-lab: Introduction to ADC-lab, Application of ADC-lab  
Mestek (Nova): Introduction to Mestek (Nova)  
Origin: Introduction to Origin

**Books:**
2. Scanning Electron Microscopy: Ootley,

**Methodology:** Lectures supplemented with case studies that may include visits.

**Assessment:** Final assessment by written and group discussion. Skill based assessment will be as per the case study.
(V) Environmental Audit (4 Credit)

**Eligibility:** Bachelor’s degree in any Faculty

**Objectives:**
- To create awareness of Environment quality
- To develop skills in Environmental and Water Auditing
- To create manpower in Air and water pollution monitoring

**Course Structure:** The course is equivalent to 4 credits. The course can be run in any of the four semesters.

**Syllabus:**

**Environmental Audit:** (1 credit)
- Preamble, scope and objectives of environmental auditing, applicability of statuary,

**Water budget and Water audit:** Water input, output, Mass Balance (1 credit)

**Occupational safety:** (1 credit)
- Safety management: General principles of safety management; need for safety humanitarian; economics, legal and social consideration of industrial safety; role of management in industrial safety; safety management principle and practices. Safety and Housekeeping: Typical accidents due to poor housekeeping; disposal of scraps and other trade wastes; Prevention of spillage; marking of aisles. Use of colours as an aid for good housekeeping.

**Air and water pollution monitoring:** (1 credit)
- Basics of air and water pollution, major pollutants, Water analysis for physico-chemical characteristics: pH, Electrical Conductivity, hardness, alkalinity, chloride etc. Air sample analysis: NOx, SOx, particulate matter etc.

**Methodology:** Lectures supplemented with case studies that may include visits.

**Assessment:** Final assessment by written and group discussion. Skill based assessment will be as per the case study.
(VI) Analytical Techniques (Chromatography) (4 credits, 60 hours)

**Objective:** Basic understanding with hands-on training of the various chromatographic techniques

1) **Paper and Thin layer chromatography (TLC)**

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
</tr>
</tbody>
</table>

Fundamentals and Principles of paper and Thin Layer Chromatography (TLC), Mobile phases, Stationary phases-Normal phase and Reverse phase, Detectors, Staining solutions (KMnO₄, Ninhydrin, PMA and others), Applicability and Importance with examples

2) **Gas Chromatography (GC)**

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
</tr>
</tbody>
</table>

Fundamentals and Principles of Gas Chromatography (GC), Instrumentation, Sample preparation, Mobile phases, Injectors, GC columns, GC detectors (Thermal Conductivity Detector (TCD), Flame Ionization Detector (FID), Mass Selective Detector (MSD) and others), Applications and importance with examples, Limitations, Data processing and interpretation, Hands-on training

3) **High Performance Liquid Chromatography (HPLC)**

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>16</td>
</tr>
</tbody>
</table>

Fundamentals and Principles of High Performance Liquid Chromatography (HPLC), Instrumentation, Types of HPLC-Normal phase HPLC, Reverse Phase HPLC, Ion Exchange Chromatography (IEC), Size exclusion chromatography, Mobile phases, Sample preparation, Limitations of HPLC, HPLC injectors, HPLC pumps, HPLC columns, HPLC detectors (UV-Visible detector, Diode array detector, Refractive index detector and others), Elution systems-Isocratic and Gradient, Applications with examples, Hands-on training

4) **Gas Chromatography–Mass Spectrometry (GC-MS)**

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>14</td>
</tr>
</tbody>
</table>

Fundamentals and Principles of Gas chromatography–mass spectrometry (GC-MS), Instrumentation, Ionization, Detectors–Mass Selective Detector (MSD), Time of flight (TOF) and others, Data analysis, Applications with examples, Hands-on training

5) **Liquid Chromatography–Mass Spectrometry (LC–MS)**

<table>
<thead>
<tr>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
</tr>
</tbody>
</table>

Fundamentals and Principles of Liquid Chromatography–Mass Spectrometry (LC–MS), Instrumentation, Ionization, MS analysis, Applications with examples, Hands-on training

(VII) Robotics (credits 4)

Eligibility: Bachelor’s degree in any Faculty

Objectives: To make students familiar with robotics

To develop design, assembling, testing and installation skill

To create manpower for working on robot

Course Structure: The course is equivalent to 4 credits. The course can be run in any of the four semesters.

Syllabus:

1. Fundamentals of Robotics (1 credit)
   Introduction and classification of robots, Basics of matrices, Rotations and transformations, Introduction to D-H parameters and its physical significance, Orientation of Gripper, Trajectory planning

2. Embedded C programming (1 credit)
   Introduction to Embedded C, C fundamentals, Control statements, Functions, Arrays, Pointers Programming

3. Robotics Sensors and Actuators (1 credit)
   Position Sensors, robot calibration by optical encoder, proximity sensors, Ultrasonic sensors, Force and Torque sensors, Touch and Slip sensors, Specifications and characteristics of Stepper motors, AC motors, DC motors and servo motors

4. Case Study: Developing and building a robot (1 credit)

Methodology: Lectures supplemented with case studies that may include visits.

Assessment: Final assessment by written and group discussion. Skill based assessment will be as per the case study.
Staff Salary for DIC functioning and honorarium for visiting faculty for PG courses (Breakup of Cost)

<table>
<thead>
<tr>
<th>Staff (Salary per month)</th>
<th>I Year (Rs)</th>
<th>II Year (Rs)</th>
<th>III Year (Rs)</th>
<th>Total Amount (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director @1,00,000/- pm</td>
<td>12,00,000/-</td>
<td>12,00,000/-</td>
<td>12,00,000/-</td>
<td>36,00,000/-</td>
</tr>
<tr>
<td>Coordinator @ 60,000/- pm</td>
<td>7,20,000/-</td>
<td>7,20,000/-</td>
<td>7,20,000/-</td>
<td>21,60,000/-</td>
</tr>
<tr>
<td>Technical Assistant @25,000/- pm</td>
<td>3,00,000/-</td>
<td>3,00,000/-</td>
<td>3,00,000/-</td>
<td>09,00,000/-</td>
</tr>
<tr>
<td>Clerk @15,000/- pm</td>
<td>1,80,000/-</td>
<td>1,80,000/-</td>
<td>1,80,000/-</td>
<td>05,40,000/-</td>
</tr>
<tr>
<td>Peon @ 10,000/- pm</td>
<td>1,20,000/-</td>
<td>1,20,000/-</td>
<td>1,20,000/-</td>
<td>03,60,000/-</td>
</tr>
<tr>
<td>Honorarium For Visiting Faculties (As per UoP norms)</td>
<td>11,50,000/-</td>
<td>11,50,000/-</td>
<td>11,40,000/-</td>
<td>34,40,000/-</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36,70,000/-</strong></td>
<td><strong>36,70,000/-</strong></td>
<td><strong>36,60,000/-</strong></td>
<td><strong>110,00,000/-</strong></td>
</tr>
</tbody>
</table>
Estimated cost of indicative principal components of one Design Innovation Centre (DIC)

<table>
<thead>
<tr>
<th>S.no</th>
<th>Budget Details</th>
<th>Amount in Crore</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Innovation Programmes, Students Fellowships and internships, (Recurring expenses for Research Proposals A, B and C)</td>
<td>1.656</td>
</tr>
<tr>
<td>2.</td>
<td>Equipment (Non-recurring expenses for the Innovation Studies for Research Proposals A, B and C)</td>
<td>1.744</td>
</tr>
<tr>
<td>3.</td>
<td>Concept Development, Mock-up models and prototyping Expenses</td>
<td>0.60</td>
</tr>
<tr>
<td>4.</td>
<td>Staff salary and honorarium for visiting faculty (PG courses)</td>
<td>1.10</td>
</tr>
<tr>
<td>5.</td>
<td>Travel &amp; Field Trial related expenses</td>
<td>0.50</td>
</tr>
<tr>
<td>6.</td>
<td>Workshops, Training &amp; Outreach</td>
<td>0.60</td>
</tr>
<tr>
<td>7.</td>
<td>Creation of Innovation at partner institute under hub &amp; spoke model</td>
<td>3.80</td>
</tr>
<tr>
<td></td>
<td><strong>Total Amount in Crore</strong></td>
<td><strong>10.00</strong></td>
</tr>
</tbody>
</table>

Note: Please see below mentioned Year wise Breakup of Cost
Estimated cost of indicative principal components of one Design Innovation Centre (DIC)

**Total Budget (Year wise breakup of cost)**

<table>
<thead>
<tr>
<th>S. No</th>
<th>Budget Heads</th>
<th>I Year (Lakhs)</th>
<th>II year (Lakhs)</th>
<th>III Year (Lakhs)</th>
<th>Total Amount (Lakhs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A)</td>
<td><strong>Non-Recurring:</strong> Equipments for the Innovation Research Proposals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Proposal (A)</td>
<td>13.0</td>
<td>-</td>
<td>-</td>
<td>13.0</td>
</tr>
<tr>
<td></td>
<td>Proposal (B)</td>
<td>55.60</td>
<td>-</td>
<td>-</td>
<td>55.60</td>
</tr>
<tr>
<td></td>
<td>Proposals (C)</td>
<td>97.0</td>
<td>--</td>
<td>--</td>
<td>97.0</td>
</tr>
<tr>
<td></td>
<td><strong>Total (A) Non-recurring</strong></td>
<td>165.6</td>
<td>--</td>
<td>--</td>
<td>165.6</td>
</tr>
<tr>
<td>(B)</td>
<td><strong>Recurring</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Students Fellowships/ Internships, Consumables, Contingency and Other Recurring Expenses For Research Proposals</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Proposal (A)</td>
<td>17.20</td>
<td>11.40</td>
<td>8.40</td>
<td>37.00</td>
</tr>
<tr>
<td></td>
<td>Proposal (B)</td>
<td>25.32</td>
<td>25.32</td>
<td>25.32</td>
<td>75.96</td>
</tr>
<tr>
<td></td>
<td>Proposal (C)</td>
<td>20.16</td>
<td>20.16</td>
<td>21.12</td>
<td>61.44</td>
</tr>
<tr>
<td></td>
<td><strong>Total (B) Recurring</strong> (Proposals A+ B + C)</td>
<td>62.68</td>
<td>56.88</td>
<td>54.84</td>
<td>174.4</td>
</tr>
<tr>
<td>(C)</td>
<td><strong>Other Recurring Expenses</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Concept Development, Mock-up models and prototyping expenses</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>60.00</td>
</tr>
<tr>
<td>4.</td>
<td>Staff salary and honorarium for visiting faculty</td>
<td>36.70</td>
<td>36.70</td>
<td>36.60</td>
<td>110.00</td>
</tr>
<tr>
<td>5.</td>
<td>Travel &amp; Field Trial related expenses</td>
<td>20.00</td>
<td>15.00</td>
<td>15.00</td>
<td>50.00</td>
</tr>
<tr>
<td>6.</td>
<td>Workshops, Training &amp; Outreach</td>
<td>20.00</td>
<td>20.00</td>
<td>20.00</td>
<td>60.00</td>
</tr>
<tr>
<td>7.</td>
<td>Creation of Innovation at partner institute under Hub &amp; Spoke model</td>
<td>140.00</td>
<td>120.00</td>
<td>120.00</td>
<td>380.00</td>
</tr>
<tr>
<td></td>
<td><strong>Total (C)</strong></td>
<td>236.70</td>
<td>211.70</td>
<td>211.60</td>
<td>660.0</td>
</tr>
</tbody>
</table>

**Total Amount in Lakhs (A+B+C)** 1000.0

**Total Amount in Crore** 10.00 Crore
CERTIFICATE

a) General Infrastructural facilities, such as furniture/space etc., are available in the University Departments and will be provided for the Project.

b) We shall abide by the rules governing the scheme in case assistance is provided to the Savitribai Phule Pune University for the above project.

c) The above research Project is not funded by any other agency.

Project Coordinator  Registrar  Vice- Chancellor
Prof. Dilip Dhavale  Dr. Narendra Kadu  Prof. W. N. Gade

For Correspondence:
Prof. Dilip Dhavale
Professor and Head,
Department of Chemistry
Savitribai Phule Pune University
Pune 411 007
E mail: ddd@chem.unipune.ac.in  dilipdhavale56@gmail.com
Phone: (020) 25601395 Ext. 501, 502
Mobile: 094225 21594
TO WHOMSOEVER IT MAY CONCERN

We understand that the University of Pune has submitted a project proposal for ‘Establishment of Design Innovation Centre’ to Government of India, Department of Higher Education, Ministry of Human Resource Development, through project coordinator Professor D.D. Dhavale, Head, Department of Chemistry, University of Pune. We are glad to know that one of the innovation research areas includes ‘Development of Receptor Targeted Vaccine Delivery System against Diphtheria, Tetanus, Pertussis, Haemophilus influenzae and Hepatitis B infections’, in collaboration with Serum, Institute of India Ltd., Hadapsar, Pune. We certify that we will be participating in this research project as collaborator and will provide all technical and other necessary support to obtain fruitful outcome in this research project.

Dr. Rakesh Kumar
Director
PV ENERGY EXPERTS
Mini Solar Panels, PV Test Equipment, PV Education, Solar Water Pumping, PV Consultancy

www.pvee.in

To

The Head, Department Of School Of Energy Studies,

SPPU Pune 411007

Dear Dr S.V. Ghaisas,

Subj: Innovative Project, Solar Cycle LOI from PV EE

Subsequent to our meetings in your office, PV Energy Experts is interested in developmental work of this project along with SFF.

As a first step we have already developed & supplied 25Watt Solar Panels with almost half the weight of conventional solar panel for this project.

Additionally suitable equipments like Charge Controller, etc will be develop under this project.

Please communicate us formally how we can work together in this regard.

Thanking you with
Best Regards
PV Energy Experts,

Vijay Shingare
Head Business Development
9890486063
pvenergy@hotmail.com

Regd Office: 1, Sahadeo Avenue, S.No. 5/9, Roshan, Pune 411008 Email: pvenergy@hotmail.com
Web: www.pvee.in
A proposal on Design Innovation Centre at IIT Bhubaneswar

DIC@IITBBS - Focus and Structure

- Product Focus: Products for Children
- Education Focus: Product Design and Manufacturing
- Structure: Five Chambers of DIC

Presented by Satyanarayan Panda
DIC@IIITBBS - Our Spokes

- College of Engineering and Technology (CET), Bhubaneswar
- Ravenshaw University (RU), Cuttack
- Bhubanananda Orissa School of Engineering (BOSE), Cuttack
- Kendriya Vidyalaya (KV), Bhubaneswar

DIC@IIITBBS - Courses to be Offered

1. Product Design: Morality and its Implications
2. Theory of Design and Visual Graphics
3. Design for Environment
4. Psychological Foundations of Innovative Product Design
5. Geometry of Forms and Model Making
6. Product Design Concepts

<table>
<thead>
<tr>
<th>0-6 Month</th>
<th>6-12 Month</th>
<th>12-18 Month</th>
<th>18-24 Month</th>
<th>24-30 Month</th>
<th>30-36 Month</th>
</tr>
</thead>
</table>
## DIC@IITBBS - Product/Prototype Plans

<table>
<thead>
<tr>
<th>0-6 Month</th>
<th>6-12 Month</th>
<th>12-18 Month</th>
<th>18-24 Month</th>
<th>24-30 Month</th>
<th>30-36 Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>Passive Products (2 Prototypes) (〆 at IITB and one at BOSI)</td>
<td>Passive Products (3 Prototypes) (〆 at IITB and two at BOSI)</td>
<td>Passive Products (Active Products) (Pass 1 november) (〆 at IITB and two at BOSI)</td>
<td>Passive Products (Active Products) (Packaging) (〆 at IITB and two at BOSI)</td>
<td>Passive Products (Active Products) (Ad Design) (〆 at IITB and two at BOSI)</td>
<td>Passive Products (Active Products) (Ad Design) (〆 at IITB and two at BOSI)</td>
</tr>
<tr>
<td>0 (Provisional Patent Filing)</td>
<td>0 (Provisional Patent Filing)</td>
<td>0 (Provisional Patent Filing)</td>
<td>0 (Provisional Patent Filing)</td>
<td>0 (Provisional Patent Filing)</td>
<td>0 (Provisional Patent Filing)</td>
</tr>
</tbody>
</table>

## DIC@IITBBS - Total Budget

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Budget Head</th>
<th>First Year (In Lakh)</th>
<th>Second Year (In Lakh)</th>
<th>Third Year (In Lakh)</th>
<th>Total (Head wise) (In Lakh)</th>
</tr>
</thead>
</table>
| 1       | Facilities for Five Chambers of DIC  
  • Chamber of 3D's  
  • Chamber of Deconstruction  
  • Chamber of Metering  
  • Chamber of Life  
  • Chamber of Trumpets | 100 | 150 | 70 | 320 |
| 2       | Fabrication and manufacturing cost | 5 | 15 | 15 | 35 |
| 3       | Consumables | 10 | 20 | 20 | 50 |
| 4       | Video Lectures | 5 | 5 | 2 | 10 |
| 5       | Contingency | 1 | 2 | 2 | 35 |
| 6       | Administrative and Support staff  
  Attorneys and Resource persons | 20 | 20 | 20 | 100 |
| 7       | Workshops/Seminars/Outreach Programs, Short-term courses, Exhibitions, Promotional Events | 10 | 20 | 20 | 100 |
| 8       | Travel & Field Work related expenses | 15 | 15 | 15 | 50 |
| 9       | Budgets for Spokes (4 nos) | 100 | 100 | 100 | 300 |
| **Total (Year wise)** | **353.5** | **378.75** | **267.75** | **1000** |
## DIC@IITBBS - Budget for Spokes

### CET, Bhubaneswar

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Budget Head</th>
<th>First Year (in Lakh)</th>
<th>Second Year (in Lakh)</th>
<th>Third Year (in Lakh)</th>
<th>Total (Head wise) (in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smart class room/Design Studio for 40 students</td>
<td>25</td>
<td>4</td>
<td>5</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Model making laboratory</td>
<td>25</td>
<td>7</td>
<td>2</td>
<td>35</td>
</tr>
<tr>
<td>3</td>
<td>Consumables</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>Library</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Support staff, Assistants and Resource persons (Courses - 2 subject a year for 3 years, Workshop - 1, Certificate course - 1)</td>
<td>7</td>
<td>10</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td></td>
<td>Total (Year wise)</td>
<td>64</td>
<td>32</td>
<td>24</td>
<td>120</td>
</tr>
</tbody>
</table>

### Ravenshaw University, Cuttack

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Budget Head</th>
<th>First Year (in Lakh)</th>
<th>Second Year (in Lakh)</th>
<th>Third Year (in Lakh)</th>
<th>Total (Head wise) (in Lakh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smart class room</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>20</td>
</tr>
<tr>
<td>2</td>
<td>Library</td>
<td>3</td>
<td>3</td>
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</tr>
<tr>
<td>3</td>
<td>Consumables</td>
<td>1</td>
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</tr>
<tr>
<td>4</td>
<td>Support staff, Assistants and Resource persons (Courses - 2 subject a year for 3 years, Workshop - 1)</td>
<td>14</td>
<td>21</td>
<td>12</td>
<td>47</td>
</tr>
<tr>
<td></td>
<td>Total (Year wise)</td>
<td>31</td>
<td>28</td>
<td>16</td>
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## DIC@IITBBS - Budget for Spokes

### BISE, Cuttack

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Budget Head</th>
<th>First Year (in Lakh)</th>
<th>Second Year (in Lakh)</th>
<th>Third Year (in Lakh)</th>
<th>Total (Head wise) (in Lakh)</th>
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<td>Total (Year wise)</td>
<td>48.5</td>
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### KV-I, Bhubaneswar

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<th>First Year (in Lakh)</th>
<th>Second Year (in Lakh)</th>
<th>Third Year (in Lakh)</th>
<th>Total (Head wise) (in Lakh)</th>
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<tr>
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<tr>
<td>5</td>
<td>Support staff and Resource persons</td>
<td>3</td>
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<td></td>
<td>Total (Year wise)</td>
<td>14</td>
<td>8</td>
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Proposal for Design Innovation Centre

Indian Institute of Technology Bhubaneswar

December 2014

Version 3.0
Introduction

The Design Innovation Centre (DIC) that is being proposed at IIT Bhubaneswar has a vision of infusing a culture of innovative thinking in the budding engineers through interdisciplinary projects leading to development of educational and community driven products primarily for children. It focuses on the domain of children’s product such as toys, teaching aids, furniture, books, movies etc. for the simple reason that these products lay the foundation of innovative thinking and problem solving attitude in the mind of our children. These articles should be designed in such a manner that through their use children are expected to learn about the world and engage in activities that encourage their cognitive, emotional, and social development. Child development occurs across several domains, including language, fine motor, gross motor, balance and coordination, self-expression, communication, problem solving, sensory, social-emotional, philosophical, ethical and cognitive development. For example an educational toy can teach a child about a particular subject or can help a child develop a particular skill. This can completely transform the way a child is introduced to different concepts or domains of knowledge. Nations with happy children are known to be happy nations. DIC at IIT Bhubaneswar would endeavor in achieving this goal in the next ten years of time.

National Institute of Design (NID) offers a course on toy design. However, the vision of DIC, Bhubaneswar is different from that of NID, in a sense that here the aim is not to build career of small number of students per year in this specific field. The primary aim is to encourage thousands of students of various domains to brainstorm and invent in an interdisciplinary environment. A long term and bigger aim is to make India known for its children’s product. IIT Bhubaneswar, with its inherent interdisciplinary academic structure is placed in a perfect position to start such a beautiful center.

Design Innovation Centre (DIC) at IIT Bhubaneswar

The setting up of a Design Innovation Centre (DIC) at IIT Bhubaneswar is a good opportunity for the introduction of design learning and innovation in eastern India. It is proposed that IIT Bhubaneswar could become a hub for design innovation and setup satellite centres (spokes) in regions near Bhubaneswar. Such a centre would further be a key step towards the full-fledged academic programme in design and creative arts at the institute. The DIC would be a timely initiative to understand the unique directions that design education could have in the context of local craft and artistic heritage and future industrial development of the region.

Vision

To infuse the culture of innovative thinking in our budding engineers through interdisciplinary projects which lead to development of educational and community driven products primarily for children.

Mission

- To become financially self-sustained within five years of inception through aggressive entrepreneurial activities

- To act as a bridging element between industry and academia
Explore and proliferate the rich heritage and culture

The ‘Hub and Spoke’ Model

As per the guidelines of MHRD the following hub & spoke model (Figure 1) is proposed for DIC IIT Bhubaneswar. DIC, IITBBS is proposed to play the role of the ‘hub’. Two of the major centrally funded training centers have been identified to act as two of the three planned ‘spokes’. In addition, one of the Kendriya Vidyalayas has been chosen to be the third spoke. As one of the main objectives of DIC is to spread the culture of innovation in every corner of the society, for this to happen effectively, the habit of innovative thinking needs to be inculcated at a very young age. In this context DIC, IIT Bhubaneswar would act as a hub and mentor to achieve this goal by facilitating interaction between innovators and young school children.

Figure 1

Department of Psychology and Philosophy, Ravenshaw University
Ravenshaw University came into existence on the 15th day of November, 2006. It was an upgradation of Ravenshaw College established in 1868, one of the oldest and largest colleges in India which subsequently became an autonomous college with CPE status by UGC and ‘A’ grade by NAAC. The College with all its glorious academic achievement and ceaseless scholastic pursuits had already created a distinct niche for itself in India and beyond. The history of this great institution is, in a manner of speaking, the history of modern Orissa. It was the cradle of ideas fostering national unity and nationalism, promoting social mobilization and gearing up the freedom struggle.

The University has 27 departments of which Department of Psychology and Philosophy are two of the pioneering Departments of the University. These two Departments are expected to infuse the budding innovators with the essence of ethics and social views into their innovations.

Department of Architecture, CET Bhubaneswar

The College of Engineering & Technology, Bhubaneswar was established by the Government of Odisha in 1981 to meet the growing technical man power need in the State. It was a Constituent College of the Odisha University of Agriculture & Technology, Bhubaneswar since inception. After creation of a Technical University for Odisha State, the College has become a Constituent College of Biju Patnaik University of Technology (BPUT), Odisha with effect from 09th July, 2002 as per section-37(1) of BPUT Act, 2002.


Department of Architecture was established 1988 and provides an introduction in to the discipline of design and physical planning in response to human needs, cultural values and technological concerns. The students explore graphics in the state of art computer labs equipped with various software packages and display their works in the well-equipped studios. In the past few years the department has organized major events like the national association of student of architecture (NASA), Zonal NASA conventions and a Kodak sponsored workshop on architectural photography. Renowned architects of national repute and distinguished professors among the leading technical institutes, such as IITs, SPA, New Delhi visit the department regularly to attend seminars and conduct workshops. The students’ forum of the department takes active participation in the celebrating events like World Photography Day, World Habitat Day, Earth Day etc.

Department of Architecture, CET Bhubaneswar is going to play a vital role in bringing in the concepts of aesthetics, ergonomics, space and forms etc. into the product design environment of the proposed DIC.

BOSE, Cuttack

Being one of the oldest Institutes of the Country, it is having 44 acres of campus in the city of Cuttack, near river Mahanadi. The institute was centre of war efforts in the Eastern Region during World War II. Initially technician courses in Civil, Electrical and Mechanical Engineering were there in the Institute. At a later stage, to meet the Industrial demand diversified courses were introduced under semester system in 1971 in this Engineering School.
BOSE, Cuttack with its good infrastructure and well trained workforce will play a major role in transforming dreams into innovations.

Kendriya Vidyalaya – 1, Bhubaneswar

KV-1 Bhubaneswar excels in the field of secondary and senior secondary education promoting national integration and a sense of "Indianness" among the children while ensuring their total personality development and academic excellence.

This association will encourage and lead to collaborative teaching initiatives, innovative research, curiosity driven development and school enrichment and support. If children are to discover what they are good at, what they like, and what they are like, then they will need variety in their extra-curricular activities, and a broad assortment of toys and other learning aids to make it possible. This will provide us an opportunity to improve learning abilities in children and the children’s products developed at DIC, IIT Bhubaneswar will play a major role in prolonged learning. This centre will also provide a platform for the students of KV to be a part of the innovation process through various workshops, seminars and exhibitions.

Proposed structure of DIC, IIT Bhubaneswar

The Design Innovation Centre at IIT Bhubaneswar is planned to be consisting of five chambers (Figure 2) where the students will inculcate the culture of innovation. Each chamber will consist of three arenas.

![Chambers Diagram](image)

Figure 2. The five chambers of DIC, IIT Bhubaneswar

**Chamber of 3D’s** (Figure 3) consists of Dream, Draw and Design Arena. In these Arenas the budding engineers of IIT Bhubaneswar, faculty members and collaborators would brainstorm to get innovative ideas to build children’s products. They would build virtual products which would move on to the real world after it passes through the various chambers.
DIC is contemplating brainstorming and collaboration session based on team idea mapping method that works by the method of association. It may improve collaboration and increase the quantity of ideas, and is designed so that all attendees participate and no ideas are rejected.

The process begins with a well-defined topic. Each participant brainstorms individually, then all the ideas are merged onto one large idea map. During this consolidation phase, participants may discover a common understanding of the issues as they share the meanings behind their ideas. During this sharing, new ideas may arise by the association, and they are added to the map as well. Once all the ideas are captured, the group can prioritize and/or take action.

**Animation** and **printing** studios in draw arena are expected to perform the following (but not restricted to):

- Animated Characters/Toys
- Animated Web Graphics
- Commercials
- Educational/Industrial films
- Logos
- Games
- Multimedia/New Media
- Rides/Simulators
- Websites

Design arena consists of numerical simulation, analysis and optimization and ergonomics studios are designed to be working with software like ANSYS, NASTRAN, CATIA, SOLIDWORKS, RHINO, MIDACO, ASCEND, SmartErgo etc.
**Chamber of Deconstruction** (Figure 4) consists of Cut, Measure and Scan Arena. In these Arenas the existing products are literally dissected so that reverse engineering can be done on these products. This gives an opportunity to improve the present state and evolve them into a new generation.

The Cut Arena involves all sorts of Mechanical Electrical and Chemical metal removal processes. The studios under this arena are planned to house various table top power tools, numerous hand tools and many chemical cutting equipment. Depending on the type of component appropriate cutting technology will be used so that the anatomy of a given component is done with minimal data loss.

The Measure Arena has been designed to enhance measurement accuracy and reduce uncertainty. This Arena concerns the application of measurement science to manufacturing and other processes and their use in the centre at various stages, ensuring the suitability of measurement instruments, their calibration and quality control of measurements. Starting from concept through design and construction, this arena will be used by all the other arenas to develop a solution appropriate for the operational expectations and budget.

The Scan Arena provides all the facilities to view measure and calibrate various detailing of the components which are dissected in the Cut Arena. 2D and 3D scanners of various sizes and accuracy levels will provide the dimensional data related to the component under investigation. Laser based scanners will provide data related to the exterior of the component whereas x-ray based scanner can provide information about even the interior arts which are not visible from outside. Different standards of contact and non-contact type profile-meters will provide information on the surface related parameters.
Chamber of Making (Figure 5) consists of Plastic, Metal and Wood Arena. After going through the Chambers of 3D’s, Deconstruction and ending the journey of virtual world the articles mould and see themselves for the first time in these Arenas.

The Plastic Arena will house all the facilities to mould and join small plastic components. For more complex components or specialized plastic quality requirement, the center works in collaboration with one of the spokes, CIPET, Bhubaneswar. They have all the expertise to build plastic components of almost any level of complexities. They also have the knowhow of preparation and use of specific grades of plastics.

The Metal Arena will house all the basic facilities for casting and forming small components. Various joining processes like soldering, welding etc. in a small scale also can be performed in these studios. It will also utilize the expertise of CTTC Bhubaneswar. They excel in the field of CAD/CAM, Tool Design & Manufacturing, Tool & Die Making, CNC Programming & Machining and Industrial Automation.
Chamber of Life (Figure 6) consists of Sense, Actuate and Control Arena. The products once made in the Chamber of Making get its life in these Arenas. They start to respond to the surrounding environment.

In the Sense Arena various kinds of sensors e.g., vision, ultrasonic, laser, thermal, sound, tactile sensors will be embedded into the products to make them interact with the environment. The various studios in the Sense Arena will house all these specialized sensors for specific applications. Many products will require various kinds of movements and the Actuate Arena deals with this requirement. The Mechanical, Electrical and Thermal studios will provide access to actuators like motors, pumps, hydraulic jacks, relay, servomotors, thermal bimorph etc. Articles embedded with sensors and actuators need controllers to perform in a controlled way. The various hydraulic, electronic and electrical controllers will assist in achieving this objective.

Chamber of Trumpets (Figure 7) consists of Ad, Package and Market arena. The innovative products after passing through the chambers of 3D’s, Deconstruction, Making and Life would like to show off and sell themselves in the market. Its success or failure would make us more determined and strong in our mission to achieve our vision.
The Ad Arena will provide a platform to our students to enhance and showcase their skills in using slogans and social media for promotion of product. The package Arena will add value with respect to aesthetics, functionality and safety features. Finally, the Market will take care of proper pricing and effective distribution of the designed products.

Facilities at IIT Bhubaneswar

IIT Bhubaneswar is having state of the art CAD centre equipped with 16 Node server with 30 numbers of high-end, graphic-intensive workstations to cater to the need of all kinds of drawing, design and animation requirements. The Centre is having software like CATIA, PRO-E, ANSYS, SOLIDWORKS, AutoCAD, NASTRAN, ADAMS etc. in order to satisfy all the software requirements.

The Institute has got an advanced manufacturing and production laboratories equipped with state of the art facilities. Various laboratories have various sophisticated equipment like 3D Profilometer, Field Emission Scanning Electron Microscope, High Speed Cameras, and Thermal Imaging Camera etc. for supporting reverse engineering activities. We have a Rapid Prototyping facility for producing prototypes of various design made by students and researchers. The instrumentation laboratories provide all kinds of sensing and actuation capabilities. The Institute also has also got advanced printers, plotters and photocopiers.

Courses/Workshops on Design Innovation

The following courses on Design Innovation are proposed:

1. Product Design: Morality and its Implications
2. Theory of Design and Visual Graphics
3. Design for Environment
4. Psychological Foundations of Innovative Product Designing
5. Geometry of Forms and Model Making
6. Product Design Concepts
The details of the courses are given below:

<table>
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<th>Product Design: Morality and its Implications</th>
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</thead>
<tbody>
<tr>
<td>Pre-Requisites: None</td>
<td>3 – 0 – 0 – 3</td>
</tr>
</tbody>
</table>

This course provides the background for discussion of the basic issues in morality and its implications in the process of manufacturing toys in particular. Emphasis is given to the moral problems engineers face in the process of designing and manufacturing toys. It places those issues within a philosophical framework, and it exhibits both their social importance and their intellectual challenge. The primary goal is to stimulate critical and responsible reflection on moral issues surrounding engineering practice and to provide the conceptual tools necessary for pursuing those issues; and also to give students sufficient experience with the use of those tools to feel reasonably confident that they can resolve those issues properly in a work environment.

**Introduction:** Why be Moral? Ethics and Morality: Conceptual analysis Morality in Engineering

**Moral Concepts:** Equality, Identity, Identification with Socio-cultural values, Duty or moral obligation, moral responsibility, valorization of national virtues, symbolization of tradition, symbolization of cultural innovation, cultural vis-à-vis multicultural values.

**Moral Issues:** Stereotyping, gender discrimination, social stigma, prejudices

**Ethical Theories:** Utilitarianism: business matters, maximization of profit, Deontology: duty for the duty sake, categorical imperatives, Virtue Ethics, Ethics of care.

**Implications:** The product matters: product and interest, product and profit, product and society, The process matters: Technology and its implication, cost and benefit, inclusiveness, sustainability, The client matters: Children and other stake holders,

**Recommended Books:**

<table>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Pre-Requisites: None</td>
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The study aims at building up the vocabulary in visual and basic design principles. Understanding of elements of visual design translated into detailed design presentation i.e. Plan, Elevation, Section, Perspectives, & Model. To acquaint the students with the basic aesthetic principles involved in design. To study and understand the use of colours and rendering techniques to prepare 2 & 3 dimensional presentations. The subject also aims to enhance the skills in Visual perceptions of design theories.
Unit – I
- To study & practice through lettering exercises & graphical presentations techniques.
- To study the fundamentals of visual – design such as points, lines, planes, colours, textures, etc. resulting into 2 dimensional composition.
- Understanding the various principles of composition eg. Symmetry, Rhythm, Harmony, Contrast, Balance, Monotony etc. and exercises based on these principles.
- Study of visual relationships through exercises on placement of objects at different eye-levels and different distances.
- Study of basic terms such as surface, form, space and understanding their relationship to each other.
- Two dimensional studies in surface composition, arrangements, relationships, continuity etc. Three dimensional studies in Stability relationship, balance, composition etc.
- Understanding the Elementary structural forms.

Hours: 10

Unit – II
- Measured drawings of different furniture types, doors, windows etc.
- Dimensional compositions using repetitively the same forms to create different arrangements incorporating, understanding of Activity, Users circulation etc.
- Dimensional composition resulting into spaces.
- Quantitative & qualitative analysis of 3-dimensional space. Perception of space in terms of mundane, vibrant, soothing, irritating, free flowing etc. Indoor and Outdoor space relationship.
- Simple imaginative problems – Memorials, bus Shelter, park furniture etc. Model of the design problems in appropriate scale.
- Characteristics of built form – Hi-tech, Urban, Rural, Simulation of different built forms in landscape setting.
- Model and building visualization.

Hours: 10

Unit – III
- Role and meaning of art various types of arts - fine arts, performing arts, commercial arts, industrial arts, folk arts, abstract art, visual arts, spatial arts, temporal arts, pop art, etc., relationship of architecture with other arts like painting and Sculpture. Principles of architectural composition unity, balance, proportion, scale, rhythm, contrast, harmony, accentuation, restraint, definition, repose, vitality, strength, with the help of illustrations of buildings, both historical as well as contemporary.
- Organising principles of architectural composition - symmetry, hierarchy, datum, and axis - different types of spatial organizations of masses linear, centralised, radial, clustered, grid organization illustrations of buildings both historical & contemporary.
- Use and need of ornament in architectural design, different types of ornamentation in buildings, historical perspective of the use of ornament in buildings.
- Use of different materials like brick, timber, stone, concrete, glass for aesthetic and structural purposes.

Hours: 10

Unit – IV
- Study of colours and colour schemes.
- Composition with primary, secondary & tertiary colours (2 sheets)
- Composition with complementary, split and analogous colours. (2 sheets)
- Study of light and shade effects on simple objects.
- Exercises in 2 & 3 dimensional compositions with effects of light and shade (2 sheets)
- Sketching of simple natural / manmade forms in combination with trees, human figures etc using pencil (2 sheets)
- Rendering buildings and other manmade forms in combination with natural elements using pen
and ink, charcoal, water colours etc. (2 sheets)
- Study of scales and proportions with perspectives of simple geometric forms.
  • 2 dimensional compositions on straight linear form.
  • 3 dimensional composition on convex-concave and curvilinear forms.

**Recommended Books:**
1. V.S.Parmer, Design fundamentals in Architecture, Somaiya publications private limited, New Delhi.
3. "Form, Space and Order" by Francis D.K. Ching
4. "Design Fundamentals in Architecture" by Parmar V.S.

**Design for Environment**

<table>
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<th>Pre-Requisites: None</th>
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</table>

**Unit 1:** Industrial Waste and Life Cycle Analysis: Air Pollutant Emissions, Waterborne Pollutant, Discharges, Solid Waste, Pollution Prevention, Ecological Damages, Effect on Climate Changes, Economic Input-Output (EIO), Life Cycle Inventory Analysis (LCI), Life Cycle Impact Assessment (LCIA), Life Cycle Interpretation

**Hours: 12**


**Hours: 10**


**Hours: 12**


**Hours: 10**

**Recommended Books:**
1. Design for environment by Joseph Fiskel, McGraw Hill
3. Industrial Ecology by Thomas E. Greadel, Braden R. Allenb: Publisher: AT&T
4. A small textbook on Environment Effect Analysis: Matties Lindahl and Johan Tingstorm: Publisher: Department of Technology, University of Kalmar
The designing of innovative educational products and toys requires a combination of knowledge in engineering technology and the psychological features of human consumers for whom they are meant. While the first one falls in the domain of architectural engineering, the second one relates to the characteristic ways of how human beings interact with their material and non-material environment, process information and generate outputs for achieving individual as well as social excellence. This course is planned to sensitize students primarily trained in hardcore scientific technology to the psychological world of the human beings who would use the products for learning and development.

The course intends to enable students:

- To appreciate how human beings perceive, learn, process information in intelligent and creative ways and solve problems and how these psychological processes can be capitalized upon in designing products and educational toys.
- To understand the fundamental psychological principles of human development with a dominant focus on children’s holistic development (physical, cognitive, emotional, social, moral) and their needs, aspirations and psychological crises.

To apply the knowledge of human psychology in designing and developing products with due priority accorded to individual and group difference parameters such as gender, community and cultural preferences and the special needs of mentally and physically challenged children.

Unit-I


- How do individuals sense, attend to and perceive various aspects of their environment?
- What are the structural and functional aspects of the environment that influence human attention and perception?
- How do individuals learn and how they use their learning to think, process information, solve problems and take decisions?
- What are the various domains of intellectual and creative functions and how can the creative potentialities be fostered in people?
- How do emotions influence individuals’ interaction with the environment and how can we develop a positive emotional set for interacting with the environment?
- How can knowledge of the basic psychological processes help us in designing products suitable for use by human beings as end-users?

Hours: 12 hours

Unit-II

Understanding Life-Span Development with focus on Child Development: Principles of development, Factors influencing development, Theories of development- Psycho-sexual development (Freud), Psycho-social development (Erikson and Neo-Freudians), Cognitive development (Piaget and Cognitivists), Theory of social constructivism (Vygotsky and cultural psychologist), moral development (Kohlberg), Product designing in relation to the world view of children

- How do children develop intellectually, socially and morally and how does their world view
change across various domains as they grow?

- What are the significant influences on the growing individuals and how these factors shape their needs, aspirations, likes, dislikes and choices in the context of the human and the material world?
- How do children construct social reality using the socio-historical experiences of their community and culture?
- How do children evaluate material products, events and people around them and differentiate between what is right from what is wrong?
- How can innovative products cater to children’s developmental stage-specific needs and preferences and help them unfold their potentialities?

**Hours: 12**

**Unit- III**

**Childhood Play and Implications for Development:** Play vs. Work, Importance and values of play for growth and development, Nature, characteristics and types of play, Theories of Play, Development of play preferences; Play equipment – Individual and Group Play, Outdoor and Indoor, Integrating play into curriculum and children’s developmental cycle formally and informally, Designing educational toys and products

- What function does play serve in the life of the growing child and why is it important to help a child create his play materials and also to provide him play materials and equipment catering to his interests and preferences?
- How do children’s play needs and preferences change as he grows and which features in toys and play materials capture children’s attention and engagement?
- What types of play materials and equipment are suitable for individual and group play activities and for indoor and outdoor situations?
- How can play materials and equipment be designed keeping in mind children’s developmental needs, aspirations and preferences?

**Hours: 06**

**Unit- IV**

**Pilot Projects for Designing Toys and Play Equipment:** Integrating psycho-social parameters into product designing and developing, Pilot project proposal presentation, Discussion, feedback and modifications. Submission of project proposals

- The students prepare pilot project proposals on designing innovative educational toys and play equipment integrating knowledge gained in psychology.
- The students present their proposals and integrate feedback from discussion to modify the proposals for submission as a course requirement.
- While designing projects, students are required to take into account the needs of diverse groups differing in gender, culture, physical and mental abilities

**Hours: 12**

**Geometry of Forms and Model Making**

**Pre-Requisites:** None

The Objective of this course is to make the student understand the geometry of complex forms and to generate ideas towards structural solutions.

**Unit – I**
Education of solid with special properties, pairs of related tetrahedral, prism and its specializations-right, equilateral parallelepiped, antiprism, di-pyramid and trapezoidal as duals of prism and anti-prism. Archimedean solids and their duals intersections and compounds of reciprocal solids, Close spacing of spheres and cylinders. Tensile structures. Ellipsoid hyperboloids and parabolic intersections etc.

**Unit – II**

Concept of Orthographic Projection, First-Angle Projection, Projections of Points, Projections of Straight Lines, Projections of Planes, Projections of Solids, Intersection of Surfaces, Development of Surfaces, Isometric Projection


Geometry of lines and planes, Geometrical shapes (two dimensional)-polygons volutes. Study of solid geometrical forms in various positions including group of forms. Simple Projections and projections of solids, Polyhedron, solids of revolution, solids in simple position, Axis perpendicular to a plane, Axis parallel to both the plane, Axis parallel to one plane and inclined to other. Axis inclined to both the planes, spheres.

Section of solids-Section planes, True shapes of section, sections-of prisms, sections of pyramids, cylinders, cones etc.

Interpenetration of solids and representation in two-dimension. Analysis of complex forms (mouldings, vaults etc.) at different intersections. Surface development of simple solid forms leading to complex forms including interpenetration.

Isometric and Axonometric projections.

**Hours: 8**

**Unit – III**

Perspective - parallel, angular and three points. Exercise from simple solid geometrical shapes leading to perspective of building forms plotting of sciography on perspective drawings simple rendering of perspectives. Free hand perspectives Different drawing mediums. Measuring point Method, Three point perspective. Perspective of Buildings, and Interior, Rendering of Perspectives.


**Hours: 8**

**Unit – IV**

Use of carpentry tools and making joints such as Dovetail joint, Mortise and Tenon joint, Lap joint, Butt joint, etc. to be used for making furniture.

Instructions on the use of tools and materials such as Clay, Thermocol, Paper and Softwood etc. for making architectural models.

**Hours: 10**

**Unit – V**

Introduction to modeling with plastics, acrylics, boards, P.O.P. and Tiles. Exercises to be developed individually for Architectural models.

**Hours: 10**

**Recommended Books:**

1. Geometry of spatial forms; Gasson Peter C. ELLIS HORWOOD, New York

**Product Design Concepts**

**Pre-Requisites:** None

**Unit-I:** Product Attributes – Function and Emotion, Product configurations and Component relationships (component Matrix), Introduction to Design Research

**Hours:** 6

**Unit-II:** Product Analysis – Diachronic, Synchronic, Understanding and Analyzing contexts, parallel situations, future situations, Understanding modularity and modular systems – 3D lattice and structures

**Hours:** 6

**Unit-III:** Design of Modular System – abstract design, Process of conception and its documentation, Seminar and exercises related to above topics

**Hours:** 9

**Unit-IV:** Creativity techniques like brain storming & syneectics to develop creative attitude and open mind, design opportunity, problem perception

**Hours:** 9

**Unit-V:** Idea Sketching, clustering of ideas for concept development, exploratory mockup models for concept development, evaluation of concepts, final concept selection, concept development, refinement and detailing.

**Hours:** 12

**Recommended Books:**

10. Kelly Tom: The Art of Innovation, double day, NY, 2001

**Certificate Course on Innovative Children’s Product Design**

**Eligibility:** Intermediate / +2 Science, Arts, Commerce

**Duration:** 3 weeks

India is considered to have talents in giving leadership to world in every professional field. India is also rich with its diversified culture and heritage. We have traditionally learnt design and art form which is highly appreciated by the world. Now to develop modern India, we need to lay foundation stone of Innovative design development amalgamating advanced technology to rich heritage. The course will focus on -

a) Design with sustainable materials of less carbon footprints.
b) Multifunctional products.
c) Honest and ethical representation of making products.
d) Learning of Indian values while playing/handling with products.

This course will attract young minds of various disciplines for innovating workshop from where world leaders will come out to glorify rich Indian heritage.

The whole learning process in DIC is conceived in five compartments, namely-

<table>
<thead>
<tr>
<th>Compartment</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>IMBIBING</td>
<td>Receiving lessons and understanding with self-individuality i.e., taking in to soul</td>
</tr>
<tr>
<td>INNOVATING</td>
<td>Changing the dimension of conventionally accepted ideas with one’s imagination.</td>
</tr>
<tr>
<td>IMAGING</td>
<td>Crystallizing one’s thought on paper with the help of modern technology.</td>
</tr>
<tr>
<td>INTERACTING</td>
<td>Sharpening of ideas through exchanging views of different minds.</td>
</tr>
<tr>
<td>IMPLEMENTING</td>
<td>Testifying innovations by simulating with multidimensional model</td>
</tr>
</tbody>
</table>

The curriculum structure is developed in the tuning of the above five compartments and after completing the whole course one will be very much equipped with innovative ideas to design children-use products.

### Workshop Proposal on Toy-Making: Socio-ethical Implications

<table>
<thead>
<tr>
<th>Theme</th>
<th>Duration: 10 days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Given the significant achievements companies are making as corporate citizens, their real worth depends on what society may actually need from them not on the needs created by the companies. Their worthiness is to be determined by what is expected of them; by them being socially responsible. This study, particularly, addresses to the ethical issues relating to the Toy manufacturing industries. Toy-making presupposes the shared values and beliefs of the society which directly or indirectly shape the growth of a child. The general perception in the society is that Toys are for children, the toy-maker makes it for them and the parents or relatives buy for them. The toy-maker anticipates a liking for his Toys. The liking comes from the perspective buyer (parents and others) and the user (the children). A child likes something that appeals to his or her senses and intellect. The buyer buys it if it is affordable and beneficial to the user. Whether the child enjoys playing the toy and whether he or she learns something new from its use are relevant for deciding its usefulness. When the question of learning comes, whether the Toy gives some basic ideas about the real time object is important. The desirability of the real time object in the society is also important. Whether the toy should cater only to the individuals and social needs or it should also contain some reformative aspect is also relevant. All of these concerns are about the cognitive, emotive, ethical and social values of the Toys. Apart from these significant concern, cost of the producing a toy is also an important issue for few parents can afford expensive toys for their children in India. In brief a great number of questions need to be addressed before embarking on the path of making toys. The workshop is designed to address all these issues.</td>
<td></td>
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<tr>
<td>Themes of the Workshop:</td>
<td></td>
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<tr>
<td>• Toys and cognitive and emotive aspect of a child (Resource Persons from psychology)</td>
<td></td>
</tr>
<tr>
<td>• Toys and social roles (Resource Persons from sociology/psychology)</td>
<td></td>
</tr>
<tr>
<td>• Toys and symbols of culture (Resource Persons from literature/history/culture study)</td>
<td></td>
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<tr>
<td>• Ethical role of toys (Resource Persons from philosophy)</td>
<td></td>
</tr>
<tr>
<td>• Socio-economic aspects of manufacturing toys (Resource Persons from Economics/management/manufacturer)</td>
<td></td>
</tr>
<tr>
<td>Participants: People engaged in toy manufacturing industries</td>
<td></td>
</tr>
<tr>
<td>Number of Participants: 40</td>
<td></td>
</tr>
<tr>
<td>Number of classes per day: 04 (1 and ½ hour duration each)</td>
<td></td>
</tr>
<tr>
<td>Number of Resource Persons: 20</td>
<td></td>
</tr>
</tbody>
</table>
## Deliverables

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Time in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliverables</td>
<td>0-6</td>
</tr>
<tr>
<td>Setting up of Various arenas</td>
<td>Dream, Draw, Design, Scan and Cut Arena</td>
</tr>
<tr>
<td>Outreach Programs</td>
<td>Workshop I</td>
</tr>
<tr>
<td>Courses</td>
<td>• Product Design: Morality and its Implications</td>
</tr>
<tr>
<td>Products/Prototypes</td>
<td>Passive Products</td>
</tr>
<tr>
<td>Intellectual Property</td>
<td>05</td>
</tr>
<tr>
<td>Sl No.</td>
<td>Budget Head</td>
</tr>
<tr>
<td>-------</td>
<td>-------------</td>
</tr>
</tbody>
</table>
| 1. | Facilities for Five Chambers of DIC -  
- Chamber of 3D’s  
- Chamber of Deconstruction  
- Chamber of Making  
- Chamber of Life  
- Chamber of Trumpets | 320 | 1<sup>st</sup> Year: 100  
NR: 90  
R: 10 | Portable scanners, high speed, high resolution cameras for reverse engineering and table top power tool kits for deconstruction, powered wheels, pug mill, glaze mixer, wood joining jigs, metrological instruments, plastic moulding machine, basic electronic components, DAQ boards, PCB manufacturing kits etc., Furniture, projectors, microphones, speakers, television and other teaching aids, heavy duty printers, plotters, and photocopiers. |
| | | | 2<sup>nd</sup> Year: 150  
NR: 120  
R: 30 | |
| | | | 3<sup>rd</sup> Year: 70  
NR: 40  
R: 30 | |
| 2. | Fabrication and manufacturing cost | 35 | 1<sup>st</sup> Year: 05  
NR: 0  
R: 5 | Outsourcing of intricate products/components during prototyping |
| | | | 2<sup>nd</sup> Year: 15  
NR: 0  
R: 15 | |
| | | | 3<sup>rd</sup> Year: 15  
NR: 0  
R: 15 | |
| 3. | Consumables | 50 | 1<sup>st</sup> Year: 10  
NR: 0  
R: 10 | Cartridges for 2D and 3D printing and plotters, raw materials for clay, plastic, metals and wood arena |
| | | | 2<sup>nd</sup> Year: 20  
NR: 0  
R: 20 | |
| | | | 3<sup>rd</sup> Year: 20  
NR: 0  
R: 20 | |
| 4. | Video Lectures | 10 | 1<sup>st</sup> Year: 5  
NR: 4  
R: 1 | Creating facility for videography of outdoor classes/workshops/seminars |
| | | | 2<sup>nd</sup> Year: 3  
NR: 0  
R: 3 | |
| | | | 3<sup>rd</sup> Year: 2  
NR: 0  
R: 2 | |
| 5. | Contingency | 35 | 1<sup>st</sup> Year: 11  
NR: 0  
R: 11 | Various incidental expenses |
| | | | 2<sup>nd</sup> Year: 12  
NR: 0  
R: 12 | |
| | | | 3<sup>rd</sup> Year: 12  
NR: 0  
R: 12 | |
| 6. | Administrative and Support staff, Artisans and Resource persons | 100 | 1<sup>st</sup> Year: 30  
NR: 0  
R: 30 | Staff salary for all the five chambers, videography and IP management. Remuneration/honorarium for visiting faculty/consultants/domain experts. Special fund to be allocated for resident artists, master designers, innovation specialists as these skills do not fit in the regular employment criteria of IIT. |
| | | | 2<sup>nd</sup> Year: 35  
NR: 0  
R: 35 | |
| | | | 3<sup>rd</sup> Year: 35  
NR: 0  
R: 35 | |
| 7. | Workshops/Seminars/Outreach Programs, Short-term courses, Exhibitions, Promotional Events | 100 | 1<sup>st</sup> Year: 30  
NR: 0  
R: 30 | Workshops, Innovation promotion events, student/faculty participation in national events pertaining to design and innovation including registration fee; Manpower training charges, Expenses towards awards etc. |
| | | | 2<sup>nd</sup> Year: 35  
NR: 0  
R: 35 | |
| | | | 3<sup>rd</sup> Year: 35  
NR: 0  
R: 35 | |
| 8. | Travel & Field Work related expenses | 50 | 1<sup>st</sup> Year: 15  
NR: 0  
R: 15 | Travel for interaction with spokes and other DICs, travel to national events/seminars/workshops/conferences, travel for field surveys. |
| | | | 2<sup>nd</sup> Year: 20  
NR: 0  
R: 20 | |
| | | | 3<sup>rd</sup> Year: 15  
NR: 0  
R: 15 | |
| 9. | Budgets for Spokes (4 nos) | 300 | 1<sup>st</sup> Year: 100  
NR: 90  
R: 10 | Creation of spokes at four locations |
| | | | 2<sup>nd</sup> Year: 100  
NR: 80  
R: 20 | - CET- 120 lakh  
- Ravenshaw University- 75 Lakh  
- BOSE- 75 Lakh  
- KV I- 30 Lakh |
| | | | 3<sup>rd</sup> Year: 100  
NR: 20  
R: 80 | |
| **Total Budget** | **1000** (Rupees Ten Crores Only) | | | |
| NR: Non-recurring, R: Recurring |
## Proposed Budget for Spokes (Duration – 3 Years)

**CET Bhubaneswar**

<table>
<thead>
<tr>
<th>Sl No.</th>
<th>Budget Head</th>
<th>Budget in Lakh</th>
<th>Year-wise Break-up (in Lakh)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td>Smart class room/Design Studio for 40 students</td>
<td>35</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 26 NR: 25 R: 1 2&lt;sup&gt;nd&lt;/sup&gt; Year: 4 NR: 0 R: 4 3&lt;sup&gt;rd&lt;/sup&gt; Year: 5 NR: 0 R: 5</td>
<td>Table, chairs, benches, shelves, LED TV/Screen, microphones, speakers and other teaching aids Drafting tables, Computers and Printer cum scanners and furniture</td>
</tr>
<tr>
<td>11.</td>
<td>Model making laboratory</td>
<td>35</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 26 NR: 25 R: 1 2&lt;sup&gt;nd&lt;/sup&gt; Year: 7 NR: 5 R: 2 3&lt;sup&gt;rd&lt;/sup&gt; Year: 2 NR: 0 R: 2</td>
<td>Model making desks, chairs, 3D printers and tools.</td>
</tr>
<tr>
<td>12.</td>
<td>Consumables</td>
<td>10</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 2 NR: 0 R: 2 2&lt;sup&gt;nd&lt;/sup&gt; Year: 4 NR: 0 R: 4 3&lt;sup&gt;rd&lt;/sup&gt; Year: 4 NR: 0 R: 4</td>
<td>Cartridges for 2D and 3D printing and plotters, raw materials for clay, plastic, metals and wood arena</td>
</tr>
<tr>
<td>13.</td>
<td>Library</td>
<td>5</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 3 NR: 0 R: 3 2&lt;sup&gt;nd&lt;/sup&gt; Year: 1 NR: 0 R: 1 3&lt;sup&gt;rd&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
<td>Books, Journals, computer, printer, staff salary and library furniture</td>
</tr>
<tr>
<td>14.</td>
<td>Support staff, Artisans and Resource persons [Courses – 2 subjects/year for 3 years, Workshop - 1, Certificate course – 1]</td>
<td>35</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 7 NR: 0 R: 7 2&lt;sup&gt;nd&lt;/sup&gt; Year: 16 NR: 0 R: 16 3&lt;sup&gt;rd&lt;/sup&gt; Year: 12 NR: 0 R: 12</td>
<td>Workshops, Innovation promotion events, student/faculty participation in national events pertaining to design and innovation including registration fee; Manpower training charges, Expenses towards awards, Honorarium, Staff salary etc.</td>
</tr>
<tr>
<td><strong>Total Budget</strong></td>
<td><strong>120</strong></td>
<td>(Rupees One Crore and Twenty Lakh Only)</td>
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<tr>
<td>Sl No.</td>
<td>Budget Head</td>
<td>Budget in Lakh</td>
<td>Year-wise Break-up (in Lakh)</td>
<td>Remarks</td>
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<td>-------------------------------------------------------------------------</td>
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<tr>
<td>1</td>
<td>Smart class room</td>
<td>20</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 13 NR: 12 R: 1</td>
<td>Table, chairs, benches, shelves, LED TV/Screen, microphones, speakers, AC, Acoustics and other teaching aids</td>
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<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 5 NR: 4 R: 1</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 2 NR: 1 R: 1</td>
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<tr>
<td>2</td>
<td>Library</td>
<td>5</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 3 NR: 0 R: 3</td>
<td>Books, Journals, computer, printer, staff salary and library furniture</td>
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<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
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<td></td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Consumables</td>
<td>3</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
<td>Cartridges, batteries, stationary etc.</td>
</tr>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 1 NR: 0 R: 1</td>
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<tr>
<td>4</td>
<td>Support staff, Artisans and Resource persons [Courses – 2 subjects/year for 3 years, Workshop - 1]</td>
<td>47</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 14 NR: 0 R: 14</td>
<td>Workshops, Innovation promotion events, student/faculty participation in national events pertaining to design and innovation including registration fee; Manpower training charges, Expenses towards awards, Honorarium, Staff salary etc.</td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 21 NR: 0 R: 26</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 12 NR: 0 R: 12</td>
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<tr>
<td></td>
<td><strong>Total Budget</strong></td>
<td><strong>75</strong></td>
<td></td>
<td><strong>(Rupees Seventy Five Lakh Only)</strong></td>
</tr>
<tr>
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<td>Budget Head</td>
<td>Budget in Lakh</td>
<td>Year-wise Break-up (in Lakh)</td>
<td>Remarks</td>
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<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Smart class room</td>
<td>12</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 8.5</td>
<td>NR: 8&lt;br&gt;R: 0.5&lt;br&gt;Table, chairs, benches, shelves, LED TV/Screen, microphones, speakers, AC, Acoustics and other teaching aids</td>
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<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 1.75</td>
<td>NR: 1&lt;br&gt;R: 0.75</td>
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<td></td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 1.75</td>
<td>NR: 1&lt;br&gt;R: 0.75</td>
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<tr>
<td>2</td>
<td>Library</td>
<td>5</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 3</td>
<td>NR: 0&lt;br&gt;R: 3&lt;br&gt;Books, Journals, computer, printer, staff salary and library furniture</td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 1</td>
<td>NR: 0&lt;br&gt;R: 1&lt;br&gt;</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 1</td>
<td>NR: 0&lt;br&gt;R: 1&lt;br&gt;</td>
</tr>
<tr>
<td>3</td>
<td>Advanced Manufacturing Facility</td>
<td>20</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 3</td>
<td>NR: 0&lt;br&gt;R: 3&lt;br&gt;Table top power tool kits, Advanced manufacturing/fabrication systems etc.</td>
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<td></td>
<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 1</td>
<td>NR: 0&lt;br&gt;R: 1&lt;br&gt;</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 1</td>
<td>NR: 0&lt;br&gt;R: 1&lt;br&gt;</td>
</tr>
<tr>
<td>4</td>
<td>Consumables</td>
<td>8</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 2</td>
<td>NR: 0&lt;br&gt;R: 2&lt;br&gt;Cartridges, batteries, stationary etc.</td>
</tr>
<tr>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 3</td>
<td>NR: 0&lt;br&gt;R: 3&lt;br&gt;</td>
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<td></td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 3</td>
<td>NR: 0&lt;br&gt;R: 3&lt;br&gt;</td>
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<tr>
<td>5</td>
<td>Support staff and Resource persons</td>
<td>30</td>
<td>1&lt;sup&gt;st&lt;/sup&gt; Year: 10</td>
<td>NR: 0&lt;br&gt;R: 10&lt;br&gt;Staff salary, honorarium, travel, boarding and lodging etc.</td>
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<td>2&lt;sup&gt;nd&lt;/sup&gt; Year: 10</td>
<td>NR: 0&lt;br&gt;R: 10&lt;br&gt;</td>
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<td>3&lt;sup&gt;rd&lt;/sup&gt; Year: 10</td>
<td>NR: 0&lt;br&gt;R: 10&lt;br&gt;</td>
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<td>Total Budget</td>
<td>75</td>
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<td>(Rupees Seventy Five Lakh Only)</td>
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<tr>
<td>Sl No.</td>
<td>Budget Head</td>
<td>Budget in Lakh</td>
<td>Year-wise Break-up (in Lakh)</td>
<td>Remarks</td>
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<td>----------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Smart class room</td>
<td>11</td>
<td>1\textsuperscript{st} Year: 7.5</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2\textsuperscript{nd} Year: 1.75</td>
<td>Table, chairs, benches, shelves, LED TV/Screem, microphones, speakers, AC, Acoustics, computer, printer cum scanner and other teaching aids</td>
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<td></td>
<td></td>
<td>3\textsuperscript{rd} Year: 1.75</td>
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<tr>
<td>2.</td>
<td>Library</td>
<td>3</td>
<td>1\textsuperscript{st} Year: 1</td>
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<td></td>
<td></td>
<td>2\textsuperscript{nd} Year: 1</td>
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<td></td>
<td>3\textsuperscript{rd} Year: 1</td>
<td>Books, Journals and Encyclopaedias.</td>
</tr>
<tr>
<td>3.</td>
<td>Exhibitions and Promotional Events</td>
<td>6</td>
<td>1\textsuperscript{st} Year: 2</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2\textsuperscript{nd} Year: 2</td>
<td>Innovation promotion events, student/faculty participation in national events pertaining to design and innovation including registration fee; Expenses towards awards etc.</td>
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<td>3\textsuperscript{rd} Year: 2</td>
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</tr>
<tr>
<td>4.</td>
<td>Contingency/Consumables</td>
<td>1</td>
<td>1\textsuperscript{st} Year: 0.5</td>
<td>Cartridges, batteries, stationary etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2\textsuperscript{nd} Year: 0.25</td>
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<td></td>
<td></td>
<td>3\textsuperscript{rd} Year: 0.25</td>
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</tr>
<tr>
<td>5.</td>
<td>Support staff and Resource persons</td>
<td>9</td>
<td>1\textsuperscript{st} Year: 3</td>
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<td></td>
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<td></td>
<td>2\textsuperscript{nd} Year: 3</td>
<td>Staff salary, honorarium, travel, boarding and lodging etc.</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>3\textsuperscript{rd} Year: 3</td>
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<tr>
<td></td>
<td><strong>Total Budget</strong></td>
<td><strong>30</strong></td>
<td></td>
<td>(Rupees Thirty Lakh Only)</td>
</tr>
</tbody>
</table>