

Internal Review Report

For

Centre for Biomedical Engineering

Indian Institute of Technology Delhi

A Joint Venture between

Indian Institute of Technology New Delhi

&

All India Institute of Medical Science New Delhi

Indian Institute of Technology New Delhi

Hauz Khas, New Delhi 110016

Internal Review Report - CBME

1	Curriculum		
1.1	List of degree programmes offered - UG + PG - and enrolment	18	Annexure 1.1
1.2	Consistency of curricula with academic vision of the department	Yes, M. Tech. programme to be started to generate skilled human resource	
1.3	Quality of programmes		
a	Periodicity of curriculum review UG and PG	Once in 2 years	
b	Mechanism for review at UG and PG level	CRC committee	
c	Coursework for each UG, PG and PhD programme - Core / Elective	7	
d	Pre PhD courses offered (<i>in last 5 yrs</i>)	3	Annexure 1.3.d
e	New advanced Masters / Pre-PhD courses introduced in last 5 yrs	3	Annexure 1.3.d
f	Overlap between courses (c) and (d) & (e), including opening latter to UG	BML 700 Open category for UG, PG and Pre-Ph.D	
g	Seminar series (weekly/regular) held each semester	2	
h	Placement details	Annexure 1.3.h	
i	Relevance of UG and programmes to recruiters, potential and on-campus recruiters	Yes	
j	Benchmarking of curriculum	Annex.3	
2	Teaching environment		
2.1	Student-Teacher ratio separately and total for UG, PG, PhD	90	
2.2	No. of students graduated in each programme, incl. PhD	47	all Ph.D.
2.3	Student-T.A. (or student-hours/T.A.) ratio	N.A.	
2.4	No. of skilled technical staff	1	
2.5	Gross laboratory space; break-up of lab space for core UG / PG teaching	5600	
2.6	Laboratory modernization performed in last 5 years for (i) UG core, (ii) PG core, (iii) elective courses	Annexure 2.6	

2.7	Course files for each course for last 5 years	2	
2.8	Study materials prepared, course-wise	Powerpoint presentation, lecture notes, web based materials, research manuscript reprints, notes	
2.9	Research and Innovations in teaching-learning processes	Latest Technologies in subject areas covered and demonstrated with audio-visual presentation to the students	
2.10	No. of students (UG and PG separately) who have spent at least a semester at another university/institute	1	
2.11	No. of students from overseas universities who have taken classes, done project work or internship, UG & PG separately, in the department	3	Annexure 2.11
2.12	Course feedback	With institute	
2.13	Industry experts who have delivered lecture(s), seminars, discussions as part of a core/elective course – UG and PG separately	3	Annexure 2.13
2.14	Industry exposure to students – course-related visits to factories, sites, industry exhibitions, field trips, etc. – UG and PG separately	N.A.	
3	Research		
3.1	No. of Masters and Ph.D. students supported - (i) by Institute Assistantship, (ii) on sponsored projects/consultancies, (iii) others sources and (iv) sponsored by external organizations		Annexure 3.1, 3.2
3.2	No. of Ph.D.s enrolled, graduated per faculty for last 5 years	9.4, 4.4	Annex. 3.1, 3.2
3.3	Areas of research (e.g. areas listed in Prospectus, and others) by (i) Volume (quantifiable parameters), (ii) Breadth, and (iii) Years these have been research areas	Annexure 3.3	
3.4	Publications per faculty (average per year for last five years) in academic journals	8	Annex. 3.4
3.5	Publications (journal and conference) total and per (a) Ph.D. student, (b) Masters student, (c) UG student	237 (a) 2.75 (b) N.A (c) N.A.	Annex. 3.4
3.6	Best papers in last 5 years: (i) Individual best 3, (ii) department/centre best 10; and brief justifications	Annexure 3.6	
3.7	Average citation per department/center	~850	

3.8	Changes, modifications, etc. done to improve the quality of (i) M.Tech., and (ii) Ph.D. graduates	Improvement in coursework structure to suit the latest trend in research articles	
3.9	Sponsored projects - (i) individually, (ii) with another faculty of the group/section of the department, (iii) with another faculty of the department but from another group/section of the department (iv) with another faculty of another dept/center	(i) 94	
3.10	Industry consultancies	15	
3.11	New areas of research which are different from the faculty's PhD thesis area	Annexure 3.11	
3.12	Methodology for (i) identifying obsolescence in research areas, and (ii) identification of new areas for future research	Annexure 3.12	
3.13	Number of large interdisciplinary projects (within department's areas, and across the institute)	12	
4	Innovation, Design and Development		
4.1	No. of students who have been funded for innovating (TePP, PRISM, etc.)	0	
4.2	Technology developed	11	Annexure 4.2
4.3	Technology transferred	10	Annexure 4.3
4.4	Number of patents filed and patent granted as a fraction of patents filed	20 Filed, 16 Granted, 0.8	Annexure 4.4
4.5	Innovations of products, processes, designs, etc. in the department	5	
4.6	Availability and access to students' workshops, "tinkering laboratories" so that they may pursue their own ideas	Yes	
4.7	No. of students/teams who have competed in national / international competitions, and outcome	International-10; National-16, best presentation, best paper, best seminar, etc.	
5	R & D Environment		
5.1	No. of post-doctoral scholars hired in the department/centre and their durations, from (i) abroad, (ii) on project, and (iii) others, and outcomes	5	
5.2	No. of foreign students enrolled in (i) Masters, and (ii) PhD programmes	3	
5.3	No. of Indian and foreign faculty/researchers who have spent a sabbatical in the	0	

	department		
5.4	Sabbatical/exchange program taken by faculty and where spent	Prof. Veena Koul- TU Dresden, Germany(DAAD Exchange-2008),	
5.5	Number of seminars (education and research separately) given by the faculty (i) in the department, (ii) in other departments, (iii) at other institutions	(i)25, (ii) 66, (iii) 132	
5.6	No. of faculty/researchers/scholars invited by the department for giving (i) seminars, (ii) spending at least a week in the department	(i) ~50	
5.7	No. of faculty/researchers who visited the department on their initiative for giving (i) seminars, (ii) spending at least a week in the department	(i) 35	
5.8	Adequacy of research infrastructure	Do not have adequate space for research laboratories or rooms for new faculties	
5.9	Adequacy of technical staff – existing numbers and competency areas; competency areas in which there is a shortage	1 Technical Assistant; Severe shortage	
5.10	Work space available for (a) Masters students, (b) Ph.D. students, (c) project staff, (d) post doctoral scholars	shortage; no teaching lab-space	
5.11	No. of national conference/workshops/seminars attended by PhD students (<i>total and per student for 5 years</i>)	3	
5.12	No. of international overseas conference/workshops/seminars attended by PhD students (<i>total and per student for 5 years</i>)	37, 1.2	
5.13	No. of students who have continued to Ph.D. (i) in same dept., (ii) other departments of IITD, (iii) in India, and (iv) abroad (separately for M.Tech. and B.Tech. students).	(i) NA, (ii) 5, (iii) 17	
5.14	No. of projects with co-guide from industry	3	
5.15	No. of students who have spend time in industry as part of thesis/project work (give number and duration).	3	
5.16	Self assessment reports of the department/centers/schools if any	institute administration	
5.17	Placement of M.Tech. and PhD graduates in technical careers	14	Annexure 1.3.h

5.18	Inter-disciplinary work -: (i) joint thesis guidance by faculty across groups within a department, or across departments/centres, (ii) Proposals submitted and funded – PI-CoPI and their group/department affiliations	(i) 41 Co-supervisor; (ii)5	
6	Outreach / External stakeholder engagement		
6.1	Educational		
a	Workshops/Short term courses – topical research for disseminating research of IITD	7	
b	Workshops/Short term courses – educational methods (teaching, learning resources, pedagogy)	20	from AIIMS
c	Learning, research material on the website	2	
d	Science & technology for public information – on website	0	
e	Courses taught to students of other IITs/NITs/Other institutions	2/2/4	
f	Courses taught via NKN	0	
g	Courses developed for NPTEL	1	
h	Books, monographs, study material made available outside IITD	5	
i	Experiments developed and made available to other institutions	4	
j	Seminars live/via NKN, web to other institutions in India/abroad	0	
k	Reach out to schools, NCERT, KVs, etc. (e.g. K-12 programmes)	0	
l	Mentoring of other institutions, e.g. new IITs, NITs, universities, etc. including faculty mentoring, curriculum development, laboratory development, etc	1 JMI New Delhi, 1 CSIR-NPL, New Delhi, 1 DRDO- INMAS, Delhi, 2 - Ranbaxy DECRUST-Murthal, IIT-Bombay, Anna University, IIT-Madras, VIT-Vellore, IISc-Bangalore, Jammu University, IIT Jodhpur, NIT-Dwarka, NIT-Jalandhar, Amity University, Delhi University, Jamia Millia Islamia, Punjabi University IIT-Roorkee, BESU, IIT-Kanpur, CSIO-Chandigarh	
6.2	Industry collaboration		
a	No. of students (Ph.D./Masters) directly linked to industry funded projects	3	
b	No. of industry staff/engineers who have taken a regular course(s) for entire semester	5	
c	Technology transfer to companies, entrepreneurs, local and other	6	

	governments/government agencies, NGOs (separately)	
d	Continuing education/courses for industry	CGMP to drug regulators and medical device companies
e	Faculty secondment to industry	0
f	Research projects undertaken with industry as partner	6 national+2 international
g	Laboratories, equipment, etc. provided by industry for use in UG / PG teaching laboratories and student projects	0
h	Seminars/workshops held with industry by the department	29
6.3	Professional	
a	Service as Board, Senate, selection committee member at other IITs, NITs, and Universities	CSIR-CCMB, CSIR-IMTECH, DBT, DST, Member of Senate-IIT Delhi, Selection committee member-DRDO, MHRD, DST, LSRB, NIT-Jalandhar, DECRUST-Murthal, University of Delhi; Chairman, Women scientist program DST; Medical devices program DST, USER committee DST; Sri Chitra national gazette; BOG member of NIT Kurukshetra
b	Service as Ph.D. thesis examiner at other institutions	26
c	Service as technical expert on committees – MHRD, DST, DSIR, DRDO, Pan-IIT initiatives, other ministries, state and local governments	DST, DBT, BIRAC (DBT), GITA (DST), CSIO
d	Technical expert on policy, regulatory, laws, standards committees	Drug Control of India
e	Member of Board/Advisory Board of public and private sector corporations	Advisor - Nanogen Pharma, Member of Nanotechnology Board,DBT,New DelhiMember of Technology Development Board. DST, Delhi
f	Positions (e.g. Director, Vice Chancellor, etc.) held by faculty on lien	0
6.4	Contribution to national development goals	
a	Projects undertaken and their outcome	0
b	Policy inputs – implications, visible impact on society	0
c	Entrepreneurship development	0
6.5	Alumni engagement	

a	Regular interactions / engagement with alumni and outcomes	0	
b	Contributions from alumni	0	
6.6	Recognitions and Awards		
a	Awards to faculty	22	Annexure 6.6.a
b	Fellows of academies, INAE, etc	2	
7	Governance		
7.1	Governance		
a	Organization structure – their autonomy/ terms of reference	HoC, Chairman of various committees	
b	Planning documents developed by the department – space, faculty, staff related.	This is being finalized with new inductions	
c	Records of discussions within the department – internal documents (meeting minutes, position papers, discussion papers, concept papers, etc.)	Faculty Board Meeting minutes; CRC Meeting minutes; 12th five year plan concept paper; Centre of Excellence in Biomedical Instrumentation	
d	Physical resources – percentage utilization for UG PG core and electives teaching separately, UG and PG student projects, Ph.D. student research. Projections for future.	30% Teaching 70% Research	
e	Financial resources – (i) funds provided to the department, (ii) processes of distribution, (iii) funding for focus areas, (iv) funding for UG and PG core teaching laboratories. Outcomes of funds utilization. Changes in funding pattern and funds utilization, and effects on departmental strategy.	(i)	15 L NP05, 1 Cr PL03 /Yr
		(ii)	As per faculty board decision
		(iii)	Laser micro-machining, Biosensor etc. Research
		(iv)	N.A.
			Publications, patents, knowhow transfers, manpower training
			Funds to be allocated to new areas of research
f	Delegation of decision making within department/centre. List the processes and structures for financial and academic management, and the methodology for their review.	Collective decision making	
7.2	Department management and operations		
a	Organization structure - mandates,	Faculty board, professorial	

	flexibility, etc.	committee
b	Processes for curriculum planning	CRC
c	Processes and methods for teaching resources management	CRC
d	Guest faculty, affiliation for teaching core, elective UG & PG courses	N/A
e	Faculty short-listing criteria	Professorial committee decision
f	How collectiveness of the faculty has enhanced academic output and enhanced quality, etc	Collective decision
g	Nature, quantum and quality of support from of secretarial staff, stores and inventory management, purchases, ambience, etc	Good
7.3	Faculty	
a	Faculty profile, and a critique of the same	Annexure 7.3.a
b	Diversity in faculty profile by: (i) gender, (ii)category, (iii) region, (iv) Ph.D. institution, (v) post-doctoral institutions worked in, (vi) organizations/industry worked in, (vi) employment prior to joining the department	Gender-5M, 4F; Category-GEN; Region-across India; Ph.D India and abroad
c	Procedure for faculty searches	Institute Guidelines
d	Result of faculty searches – area-wise (as in Annexure IV), number of applicants, short-listed and offered a position, their educational qualifications & experience	Available with institute
e	Success in recruitment (data for last 5 years), and offers that the persons had from other IITs/IISc/TIFR	Excellent from last 1 year
f	Faculty lost to other institutions post selection	3
g	Faculty time utilization – in class, in meetings, project management, Ph.D. guidance, Masters project guidance, UG project guidance	20% / 15 % / 30 % / 25 % / 5 / 5
h	Level of harmony amongst department faculty	Excellent
7.4	Students	
a	Criteria for short-listing and selecting students for admission to Master's and Ph.D. programmes of past 5 years	As per institute Guideline
b	Facilities provided to students and their maintenance/management system	Inter and intra -Laboratories at IIT & AIIMS / based on guidance from supervisors
c	Mentoring seminars/sessions held for Ph.D. students for prospective faculty careers	once in a month
8	Benchmarking	

8.1	Identify departments/centres within IITD as peers	CPSE,DBEB,Textile,Chemistry, Electrical, IDDC, CARE
8.2	Identify departments/centres/schools/divisions from other IITs, IISc, NITs, private universities as peers, and reasons/criteria there for	Broadly from AIIMS New Delhi, DRDO, CSIR.
8.3	Identify departments/centres from institutions in other countries as peers	IIT-Roorkee, BESU, IIT-Kanpur, CSIO-Chandigarh, DECRUST-Murthal, IIT-Bombay, Anna University, IIT-Madras, VIT-Vellore, IISc-Bangalore, Jammu University, IIT Jodhpur, NIT-Dwarka, NIT-Jalandhar, Amity University, Delhi University, Jamia Millia Islamia, Punjabi University
8.4	Define parameters for benchmarking (i) research, (ii) curriculum - separately for UG, Masters, and Ph.D. programmes, (iii) teaching-learning processes	Annexure 8.4
8.5	Perform benchmarking and report the analysis/findings for the last 5 (or 10) years	
9	Feedback systems and results	
9.1	System for feedback from UG students and its results	Teaching feedback available online
9.2	System for feedback from PG, Master's and Ph.D., students, and their outcome	Teaching feedback available online / Improvement in research and teaching
9.3	System for feedback from recruiters (i) on-campus, and (b) off-campus - separately for UG and PG graduates; and the results	N/A
9.4	Mechanism of obtaining industry feedback and the findings	N/A
9.5	Alumni feedback mechanism and its outcome	N/A
9.6	Placement records – Ph.D., M.Tech. and B.Tech	Annex. 1.3.h
10	Vision for next 5-10 years	
10.1	Goals and benchmarking for future in relation to (i) curricula, (ii) research, (iii) outreach, and (iv) processes for regular internal assessment	(i) M. Tech. programme to be started to generate skilled human resource (ii) Development of technologies in research for mass healthcare, in prevention,

		non-invasive diagnostics, therapeutics, trauma and rehabilitation. (iii) transfer of tech. to NGOs & Indian Industries (iv) Intra institute committees
10.2	Vision of curricula and teaching-learning processes - UG, PG and Ph.D.; innovations proposed	M. Tech. programme to be started to generate skilled human resource
10.3	Areas identified for improvement in (i) curriculum, (ii) teaching-learning processes	Biosensors, Drug Delivery, Nanomedicine and regenerative medicine, Lab-on-a-chip, Biomaterials, Biomedical Instrumentation, Signal processing, medical imaging, nanobiotechnology, biomechanics, bio-control systems, virtual instrumentation
10.4	New areas for research and Masters programme, and industry participation in these	Biosensors, Drug Delivery, Nanomedicine and regenerative medicine, Lab-on-a-chip, Biomaterials, Biomedical Instrumentation, Signal processing, medical imaging in collaborations with national institutes
10.5	Projections for (i) funded projects, (ii) journal publications	(i) 2 (ii) 3 /faculty/yr.
10.6	Projected graduation numbers - Ph.D., M.Tech. and B.Tech	5~6 / 10 / 0 /yr.
10.7	Projected faculty profile, and areas for recruitment of faculty	Electronics and instrumentation, Medical Devices and Sensors, Biomechanics, Biomedical instrumentation & Electronics, Biomaterials, Biomedical Imaging simulation & modelling, Biophysical modelling and analysis, Biomechanics
10.8	Projections for future benchmarking (for comparison after 5 years) – institutions in India and abroad, and parameters for future comparison	Patents, publications and tech. transfers in any given area of research
10.9	Infrastructure and governance - limiting factors that affect achievement of benchmarks and methods to overcome these	Infrastructure, space, instruments, consumable, technical staff

10.10	Working with other departments/centers and institutions in teaching and research	Research area expansion in Mechanobiology of cancer with Dept. of Applied Mechanics, Department of chemistry, Polymerscience, Biotechnology, Electrical Engg, Civil, CAS
10.11	New initiatives that the department/centre will undertake	M. Tech. programme in Biomedical Engineering, Biosensors, Medical Devices
10.12	Outreach goals and anticipated limitations in the attainment of these	Transfer of tech. to NGOs & Indian Industries
10.13	Mechanisms for effective changes based on feedback received and development and implementation of corrective measures	Continuous improvements in research methodologies amongst various collaborators
10.14	Questions to which the department seeks answers from the Review Committee	Suggestions for improvement
11	Information in public domain	
11.1	Minutes of all meetings	With institutes
11.2	All reports archived in the central/department/centre libraries	With institutes & funding agencies
11.3	Past vision documents, review documents, Standing Review Committee documents	0
11.4	Any other documents developed by the department, a group/section of the department/centre	0
11.5	Feedback documentation and action taken on the same, and its outcome	0

1.1 List of degree programmes offered - UG + PG - and enrollment

Course Code	Course Name	Average Enrolment	Credits	Teacher Student Ratio	Taught by	Type
BML830	Biosensor Technology	15	3-0-1		Sandeep K. Jha/ Nivedita K. Gohil	PG
BML800	Research Techniques in Biomedical Engg.	8	3-0-0		S. Anand	PG
BMV850	Vascular Engineering	80	1-0-0		S. Anand/Amit Sengupta	UG+PG
BML700	Introduction to Basic Medical Sciences for Engineers	20	3-0-0		Nivedita K. Gohil	UG+PG
BML710	Industrial Biomaterial Technology	20	3-0-0		V. Koul	UG+PG
BMV840	Emerging Health Care Technology	70	1-0-0		Amit Sengupta	UG+PG
BML820	Biomaterial	50	3-0-0		H. Singh/Alok Ray	PG
BMV700	Biomechanical Design of Medical Devices	60	1-0-0		Dinesh K.	UG+PG
PTL 724	Polymer Coating	25	3-0-0		H. Singh	UG+PG
EEL736	Biomedical Electronics	50	3-0-0		S.M.K. Rahman	UG+PG
EEL422	Computers in Biomed	50	3-0-0		S.M.K. Rahman	UG+PG
EEL324	Digital Hardware	50	3-0-0		S.M.K. Rahman	UG
EEL308	Comp. Acrh. Lab	150	0-0-4		S.M.K. Rahman	UG
EEL358	Operating Systems	50	3-0-0		S.M.K. Rahman	UG
EEL723	Microprocessor based Ind. Control	80	3-0-0		S.M.K. Rahman	UG+PG
EEL375	Embedded systems	50	3-0-4		S.M.K. Rahman	UG
EEL789	Optoelectronics	25	3-0-0		S. Anand	UG+PG
CYP100	UG Chem Lab	50	0-0-4		V. Koul	UG Chem Lab
	Students	903		90	Per Faculty	
1.3.d New courses offered (in last 5 yrs)						
BMV840	Emerging Health Care Technology					
BMV850	Vascular Engineering					
BMV700	Biomechanical Design of Medical Devices					

Annexure-5**1.3.h Placement details of Ph.D graduates in Technical Careers**

Prog. Type	Prog. Name	No. of graduating students	Nature of job for first 2-3 yrs after graduation	Nature of job after 5 yrs after graduation	% of graduates in technical line of work	% of graduates started in technical line and are managers/administrators
Research	Ph.D.	14	Scientist, and others, as given below	Scientist, and others, as given below	Nil	1 both scientist and administrator & as given below

Sl.No.	Name	Designation and address
1	Shveta Mahajan	RA, CBME, IIT Delhi
2	Rachna Prasad	Women Scientist, CBME, IIT Delhi
3	Raja Mohamed	Research Scientist, Orchid Chemicals and Pharmaceuticals Ltd, Chennai Area, India
4	Rachna Rastogi	Post-doctoral fellow, The University of Utah, Salt Lake City, Utah
5	Dipti Singh	Senior Scientist, Bausch and Lomb, UK
6	Nany Gulati	Scientific Writer, Novartis, Hyderabad Area, India
7	Amit Kesarwani	Assistant General Manager, Torrent Pharmaceuticals Ltd
8	Krishna Burugapalli	Research Fellow, Brunel University, UK
9	Maneesh Jaiswal	Assistant Professor, Pharmaceutics Division, Dept of Pharmacy, Jaypee University of Information Tech., HP, India.
10	DEEPAK JOSHI	Post-Doctoral Research Fellow Department of Human Physiology, University of Oregon, Eugene
11	TAPAN GANDHI	Post-Doc, Dept of Brain and Cognitive Sciences, Massachusetts Institute of Technology, Cambridge, MA, USA
12	SANJEEV KUMAR	Junior Scientist CSIO Chandigarh
13	VIJAY KHARE	Associate professor, Jypee institute of technology, Noida, UP (India)
14	NANDAKUMAR SELVARAJ	Scientist worcester polytechnic institute, worcester, USA

2.5 Centre for Biomedical Engineering

Block/Room No.	Area (Sq. ft.)	Use type	Incharge
II-98 II-99 Basement	900	Workshop	S. Anand
II-299	200	Faculty room	S. Anand
II-299A	60	Corridor Door	S. Anand
II-299B	64		S. Anand
II-299D	300	Lab	S. Anand
II-393	144	Rehab Lab	S. Anand
	1612		
II-388	80	Faculty room	S. K. Jha
IV LT-4 A	450	Lab-on-a-chip Lab	S. K. Jha
	530		
II-389	80	Faculty room	TBA
III-299B	300	Committee room	
II-395	240	Store	Nirmal Kumar
III-398	96	Office	
III-399	96	Office	
II-298	144	Faculty room	Dinesh K.
IV LT-4 B	450	Laser Lab	Dinesh K.
	594		
II-191	144	Faculty room	V. Koul
II-192	60	Corridor Door	V. Koul
II-193	48	Dark room	V. Koul/S. Anand
II-194	80	R/Scholar	V. Koul
II-195	80	Dark room	V. Koul/S. Anand
II-196	300	Biosensor Lab	V. Koul/S. Anand
II-292	96	Mammalian Cell Culture Lab	V. Koul
II-293	96	Hyperthermia Lab	V. Koul
II-294	60	Corridor Door	V. Koul
II-295	300	Drug Delivery Lab	V. Koul
II-296	150	Drug Delivery Lab	V. Koul
II-297	80	Back room	V. Koul
	1494	Sq. ft.	
II-189-190	900	Lab(IR)	H. Singh
III-297	144	Faculty room	H. Singh
III-396	600	Biomaterials lab	H. Singh
III-396	48	Corridor Door	H. Singh
III-396	600	Biomaterials lab	H. Singh
III-396	48	Corridor Door	H. Singh
	2340		
III-298	96	Tissue Characterization Lab	A. R. Ray
III-299	320	Biocompatibility Evaluation Lab	A. R. Ray

III-299A	200	Faculty room	A. R. Ray
	616		
II-394	144	Faculty room	Nivedita K. Gohil
II-396	240	Biomechanics Lab	Nivedita K. Gohil
II-397	60	Corridor Door	Nivedita K. Gohil
III-286	300	Biomedical lab	Nivedita K. Gohil
III-287	187.5	Biomedical lab	Nivedita K. Gohil
	931.5		
III-395	480	Bioelectronics lab	S.M.K. Rahman
III-397	120	Faculty room	S.M.K. Rahman
III-391	144	Biosignal lab	S.M.K. Rahman
	744		
Total	9279.5	Sq. ft.	
For research	5995	Sq. ft	

2.6 Laboratory modernization performed in last 5 years for (i) UG core, (ii) PG core, (iii) elective courses

GPC, Confocal Microscopy, Raman Confocal Microscopy, Cell Culture Lab, Nanosite Measurement

Soft tissue engineering lab, animal cell culture, Drug delivery lab

2.11 No. of students from overseas universities who have taken classes, done project work or internship, UG & PG separately, in the department

Biosensor Technology(BML-830) was taken by 3 overseas undergraduates

2.13 Industry experts who have delivered lecture(s), seminars, discussions as part of a core/elective course – UG and PG separately

Dr. Surya Mohapatra, Quest Diagnostics Inc

Harch Chitle, HCL Healthcare

Rajesh Khurana, Timpac Engineers

3.1 Ph.D. Thesis Completed in past 10 Years

Year	Name of the candidates	Title of the Thesis
2014	SHAMAYITA PATRA	
2014	Shamayita Patra	Study on Preparation of Biodegradable Scaffold for Small Diameter Blood Vessel Regeneration
2013	NAVEEN KUMAR	
2013	MAUMITA BHATTACHARJEE	
2013	Sheveta Mahajan	Synthesis , Characterization and Evaluation of Polymer-iron oxide hybrid nanosystems for Targeting and Imaging applications
2013	Naveen Kumar Thakral	Design and Evaluation of Organ Specific Drug Delivery System
2013	Maumita Bhattacharjee	Multi-Lamellar Silk Fibroin Based Scaffold for Intervertebral Disc Tissue Engineering
2013	KanchanBala	Interactions of advanced glycation end products in diabetes
2012	MANOJ KUMAR	DEVELOPMENT OF NANOPLATFORMS FOR CANCER DIAGNOSIS AND AND THERAPY
2012	GURPAL SINGH	DEVELOPMENT OF BIOCONJUGATED QUANTUM DOTS FOR CANCER IMAGING AND DETECTION
2012	Nanny Gulati	Evaluation of temperature sensitive polymeric nanoparticles for cancer targeting : in vitro&in vivo studies
2012	SANJEEV KUMAR	REAL TIME ELECTRO ENCEPHALOGRAPM BASED QUNTITATIVE ESTIMATION OF BALANCED ANESTHESIA IN PATIENTS UNDERGOING ORTHOPAEDIC AND LAPAROSCOPIC SURGERY
2012	VIJAY KHARE	FUNCTIONAL NEURO ELECTRIC MAPPING OF ALPHA DYNAMICS OF IMAGERY TASK : AN OPTIMAL SYSTEM FOR PHYSICALLY CHALLENGED
2011	SHALINI SAXENA	
2011	BISMITA NAYAK	
2011	Maneesh Jaiswal	Hydrogel based scaffolds for wound healing applications
2011	Shalini Saxena	Studies on the Development of Antimicrobial Polypropylene Suture by Plasma Grafting
2011	Bismita Nayak	Intranasal vaccine delivery using polymeric nanoparticles
2011	Manisha Sharma	Iron profile in hematological disorders
2011	DEEPAK JOSHI	CONTRALATERAL LIMB CONTROLLED PROSTHETIC KNEE JOINT
2011	TAPAN GANDHI	

2010	DIPTI KAKKAR	SYNTHESIS, CHARACTERIZATION AND BIOLOGICAL EVALUATION OF POLY(ETHYLENE GLYCOL) BASED POLYMERIC SYSTEM FOR TUBERCULOSIS AND CANCER THERAPY
2010	SWATI JAIN	DEVELOPMENT OF POLYMERIC MATRICES AND FLUORESCENT NANOPARTICLES FOR IMMUNO-BASED DETECTION OF PATHOGENIC BACTERIA
2010	Vinay Tripathi	DEVELOPMENT OF 17 α -HYDROXYL PROGESTERONE IMMUNOASSAY USING DIFFERENT SPACERS IN IMMUNOGEN AND ENZYME CONJUGATE
2010	NAVDEEP GROVER	STUDIES ON THE DEVELOPMENT OF POLYESTER SCAFFOLDS BY RADIATION GRAFTING FOR TISSUE ENGINEERING
2010	RICHA JACKERAY	DETECTION OF POLYMERIC MATRICES FOR IMMUNO-BASED DETECTION OF SALMONELLA TYPHI IN WATER
2010	LOMAS TOMAR	DEVELOPMENT OF POLYMERIC NANO AND MICROPARTICLES FOR INSULIN DELIVERY
2010	ANUP DAS	
2010	POONAM VERMA	
2010	Anup Das	Preparation and Characterization of pH sensitive polymers
2010	Poonam verma	Evaluation of polymeric scaffold for human tissue growth
2009	VIPIN KUMAR	
2009	Raja Mohamed S.	Synthesis, characterization and evaluation of macro & nano hydrogels for cancer targeting
2009	Rachna Rastogi	Design & evaluation of electrical & chemical enhancing technologies for transdermal delivery of insulin
2009	Vipin Kumar	Preparation and Characterization of biocompatible and biodegradable polymers
2009	NANDAKUMAR SELVARAJ	RESPIRATION AND VASCULATURE DEPENDENT MODULATION OF PHOTOPLETHYSMOGRAM AND AUTONOMIC DRIVE
2008	PURENDU PARHI	
2008	Purendu Parhi	Development of bone substitute materials
2007	Dipti Singh	Synthesis, characterization and evaluation of pH & temperature sensitive hydrogels for biomedical applications
2007	Monalisa Mukherjee	Studies on Heme Proteins Mimetic Materials
2006	Rachna Prasad	Combinational approach for transdermal delivery of methotrexate using chemical and electrical enhancer
2006	K.K. Dubey	Microbial Process Development for Regioselective Biotransformation of an anticancer Drug

2005	N.Vigneshwaran	Biochemical and Biophysical characterization of hemoglobin advanced glycation end product and its relevance to <i>diabetes mellitus</i>
2004	Amit Kumar	Optimal electrochemical enhancement of transdermal insulin delivery using polyacrylamide based hydrogel patches
2004	S.Y. Hussain	Effect of Homodynamic forces on Biochemical and structural Properties of Arterial Wall
2004	G.Bijukumar	A novel approach towards the development of a marker in diabetes
2003	Burugapalli Krishna	Synthesis & evaluation of hydrogels for controlled drug delivery
2004	Sachin Baladhare	Development of Polymeric for Transdermal Drug Delivery
2003	Rishi Pandey	Suspension Polymers of Acrylic monomers for Biomedical Applications
2003	Rishi Arora	UV Curavble inks for Ceramic Printing
2003	Smarati Gupta	Development of SMA Cross linked Hydrogels for Drug Delivery
2011	Poonam Gupta	Various methods for non invasive Blood Glucose measurement specially reverse iontophoresis technique
2010	Shalu Agarwal	Design and development of solid state Colorimeter
2007	Varnit Jain	Prediction of Stock values
2007	Vibhor Sahare	Prediction of Stock values
2004	V. K. Srivastava	Real time DSP of EEG on FPGA

<u>3.2 Ph. D Projects Ongoing</u>	
Name of Student	Supervisor/Co-supervisor
Alka Khanna	H. Singh
Manu Dalela	H. Singh
Raj Kumar Sinha	H. Singh
Vivek Bansal	H. Singh
Dikshi Gupta	H. Singh
Sumeet Kapoor	H. Singh
Vasundhara Shukla	H. Singh
Avneet Kaur	H. Singh
Dinesh Kumar	H. Singh
Kanwaljit Singh	A. R. Ray/P. M. Pandey
Sanskrita Das	A. R. Ray/Sourabh Ghosh
Harjeet Singh Jaggi	A. R. Ray/Bhabani K Satpathy
Sumit Murab	A. R. Ray/Sourabh Ghosh
Jincy Joy	A. R. Ray/Bhuvanesh Gupta
Shikha Pahwa	A. R. Ray/ Sourabh Ghosh
Harshita	A. R. Ray/Bhabani K Satpathy
Pallavi Gulati	A. R. Ray/Harpal Singh
Sarul Malik	S. Anand
Sweeti	S. Anand
Anirban Sengupta	S. Anand
Piyush swami	S. Anand
Marieswaran M	S. Anand
Anoop Kant Godiyal	S. Anand
Appan Roychoudhuri	S. K. Jha
Avinash Kaur	Dinesh K.
Neha Singh	S. Anand
J. Jene Rossario Raj	SMK Rahman
Gurmeet Singh	S. Anand
Ramandeep Singh	S. Anand
Satish	S. Anand
Pankaj Parasar	S. Anand
Rajpal Singh Maan	S. Anand
SMK Rehman	S. Anand
Mohd. Islam	S. Anand
Anjani Kumar	S. Anand
Anuradha Soni	S. K. Jha
Bikesh Humar Nirala	Nivedita K Gohil
Sharwan pahuja	S. Anand
Yogeswar Rao	S. Anand
Kritika Goyal	V. Koul
Thanusha	V. Koul
Dr. Jatin (AIIMS)	V. Koul

Sumit Madan (PT)	V. Koul
Gopendra singh (PT)	V. Koul
Arun Kumar	V. Koul
Shantanu Vijay Lale	V. Koul
Aji Alex M.R.	V. Koul
Chetan Nehate	V. Koul
Sirsendu Bowmick	V. Koul

3.3 Areas of Research										
S.No.	Name of Research Area	Faculty involved	Ph.Ds		Journals papers	Conference papers	Sponsored projects (Nos. & value)		Industry consultancies (Nos. & value)	Listed in prospectus since
			Completed	On-going			Nos.	Nos.		
1	Biomechanics (cardiovascular)	Nivedita K Gohil, Dinesh K.	3	1	9	8	3 (20.1 L)	-	-	Beginning
2	Biosensor technology and applications	Nivedita K Gohil, S. Anand	3	-	11	6	3 (60.7 L)	-	-	1995
3	Biosensors, Lab-on-a-chip, Medical Diagnostic devices	Sandeep K. Jha, S. Anand, S.M.K. Rahman, Dinesh K.	0	5	0	1	-	3 (71 L)	-	1995
4	Biomedical Instrumentation, Rehabilitation Engineering, Biomedical Transducers and Sensors, Biomechanics Technology in Reproduction Research. Controlled Drug Delivery System, Medical imaging, Implants	S. Anand, A. Godavarty, Dinesh K.	5	18	78	11	10 (2.5 Cr.)	5 (94.5 L)	1 (1.5 L)	Beginning
5	Drug delivery Systems ,Soft tissue regeneration , Transdermal Drug delivery systems , Polymeric nanoparticles for cancer and brain targeting	V. Koul	18	10	24	33	10 (1.77Cr.)	1 (37 L)	3 (8.9 L)	1998

6	Polymeric Biomaterials, Nanobiotechnology, Drug Delivery Systems, Antimicrobial Polymers for Water Disinfection, Medical diagnostics & Synthesis and Modification of Polymers for Biomedical and Industrial Applications	H. Singh	8	9	32	5	28 (2.9 Cr.)	5 (1.97Cr.)	11 (2.75L)	Beginning
7	biocompatible materials for medical applications, which include drug delivery devices, catheters, contact lens and other medical implants, Urban Transport engg. & Road safety medicine	A. R. Ray, Dinesh Mohan	12	8	62	13	20 (37.7 Cr.)	8 (9.8 Cr.)	-	Beginning

3.4 Publications in International (SCI indexed) Journals (Past 10 Years)

2014	Bhattacharjee, M., Chameettachal, S., Pahwa, S., Ray, A. R. & Ghosh, S. Strategies for Replicating Anatomical Cartilaginous Tissue Gradient in Engineered Intervertebral Disc. <i>Acs Applied Materials & Interfaces</i> 6, 183-193, doi:10.1021/am403835t (2014).
2013	Anoop Kant Godiyal, Deepak Joshi and Sneh Anand, "Contralateral Knee Angle Estimation using radial basis function network (RBFN)", <i>Neural Computing and Application</i> , Springer, under review
2013	Bhattacharjee, M. et al. The role of 3D structure and protein conformation on the innate and adaptive immune responses to silk-based biomaterials. <i>Biomaterials</i> 34, 8161-8171, doi:10.1016/j.biomaterials.2013.07.018 (2013).
2013	Bindu, M. G., Satapathy, B. K., Jaggi, H. S. & Ray, A. R. Size-scale effects of silica on bis-GMA/TEGDMA based nanohybrid dental restorative composites. <i>Composites Part B-Engineering</i> 53, 92-102, doi:10.1016/j.compositesb.2013.04.046 (2013).
2013	Das, A.; Mehndiratta, M.; Chattopadhyay, P.; Ray, A. R. Enhanced Redifferentiation of Chondrocytes on Microperiodic Silk/Gelatin Scaffolds: Toward Tailor-Made Tissue Engineering. <i>Biomacromolecules</i> 14, 311-321, doi:10.1021/bm301193t (2013)
2013	Devender Arora, Sneh Anand, Anjana Sharma, "Visible Spectrum Role in Bacterial Inactivation through Continuous and pulse wavelength", <i>International Journal of Scientific & Engineering Research</i> (2013), Vol.4(6), pp. 2390-2393.
2013	Ghosh, S. (2013). Enhanced Redifferentiation of Chondrocytes on Microperiodic Silk/Gelatin Scaffolds: Toward Tailor-Made Tissue Engineering.
2013	Harminder Kaur, Geetanjali Pujari, Asitikantha Sarma, Yogendra Kumar Mishra, Mi Kyung Jin, Bikesh K. Nirala, Nivedita K Gohil, Rainer Adelung, Devesh Kumar Avasthi. Study of in vitro toxicity of glucose capped gold nanoparticles in malignant and normal cell lines. <i>Adv. Mat.Lett.</i> , 2013; 4(12): 888 – 894.
2013	Maneesh Jaiswal, Asheesh Gupta, Ashwini K. Agrawal, Manjeet Jassal, Amit Kr. Dinda, Veena Koul. Bilayer composite dressing of gelatin nanofibrous mat and PVA hydrogel for drug delivery and wound healing application: In-vitro and in-vivo studies, <i>Journal of Biomedical Nanotechnology</i> 2013 ,Vol. 9, 1495-508.
2013	Patra, S. et al. A Novel Route to Polycaprolactone Scaffold for Vascular Tissue Engineering. <i>Journal of Biomaterials and Tissue Engineering</i> 3, 289-299, doi:10.1166/jbt.2013.1087 (2013).
2013	Piyush Swami, Sirsendu S. Ray, Tapan Gandhi, Sneh Anand, "When bottom-up meets top-down: Temporal integration of local features for global perception during face recognition," <i>Journal of Neuroscience</i> , Informa Healthcare. (In Review)
2013	Saxena, T.; Tandon, B.; Sharma, S.; Chameettachal, S.; Ray, P.; Ray, A. R.; Kulshreshtha,. Combined miRNA and mRNA Signature Identifies Key Molecular Players and Pathways Involved in Chikungunya Virus Infection in Human Cells. <i>Plos One</i> 8, doi:10.1371/journal.pone.0079886 (2013)
2013	Shveta Mahajan, Veena Koul, Veena Choudhary, Gauri Shishodia, Alok C Bharti. Preparation and in vitro evaluation of folate-receptor-targeted SPION-polymer micelle hybrids for MRI contrast enhancement in cancer imaging, <i>Nanotechnology</i> , 2013, 24, 015603.
2013	Sruti Chattopadhyay, Avneet Kaur, Swati Jain and Harpal Singh, "Sensitive detection of food-borne pathogen Salmonella by modified PAN fibers-immunoassay" <i>Biosensors and Bioelectronics</i> , 2013, 45, 274-280.
2013	Swati Jain, Sruti Chattopadhyay, Richa Jackeray, C.K.V. Zainul Abid, Harpal Singh, "Novel Functionalized Fluorescent Polymeric Nanoparticles for Immobilization of Biomolecules" <i>Nanoscale</i> , (2013) (Accepted).
2013	T. Gandhi, B. Ghosh, P. Swami, J. Santhosh, S. Anand, "Cross-fertilization of structural encoding and pre-stored structural codes in face recognition," <i>International Journal of</i>

	Visual Cognition, Taylor & Francis. (In Review)
2013	Thakral, N. K.; Ray, A. R.; Jacobsen, J.; Bar-Shalom, D.; Eriksson, A. H.; Majumdar, D. K. Colon targeting of fluticasone propionate inclusion complex: a novel approach in inflammatory bowel disease. <i>Journal of Inclusion Phenomena and Macrocyclic Chemistry</i> 75, 175-184, doi:10.1007/s10847-012-0159-z (2013)
2012	Bhattacharjee, M.; Miot, S.; Gorecka, A.; Singha, K.; Loparic, M.; Dickinson, S.; Das, A.; Bhavesh, N. S.; Ray, A. R.; Martin, I.; Ghosh, S.. Oriented lamellar silk fibrous scaffolds to drive cartilage matrix orientation: Towards annulus fibrosus tissue engineering. <i>Acta Biomaterialia</i> 8, 3313-3325, doi:10.1016/j.actbio.2012.05.023 (2012)
2012	Bikesh K Nirala, Shelza Saluja, Anoop Mishra, and Nivedita K Gohil. Erythrocyte ATPase activity in relation to hyperglycemia and hyperlipidemia in diabetic Asian Indian population. 2012; <i>International Journal of Diabetes and Metabolism</i> 2012, 20: 75 – 79.
2012	D. Agrawal, S. Kumar, A. Kumar, S. Gombar, A. Trikha, S. Anand "Design of an Assistive Anaesthesia Drug Delivery Control using Knowledge Based Systems, Knowledge-Based Systems (Elsevier), 2012, Vol.3, pp.1-7.
2012	Deepak Joshi, A. Mishra, Sneha Anand, "A Naïve Bayes Classifier for detection of mental activity in gait signature" <i>Computer methods in biomechanics and biomedical engineering</i> , Vol.15, Issue 4, April 2012, pp. 411-416.
2012	Gupta, B., Geeta & Ray, A. R. Preparation of Poly(epsilon-caprolactone)/Poly(epsilon-caprolactone-co-lactide) (PCL/PLCL) Blend Filament by Melt Spinning. <i>Journal of Applied Polymer Science</i> 123, 1944-1950, doi:10.1002/app.34728 (2012).
2012	Gupta, B., Patra, S. & Ray, A. R. Preparation of porous polycaprolactone tubular matrix by salt leaching process. <i>Journal of Applied Polymer Science</i> 126, 1505-1510, doi:10.1002/app.36922 (2012).
2012	J. Jean Rossario Raj, S.M.K Rahman, Anand Sneha, "Electronic Design of Compact Power Supply Unit for Various Voltages in Ultrasound Transient Elastography" <i>International Journal of Electronics Communication and Computer Engineering</i> Volume 3, Issue 4, ISSN (Online): 2249–071X, ISSN (Print): 2278–4209
2012	J. Jean Rossario Raj, S.M.K Rahman, Anand Sneha, "Electronic hardware design for ultrasound Transient Elastography" <i>International Journal of Engineering Science and Technology (IJEST)</i> , Vol. 4 No.08 August 2012, pp 3700-3704
2012	Jaggi, H. S., Kumar, Y., Satapathy, B. K., Ray, A. R. & Patnaik, A. Analytical interpretations of structural and mechanical response of high density polyethylene/hydroxyapatite bio-composites. <i>Materials & Design</i> 36, 757-766, doi:10.1016/j.matdes.2011.12.004 (2012).
2012	Kanchan Bala and Nivedita Karmakar Gohil. Interaction of glycosylated protein and DFO mimicked hypoxia in cellular responses of HUVECs. <i>Molecular BioSystems</i> , 2012, 8 (10) : 2657 -2663.
2012	Lea Paslay, Brooks Abel, Tyler Brown, Veena Koul, Veena Choudhary, Charles McCormick, Sarah Morgan. Antimicrobial poly(methacrylamide) derivatives prepared via aqueous RAFT polymerization exhibit biocidal efficiency dependent upon cation structure <i>Biomacromolecules</i> , 2012, 13, 2472–82.
2012	M. S. Nagananda, Amit Sengupta, S. M. K. Rehman, J. Santhosh and S. Anand, "Identifying Prospective Biomarkers for Cognitive Impairments during Pregnancy – Review of Current Status and Some Preliminary Results, <i>Gynecology & Obstetrics</i> , open access journal, 2012, pp. 1-7
2012	Manoj Kumar, Gural Singh, Vikas Arora, Sujeet Mewar, Uma Sharma, N. R. Jagannathan, Sameer Sapra, Amit K. Dinda, Surender Kharbanda and Harpal Singh. "Cellular Interaction of Folic acid Conjugated Superparamagnetic Iron oxide Nanoparticles and its use as Contrast Agent for Targeted Magnetic Imaging of Tumor cells". <i>International Journal of Nanomedicine</i> . 2012:7 3503–3516.

2012	Swati Jain, Sruti Chattopadhyaya, Richa Jackeraya, C.K.V. Zainul Abida, Guneet Singh Kohli, Harpal Singh, "Highly sensitive detection of Salmonella typhi using surface aminated polycarbonate membrane enhanced-ELISA", <i>Biosensors and Bioelectronics</i> , 31 (2012) 37–43.
2012	T. Gandhi, B.K. Panigrahi, J. Santhosh, S. Anand, "Contribution of Brain Waves for Visual Differences in Animate and Inanimate Objects in Human Brain" <i>J. of Computational and Theoretical Nanoscience (ASP)</i> , 2012, Vol. 9, pp. 233-242.
2012	Thakral, N. K., Ray, A. R., Bar-Shalom, D., Eriksson, A. H. & Majumdar, D. K. Soluplus-Solubilized Citrated Camptothecin-A Potential Drug Delivery Strategy in Colon Cancer. <i>Aaps Pharmscitech</i> 13, 59-66, doi:10.1208/s12249-011-9720-0 (2012).
2011	Bhattacharjee, M., Miot, S., Spagnoli, G., & Martin, I. (2011). Tissue Engineering of Annulus Fibrosus : Silk Fibres Can Offer Solution for Lower Back Pain, (2), 1–7.
2011	Deepak Joshi, A. Mishra, Sneha Anand, "ANFIS based knee Angle Prediction: An approach to design speed adaptive Echo Controlled AK Prosthesis" <i>Journal of Applied Soft Computing</i> , Vol. 11(8), 2011, pp. 4757-4765
2011	Deepak Joshi, Rahul Ribeiro, S. Srivastava, Sneha Anand, D. Majumdar, "Gait Coordination: Potential Marker for Mental State" <i>International Journal of Medical Engineering and Informatics</i> , Vol. 3(1), 2011, pp.30-39
2011	Gupta, B., & Ray, A. R. (2011). Preparation of Poly (e -caprolactone)/ Poly (e -caprolactone- co - lactide) (PCL / PLCL) Blend Filament by Melt Spinning. doi:10.1002/app
2011	Gurpal Singh; Zaidi, Neelam Hazoor; Soni, Udit; Gautam, Manoj; Jackeray, Richa; Singh, Harpal; Sapra, Sameer "Detection of Bioconjugated Quantum Dots Passivated with Different Ligands for Bio-Applications", <i>Journal of Nanoscience and Nanotechnology</i> , (2011) 11, 3834-3842.
2011	Kanchan Bala, James Gomes and Nivedita Karmakar Gohil. Interaction of glycosylated human serum albumin with endothelial cells in a hemodynamic environment: Structural and functional correlates. <i>Molecular BioSystems</i> , 2011, 7, 3036–3041.
2011	Kanchan Bala, Kiran Ambwani and Nivedita Karmakar Gohil. Effect of different mitogens and serum concentration on HUVEC morphology and characteristics: Implication on use of higher passage cells. <i>Tissue and Cell</i> ; 2011, 43 :216 – 222.
2011	Maneesh Jaiswal, Veena Koul, Amit K Dinda, Sujata Mohanty, Gopal Krishen Jain. Cell adhesion and proliferation studies on semi-interpenetrating polymeric networks (semi-IPNs) of polyacrylamide and gelatin, <i>Journal of Biomedical Material Research-Applied Biomaterial Part-B</i> : 98,2, 2011,342-350.
2011	N. AGARWAL, M. S. NAGANANDA, S. M. K. RAHMAN, A. SENGUPTA, J. SANTHOSH and S. ANAND, "Portable cost-effective EEG data acquisition system" <i>Journal of Medical Engineering & Technology</i> , Vol. 35, Nos. 3–4, April–May 2011, pp. 185–190
2011	N. Agarwal, M.S. Nagananda, S.M.K. Rahman, A. Sengupta, J. Santhosh, S. Anand. "Portable Cost-Effective EEG Data Acquisition System" <i>J. Med Engg. & Tech</i> , Vol. 35 (3-4), 2011, pp.185-190
2011	Nayak, B., Ray, A. R., Panda, A. K., & Ray, P. (2011a). Improved immunogenicity of biodegradable polymer particles entrapped rotavirus vaccine. <i>Journal of biomaterials applications</i> , 25(5), 469–96. doi:10.1177/0885328209353642
2011	Rachna Rastogi, Nany Gulati, Ravinder K. Kotnala, Uma Sharma, Rama Jayasundar, Veena Koul. Evaluation of folate conjugated pegylated thermo sensitive magnetic nanocomposites for tumor imaging and therapy, 2011, <i>Colloids and Surfaces B: Biointerfaces</i> , 82 160–167.
2011	Raja Mohamed, Dirk Kuckling, Hans-Jürgen P. Adler, Veena Koul, Veena Choudhary. Interpenetrating polymer network (IPN) nanogels based on gelatin and poly(acrylic acid) by inverse miniemulsion technique: Synthesis and characterization, 2011, <i>Colloids and Surfaces B: Biointerfaces</i> , 83, 204-213.

2011	Richa Jackeray, Gurpal Singh, Swati Jain, Zainul Abid C.K.V, and Harpal Singh, "Bioconjugated quantum dots based rapid detection of pathogenic bacteria from water samples", International Journal of Nanoscience 10(2011):199-203.
2011	Richa Jackeraya, Zainul Abid C.K.V., Gurpal Singh, Swati Jain, S. Chattopadhyaya, Sameer Saprab T.G. Shrivastav, Harpal Singh, "Selective capturing and detection of Salmonella typhi on polycarbonate membrane using bioconjugated quantum dots", Talanta, 84 (2011) 952-962.
2011	S.K. Pahuja, Sneh Anand, A. Sengupta "Electrical Impedance Tomography based Image Reconstruction and feto- maternal monitoring in pregnancy" Health (USA), 2011, Vol.3(8), 482-486.
2011	S.K. Pahuja, Sneh Anand, A. Sengupta "Novel Method of Feto-Maternal Monitoring Using Music Therapy - A Non-Stress Test", Int. J. of Advanced Research in Computer Science, 2011, Vol. 2(4), pp. 472-474.
2011	T. Gandhi, A. Kapoor, C. Kharya, J. Santhosh, V. Alok, S. Anand "Enhancement of interhemispheric brain waves synchronization after Pranayama practices", Int. J. of Biomed Engg & Tech (Inderscience), 2011, Vol. 7(1), pp. 1-17.
2011	T. Gandhi, B.K. Panigrahi, S. Anand "A comparative study of wavelet families for EEG signal classification," J. of Neurocomputing (Elsevier), Vol. 74(17), 2011, pp. 3051-3057
2011	T. Gandhi, P. Swami, J. Santhosh, S. Anand "Dynamical neural activation in human brain during face recognition", Int. J. of Biomed Engg & Tech, (Inderscience), 2011, Vol. 7(2), pp. 135-147.
2011	T. Gandhi, S. Anand, P. Sinha "Impairment in face processing without external contour after sight onset of congenital cataract blind children", Int. J. of clinical EEG & neurology, 2011, 42(1), pp.67.
2011	Vijay Khare, Jayashree Santhosh, Sneh Anand, Manvir Bhatia, "Brain Computer Interface Based Real Time Control of Wheelchair Using Electroencephalogram" International Journal of Soft Computing and Engineering, 2011, Vol. 1(5), pp. 41-45.
2010	Abhinav, Meghna Sareen, Mahendra Kumar, Jayashree Santhosh, Ashok Salhan, Sneh Anand "Nadi Yantra: a robust system design to capture the signals from the radial artery for assessment of the autonomic nervous system non-invasively" J. Biomedical Science and Engineering, 2009, 2, 471-479
2010	Alka Khanna, V. Samuel Raj, Bansidhar Tarai, Ruchi Sood, Pawan Kumar Pareek, Dilip J. Upadhyay, Pawan Sharma, Ashok Rattan, Kulvinder Singh Saini and Harpal Singh, "Emergence and Molecular Characterization of Extensively Drug-Resistant <i>Mycobacterium tuberculosis</i> Clinical Isolates from the Delhi Region in India" Antimicrobial agents and chemotherapy, Nov. 2010, p. 4789-4793.
2010	Anup Das, Mohit Mehndiratta Parthaprasad Chattopadhyay, A. R. Ray. Prolonged Zero-Order BSA Release from pH-Sensitive Hydrogels of Poly(AAc-co-DMAPMA) having Rich Nano Through Micro Scale Morphology", Journal of Applied Polymer Science, 115, 393-403
2010	Avasthi DK, Mishra YK, Singhal R, Kabiraj D, Mohapatra S, Mohanta B, Gohil NK and Singh N. Synthesis of plasmonic nanocomposites for diverse applications. Journal of NanoScience and NanoTechnology. 2010; 10, 2705-2712.
2010	Bhuvanesh Gupta, Navdeep Grover, Sujata Mohanty, Krishan Gopal Jain and Harpal Singh, Radiation induced grafting of acrylic acid/n-vinyl pyrrolidione onto polyethylene terphthalate fabric and growth of HMSC. Journal of Applied Polymer Science, 115(2010), 116-126.
2010	C. K. V. Zainul Abid, Sruti Chattopadhyay, Nasreen Mazumdar, Harpal Singh, Synthesis and characterization of quaternary ammonium PEGDA dendritic copolymer networks for water disinfection, Journal of Applied Polymer Science, 116 (2010), 1640, 1649.

2010	Deepak Joshi, Ashutosh Mishra, Sneha Anand "LVQ based speed adaptive swing and stance phase detection: An alternate to Foot Switch" J. Advance soft Comput. Appl. 2010, 2(1) ISSN: 2074-8523.
2010	Deepak Joshi, Sneha Anand. "Cyclogram and Cross correlation: A comparative study to quantify gait coordination in mental state" Journal of Biomedical Science and Engineering Vol.3, No.3, 2010, pp.322-326.
2010	Deepak Joshi, Sneha Anand. "Study of Circular Cross correlation and phase shift to estimate knee angle: An application to prosthesis" International Journal of Biomechatronics and Biomedical Robotics Vol.1, No. 2, (2010) pp. 99-103.
2010	Lomas Tomar, Charu Tyagi, S Lahri and Harpal Singh, Polymeric nano and microparticles for oral insulin delivery, Polymers for advanced technologies, Accepted January 8, 2010.
2010	M. S. NAGANANDA, AMIT SENGUPTA, JAYASHREE SANTHOSH, SNEHA ANAND, S. M. K. RAHMAN, A. M. KHAN, PRIYARATA RAUTRAY, DEVIDUTT GHARAI, L. K. DAS, "Design and Pragmatic studies of bathroom for Elderly people in India" WSEAS TRANSACTIONS on BIOLOGY and BIOMEDICINE, Issue 4, Volume 7, October 2010, pp. 287-305
2010	M. Soni, S. Maji, S. Anand, U. Singh, "A CAD Based Dynamic Analysis Approach to AK Prosthesis Design". Vibromechanika (J. Vibro Engg). 2010, Vol.12 (2), pp: 170-176
2010	M. Soni, S. Maji, S. Anand, U. Singh, "Modelling an above knee prosthesis – A Kinematics Approach" Vibromechanika (J. Vibro Engg). 2010, Vol.12 (2), pp:215-224
2010	Mishra, R. K., & Ray, A. R. (2010). Synthesis and Characterization of Poly { N - [3- acid } Hydrogels for Drug Delivery. doi:10.1002/app
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2003	Anu Shilpa, S.S. Agrawal and A.R.Ray. Controlled Delivery of Drugs from Alginate Matrix. <i>J. Macromolecular Science Part-C</i> 43(2) 187-221
2003	Gupta R., N. Anjum and Harpal Singh, "Preparation of Antimicrobial Sutures by Preirradiation Grafting of Acrylonitrile onto Polypropylene : Influence of Synthesis Condition", <i>Journal Appl. Polymer Sci.</i> , 2003
2003	Mohammad Changez, Krishna Burugapalli, Veena Koul, and Veena Choudhary, "The Effect of Composition of Poly (Acrylic acid) – Gelatin Hydrogel on Gentamicin Sulphate Release: In Vitro", <i>Biomaterials</i> , 2003, 24, 527–536
2003	N. Majumdar, A Ratan and Harpal Singh, "Iodine Incorporated Latex Catheters: InvitroAntimicrobial Studies," <i>Trends in Biomaterials & Artificial Organs</i> , Vol. 17(1). PP28-33, 2003.
2003	R. K. Dey and A.R.Ray. Synthesis and characterization and blood compatibility of polyamidoamines copolymers. <i>Biomaterials</i> 24(18) 2985-2993
2003	R.K Dey, S.Samal, S. Acharya, A R Ray. Synthesis, characterization, and metal ion uptake studies of chelating resins derived from formaldehyde/furfuraldehyde condensed phenolic Schiff base of 4,4'-diaminodiphenylmethane and o-hydroxyacetophenone" <i>JOURNAL OF APPLIED POLYMER SCIENCE</i> 88 (2): 570-581
2003	R.K. Dey, AR Ray. Synthesis, characterization, and blood compatibility of copolymers of polyamidoamines and N-vinylpyrrolidone. <i>JOURNAL OF APPLIED POLYMER SCIENCE</i> ,90 (14): 4068-4074
2003	Vigneshwaran N, Bijukumar G, Karmakar N , Anand S and Misra A. Fluorescence and biochemical characterization of glycated hemoglobin. <i>Macromolecular Symposia</i> ; 2003; 193(1) : 119 – 128.
2003	Bijukumar G, Vigneshwaran N, Karmakar N, Anand S and Misra A. Hyperglycemia induced glycosylation alters red cell morphology. <i>Biophysical Journal (Suppl)</i> ; 2003; 84 : 2 (abs).
2003	G.Bijukumar, N.Vigneshwaran, N.Karmakar, S.Anand and A.Misra. Evaluation of autofluorescent property of hemoglobin- advanced glycation end product as a long term glycemic index of diabetes. <i>Diabetes</i> ; 2003 ; 52
Conference Publications (Past 10 Years)	
2012	Bikesh Kumar Nirala and Nivedita Karmakar Gohil. Correlation of erythrocyte ATPase activity and glycated hemoglobin in Indian diabetic population. Poster presentation at the Gordon Research Conference 'Signaling by adhesion receptors', June-24-29, 2012, Waterville, USA.
2011	Bala, K., Ambwani, K., Gohil, N.K. Effect of different mitogens and serum concentration on HUVEC morphology and characteristics: Implication on use of higher passage cells for in-vitro studies. National Conference on "Contemporary Trends in Biological and Pharmaceutical Research", March 12-13 '2011 Birla Institute of Technology & Science, Pilani, Rajasthan, India, pp 3-4.
2011	Bala, K and Gohil Nivedita K. Hypoxia and advanced glycated serum albumin induced expression of HIF-1 α in human umbilical vein endothelial cells (HUVECs). International conference 'Cell signaling Networks 2011' (along with associate meeting of the International Union of Biochemistry and Molecular Biology) Oct 22 - Oct 27 2011; Merida, Mexico; pp 173 (abstract).
2010	Kanchan Bala, Nivedita K Gohil, J Gomes. Age characterization: High sugar concentration

	indicating hyperglycemic condition stabilizes secondary structure of human serum albumin. Proceedings of the 2nd International Conference on Drug Discovery and Therapy, Feb. 1- 4, 2010; Dubai, U.A.E; pp 182-183 (abstract).
2009	Sharma M, Gohil N K. Interaction of azotobactin with blocking and mobilizing agents in the measurement of non-transferrin bound iron in hematological disorders. Proceedings of the 14th Congress of the European Hematology Association, June 4 - 7, 2009; Berlin; pp 1291 (abstract).
2009	Nivedita K Gohil, Manisha Sharma and Renu Saxena. Assessment of non-transferrin bound iron in thalassemic sera using a new fluorescence based assay. Proceedings of the 14th Congress of European Hematology Association held in Berlin, Germany ; June 4 – 7, 2009. (Poster).
2007	P. Venkata Reddy, Ajay Kumar†, S. M. K. Rahman, Tanvir Singh Mundra,"A New Method for Fingerprint Antispoofing using Pulse Oximetry" Proc. IEEE Intl Conf. Biometrics, Theory and Applications, Washington D. C., pp. 36-41, Sep. 27-29, 2007.
2005	Bhaskar M. Murari, Sneha Anand, N.Karmakar, N K Chaudhary. Fluorescence spectroscopic study of dip coated sol gel thin film for possible applications in biosensors. In SOLGEL 2005, 13th International Workshop on Sol Gel Science and Technology, Univ. of California, Los Angeles, USA, August 2005.
2005	Bijukumar G, Misra A, Anand S and Gohil NK. Evaluation and association of hemoglobin-AGE with dyslipidemia and whole blood viscosity in Asian Indians with diabetes mellitus. In Hozman J., Kneppo P. (Editors), IFMBE Proceedings, Vol. 11., IFMBE, 2005. ISSN 1727-1983. Proceedings of the 3rd European Medical & Biological Engineering Conference - EMBEC'05, Prague, Czech Republic, 20 – 25 Nov. 2005; pp 3622 - 3627.
2004	Bhaskar M.Murari, Sneha Anand, N.Karmakar, N K Chaudhary. Physico-chemical sensing of myoglobin using sol gel thin films. In proceedings of the International Conference on Chemistry Biology Interface : Synergistic New Frontiers; held on Nov. 21 – 26, 2004 at Dr. BR Ambedkar Center for Biomedical Research, University of Delhi, India.
2011	V.koul,N.Gulati, assessment of temperature sensitive nanoparticles for imaging and cancer targeting,2 nd Nanotoday Conference,Hawaii,USA,11-15 Dec 2011
2011	M. Jaiswal, V. Koul. "Assessment of physico-chemical and biological properties of hydrogel based 3-dimensional scaffolds of poly (acrylic acid-hydroxyethyl methacrylate)/gelatin for skin tissue regeneration." 4th Indo-Australian Conference on Biomaterials, Tissue Engineering and Regenerative Medicine. Society of Biomaterials and Artificial Organs, Vallabh Vidyanagar, Gujarat, India. Feb.10-12, 2011
2010	M. Jaiswal, A. Dinda, A. Gupta, and V. Koul, "Semi-IPNS hydrogel for wound dressing application; influence of gelatin and polyacrylamide", International conference on frontiers of polymers and advanced materials, MACRO, New Delhi, Dec 14-17, 2010.
2010	N. Gulati, R. Rastogi, A. Dinda, and V. Koul, "Physicochemical characterization and biocompatibility studies on temperature sensitive magnetic nanoparticles for cancer targeting", First world Congress on Nanomedicine and Drug Delivery, Kottayam, Kerala, April 16-18, 2010.
2009	N Gulati, V. Koul, and A.K. Dinda, "Toxicity of Temperature Sensitive Polymeric Nanoparticles for Cancer Targeting", Asian Polymer Association 2009, New Delhi, Dec 17-20, 2009.
2009	M. Jaiswal, V. Koul, A. Dinda, and A. Gupta, "Self proliferation studies on the biodegradable 3D scaffold of Pam/gelatin for tissue engineering", Asian Polymer Association 2009, New Delhi, Dec 17-20 2009.
2009	M. Jaiswal, V. Koul, A. Dinda, and A. Gupta " Double network hydrogel based loaded with bioactive agents for wound dressing application" Wound Con 2009, Gangtok, Sikkim, March 2-4 2009.
2009	N. Kumar, V. Koul, and A. K. Dinda, "Temperature sensitive polymeric nanoparticles for breast

	cancer targeting”, National Seminar on Biomedical Engineering and Technology, Alwar, Rajasthan, April 12-13 2008.
2008	Raja Mohamed, Dirk Kuckling, Hans Juergen P. Adler, Veena Koul, and Veena Choudhary, “Folate conjugated IPN nanogels as drug carriers-synthesis and characterization”, Poly Char 16- World forum on Advanced Materials, 2008, Lucknow, India.
2008	Raja Mohamed, Veena Choudhary, and Veena Koul, “Biodegradable Interpenetrating Polymer Network (IPN) Macro Hydrogels for Cancer Targeting”, National Seminar on Biomedical Engineering – Key to Global Health, Alwar, Rajasthan, April 12-13 2008.
2008	Shveta Mahajan, Veena Koul, Amit K. Dinda, and Veena Choudhary, “Synthesis and characterization of mannose-conjugated gelatin nanoparticles for macrophage targeting”, BIO & POLYMERS - New Polymer Technologies with Water", Aachen, Germany, Sept. 28-30 2008.
2008	R. Rastogi, V. Koul, and S. Anand, “Transdermal Iontophoresis-An approach to needle-free insulin delivery”, National Seminar on Biomedical Engineering, Alwar Institute of Engineering and Technology, Rajasthan, April 12-13 2008.
2007	Rachna Rastogi, Sneha Anand, Veena Koul, and Amit K. Dinda, “Elucidation of pathways involved in transdermal iontophoretic delivery of insulin-Fluorescence studies”, International Conference on Cellular and Molecular Bioengineering, NTU Singapore, Dec. 10-12 2007.
2007	V. Koul, “Cancer targeting of natural products by macro and nano-hydrogels”, 2nd International symposium on translational Research on Natural Products and Cancer, 54, Dec. 9-12 2007.
2007	Raja Mohamed, Dirk Kuckling, Hans Juergen P. Adler, Veena Koul, and Veena Choudhary, “IPN nanogels as Targeted Drug Carriers for Solid Tumors – Synthesis and Characterization”, REACT 2007, Dresden, Germany.
2007	V. Koul, “Smart random terpolymer nanoparticles for targeted intracellular delivery of anticancer drug. National Symposium on Nanotechnology in Medicine”, All India Institute of Medical Sciences, New Delhi, Jan 13 2007.
2007	V. Koul, “Synthesis and Characterization of Temperature sensitive nanoparticles for targeted delivery of anticancer drug”, Indo-Australian Conference on Biomaterials, Implants, Tissue Engineering and Regenerative Medicine, SCIMST, Thiruvanthapuram, Jan 10-12, 2007.
2006	D. Singh, V. Koul, V. Choudhary, and Amit Dinda, “Site specific targeted delivery of drug loaded hydrogels: Studies on synthesis, characterization, tissue compatibility and drug release”, International Conference on the Design of Biomaterials, Kanpur, Dec 8-11, 2006.
2006	R. Rastogi, V. Koul, and S. Anand, “Effect of chemical pretreatment on the iontophoretic delivery of insulin across porcine stratum corneum”, International Conference on the Design of Biomaterials, Kanpur, Dec 8-11 2006.
2006	D. Singh, D. Kuckling, V. Choudhary, H.J. Adler, and V. Koul, “Photopolymerization of N-isopropylacrylamide with poly (ethylene glycol)methacrylate and their evaluation as cell culture membrane”, 232nd ACS National Meeting, San Francisco, CA, September 10-14, 2006.
2006	V. Koul, “Biophysical Assessment of Physico-Chemical enhancers used for Transdermal Delivery of Methotrexate”, XVI conference of Society for Biomaterials and Artificial Organs, I.I.T Delhi, February 24-26, 2006.
2006	R. Rastogi, V. Koul, and S. Anand, “Physical enhancement techniques for transdermal drug delivery,” XVI Conference of Society for Biomaterials and Artificial, I.I.T Delhi, February 24-26, 2006.
2006	V. Koul, R. Prasad, and S. Anand, “Biophysical Assessment of Physico-Chemical enhancers used for Transdermal Delivery of Methotrexate”, XVI conference of Society for Biomaterials and Artificial Organs, I.I.T-Delhi, February 24-26, 2006.
2006	A.K. Dinda, K. Burugapalli, and V. Koul, “Evaluation of Biocompatibility and Immunotoxicity of Interpenetrating Network Hydrogels by Subcutaneous Implantation Model”, XVI conference

	of Society for Biomaterials and Artificial Organs, I.I.T-Delhi, February 24-26 2006.
2005	K. Burugapalli, V. Koul, and A.K. Dinda, "Immunotoxicity evaluation by subcutaneous implantation of interpenetrating network hydrogels in mice", XV National Conference on Biomaterials and Artificial Organs, SCIMST, Trivandrum, India, January 21-23 2005.
2005	V. Choudhary, and V. Koul, "Biodegradable Hydrogels", ICBC, Kottayam, India, March 21-23 2005.
2005	R. Prasad, V. Koul, S. Anand, R. K. Khar, and A.K. Dinda, "Transdermal permeation of methotrexate using AC/DC iontophoresis and its effect on skin histopathology", XV National Conference on Biomaterials and Artificial Organs, SCIMST, Trivandrum, India, January 21-23 2005.
2004	D. Singh, V. Koul, and V. Choudhary, "Interpenetrating Polymer network based on PVP-Acrylic acid and gelatin", International conference on Polymer for Advanced Technologies, MACRO, Trivandrum, India, Dec 14-17 2004.
2004	D. Singh, V. Choudhary, V. Koul, H-J.P. Adler, and D. Kuckling, "Synthesis and characterization of poly (N-isopropylacrylamide) films by photopolymerization", ICBC, Kottayam, India, March 21-23 2005.
2004	K. Burugapalli, V. Koul, and A.K. Dinda, "Immunotoxicity evaluation by subcutaneous implantation of interpenetrating network hydrogels in mice", XV National Conference of Society for Biomaterials and Artificial Organs, SCIMST, Trivandrum, India, Jan 21-23 2005.
2004	R. Prasad, V. Koul, S. Anand, R.K. Khar, and A.K. Dinda, "Transdermal permeation of methotrexate using AC/DC iontophoresis and its effect on skin histopathology", XV National Conference of Society for Biomaterials and Artificial Organs, SCIMST, Trivandrum, India, Jan 21-23 2005.
2004	K. Burugapalli, V. Koul, V. Choudhary, and A.K. Dinda, "Biodegradable Hydrogels for Controlled Release of Antibiotics for Treatment of Osteomyelitis", 7th World Biomaterials Congress, Sydney, Australia, May 17-21 2004.
2003	R. Prasad, V. Koul, S. Anand, and R.K. Khar, "Transdermal iontophoretic delivery of methotrexate: Effect of chemical enhancers", 55th Indian Pharmaceutical Congress, Sri Ramachandra Medical College & Research Institute, Chennai, India, December 19-21 2003.

3.6 Best Publications: Chosen on thrust areas, impact factor of journals

Swati Jain, Sruti Chattopadhyay, Richa Jackeray, C.K.V. Zainul Abid, Harpal Singh, "Novel Functionalized Fluorescent Polymeric Nanoparticles for Immobilization of Biomolecules" *Nanoscale*, (2013) (Accepted).

Nirmal prabhakar, Harpal Singh and bansi D. Malhotra, "Role of redox indicator in mycobacterium tuberculosis detection based on peptide nucleic acid immobilized polypyrrole-polyvinylsulphonate film", *Biomacromolecules*. 2008, 821-826

T. Gandhi, S. Anand, P. Sinha "Impairment in face processing without external contour after sight onset of congenital cataract blind children", *Int. J. of clinical EEG & neurology*, 2011, 42(1), pp.67

T. Gandhi, S. Anand, P. Sinha "Impairment in sensory reactivity of children with autism spectrum disorder", *Int. J. of Society for Psychophysiological Research*, 2010, Vol.47(1), pp.23

Kanchan Bala and Nivedita Karmakar Gohil. Interaction of glycated protein and DFO mimicked hypoxia in cellular responses of HUVECs. *Molecular BioSystems*, 2012, 8 (10) : 2657 -2663.

Kanchan Bala, James Gomes and Nivedita Karmakar Gohil. Interaction of glycated human serum albumin with endothelial cells in a hemodynamic environment: Structural and functional correlates. *Molecular BioSystems*, 2011, 7, 3036–3041.

Maneesh Jaiswal, Asheesh Gupta, Ashwini K. Agrawal, Manjeet Jassal, Amit Kr. Dinda, Veena Koul. Bilayer composite dressing of gelatin nanofibrous mat and PVAhydrogel for drug delivery and wound healing application: In-vitro and in-vivo studies, *Journal of Biomedical Nanotechnology* 2013 ,Vol. 9, 1495-508.

Mohammad Changez, Krishna Burugapalli, Veena Koul, and Veena Choudhary, "The Effect of Composition of Poly (Acrylic acid) – Gelatin Hydrogel on Gentamicin Sulphate Release: In Vitro", *Biomaterials*, 2003, 24, 527–536

Bhattacharjee, M. Miot, S.; Gorecka, A.; Singha, K.; Loparic, M.; Dickinson, S.; Das, A.; Bhavesh, N. S.; Ray, A. R.; Martin, I.; Ghosh, S. The role of 3D structure and protein conformation on the innate and adaptive immune responses to silk-based biomaterials. *Biomaterials* 34, 8161-8171, doi:10.1016/j.biomaterials.2013.07.018 (2013)

Das, A.; Mehndiratta, M.; Chattopadhyay, P.; Ray, A. R . Enhanced Redifferentiation of Chondrocytes on Microperiodic Silk/Gelatin Scaffolds: Toward Tailor-Made Tissue Engineering. *Biomacromolecules* 14, 311-321, doi:10.1021/bm301193t (2013)

3.9: Sponsored Projects

Consultancy Projects (CW) details of the last 3 years

Project Title	Total Amount	PI Name
Evaluation of Rehabilitation Devices for the Spinal Cord injury patients	Rs. 1,50,000	SNEH ANAND
Analysis and Testing of Polymeric Samples Submitted by Department of Customs	Rs. 47,615	HARPAL SINGH
Analysis & Testing of Rubber Compounds	Rs. 18,519	HARPAL SINGH
Analysis and Identification of Rubber Compound	Rs. 18,519	HARPAL SINGH
Analysis of Rubber Compound	Rs. 18,519	HARPAL SINGH
Analysis of Rubber Compound	Rs. 37,037	HARPAL SINGH
Analysis of Polyester Bonded Fabric	Rs. 22,273	HARPAL SINGH
Technical Opinion & Testing of Samles of Polyester Fabric	Rs. 22,274	HARPAL SINGH
Technical Openion and Testing of Samples and Interpretation of Results of Polyester Fabric	Rs. 22,274	HARPAL SINGH
Identification of Polymethyl Methacrylate Monomer	Rs. 22,250	HARPAL SINGH
Evaluation of UV Stability of Air Born Warning Sphere	Rs. 25,031	HARPAL SINGH
Determination of Biodegradability of Polyurethane Foam Panel	Rs. 20,000	HARPAL SINGH
Development of Process for Total Haemoglobin and Carboxyhaemoglobin level Quantification in whole blood [Duration:3 months-M/s Wrig Systems Pvt. Ltd, Rs. 0.70422 Lakhs-PDC 2011]	Rs. 70,422	VEENA KOUL
Development of the iontophoretic kit for transdermal delivery for Diclofenac [Duration: 1 year-M/s Troikaa Pharmaceuticals Ltd PDC 2010]	Rs. 5,20,000	SNEH ANAND/ VEENA KOUL
Development of hydrogels dressings for chronic wounds [Duration: 6 months-Azzure Medical Systems-Rs. 3 lakhs,2005]	Rs. 3,00,000	VEENA KOUL

3.9 List of Research Projects undertaken at Centre for Biomedical Engineering since 01/04/2003

Project Title	Sponsor	Total Funds	PI/Co-PI Name	Start Date	Completion Date
Effect of Moulding Cycles on Physical Properties of Polycarbonate	Siddhartha Asia Ltd.	Rs. 46,296.00	HARPAL SINGH	17-Jul-03	16-Jan-04
Biomechanical Testing of External Skeletal Fixators	Indian Veterinary Research Institute	Rs. 1,01,157.00	R.K. SAXENA	31-Jul-03	30-Jul-04
Analysis & Testing of Rubber Compounds	Office of the Assistant Commissioner of Customs	Rs. 18,519.00	HARPAL SINGH	06-Aug-03	30-Aug-04
Analysis and Identification of Rubber Compound	Assistant Commissioner of Customs	Rs. 18,519.00	HARPAL SINGH	09-Sep-03	08-Oct-03
Analysis of Rubber Compound	Asstt. Commissioner	Rs. 18,519.00	HARPAL SINGH	23-Jan-04	22-Mar-04
Analysis of Rubber Compound	Office of the Assistant Commissioner of Customs	Rs. 37,037.00	HARPAL SINGH	31-Mar-04	29-Sep-04
Analysis of Polyester Bonded Fabric	Y.S. Enterprises	Rs. 22,273.00	HARPAL SINGH	15-Feb-07	14-Mar-07
Technical Opinion & Testing of Samles of Polyester Fabric	Prasad Enterprises	Rs. 22,274.00	HARPAL SINGH	13-Apr-07	12-Jun-07
Technical Openion and Testing of Samples and Interpretation of Results of Polyester Fabric	A.S. International	Rs. 22,274.00	HARPAL SINGH	13-Apr-07	12-Jun-07
Identification of Polymethyl Methacrylate Monomer	Assistant Commissioner of Customs	Rs. 22,250.00	HARPAL SINGH	12-Nov-07	31-Dec-07
Evaluation of UV Stability of Air Born Warning Sphere	Avaid's Technovators Pvt. Ltd	Rs. 25,031.00	HARPAL SINGH	07-Jan-08	06-Feb-08

Determination of Biodegradability of Polyurethane Foam Panel	Avaid's Technovators Pvt. Ltd	Rs. 20,000.00	HARPAL SINGH	26-Aug-08	25-Oct-08
Development of Process for Total Haemoglobin and Carboxyhaemoglobin Level Quantification in Whole Blood	WRIG Nanosystems Pvt. Ltd., New Delhi	Rs. 63,846.00	VEENA KOUL	21-Feb-11	20-May-11
Direct CSIR Research Associateship to Dr. Sruti Chattopadhyay at CBME	Council of Scientific & Industrial Research	Rs. 7,50,506.00	HARPAL SINGH	02-Apr-07	31-Mar-10
Direct RA Ship to Dr. Manawwar Alam	Council of Scientific & Industrial Research	Rs. 3,51,200.00	ALOK RANJAN RAY	01-Apr-08	31-Mar-10
Direct RA Ship to Sh. Rakesh Kumar Mishra.	Council of Scientific & Industrial Research	Rs. 2,15,974.00	ALOK RANJAN RAY	05-May-09	04-May-10
Distributed Computational Methods for Bioelectric, biomedical and Related Area,	Industrial Research & Development, IIT Delhi.	Rs. 1,00,000.00	ASHUTOSH MISHRA	03-Aug-09	02-Feb-11
MI to operate DDF at CBME	Indian Institute of Technology Delhi.	Rs. 1,00,000.00	ALOK RANJAN RAY	15-Jun-09	14-Jun-14
MI for release of assistanship to Ms. Geeta, under the Prof. A. R. Ray, CBME	Industrial Research & Development, IIT Delhi.	Rs. 1,44,000.00	ALOK RANJAN RAY	01-Mar-10	28-Feb-11
Direct RAship of ICMR to Dr. Sruti Chattopadhyay	Indian Council of Medical Research	Rs. 6,86,800.00	HARPAL SINGH	01-Sep-10	31-Aug-13
6th meeting of the programme advisory & monitoring committee for 'Technology Interventions for elderly (TIDE)'	Department of Science & Technology (DST)	Rs. 4,17,578.00	HARPAL SINGH	25-Nov-11	26-Nov-11
Nanomedicine and medical Daignosis	International Division, Dept. of Science & Techn.	Rs. 6,18,500.00	HARPAL SINGH	12-Jan-12	29-Feb-12
Basic Polymers and their Aplication in Pharmaceuticals	Torrent Pharmaceutical Ltd.	Rs. 4,99,800.00	HARPAL SINGH	23-Mar-12	25-Mar-12

DST Post Doc. Fellowship in Nano Science & Tech. to Dr. Aniruddha Roy	Jawaharlal Nehru Centre for Adv. Sci. Research	Rs. 10,40,000.00	ALOK RANJAN RAY	16-Feb-12	15-Feb-14
Visit of Ms. Sanskrita Das, IIT Delhi for Six Months to Pohang University of Science and Technology (POSTECH), Republic of Korea under the India-Korea Research Internship Programme	Department of Science & Technology (DST)	Rs. 80,000.00	ALOK RANJAN RAY	09-May-13	08-Nov-13
Development of sensitive and automated Dissolved Oxygen (DO) Meter	Industrial Research & Development, IIT Delhi.	Rs. 1,00,000.00	SANDEEP KUMAR JHA	27-Nov-13	26-Nov-14
design and analysis of Orthodontic Miniscrews using Finite Element Method	Industrial Research & Development, IIT Delhi.	Rs. 1,00,000.00	DINESH KALYANASU NDARAM	28-Nov-13	27-Nov-14
Pathophysiological, Biomechanical and Metallurgical Study of Orthopaedic Implants	Indian Council of Medical Research	Rs. 13,65,345.00	SNEH ANAND	01-Jan-04	08-Aug-06
Iodine release from polymeric carriers for disinfection of drinking water	Department of Science & Technology (DST)	Rs. 4,98,000.00	HARPAL SINGH	04-Feb-04	03-Feb-06
Development of Blood Compataible Polymeric Biomaterials for Medical Devices	Ministry of Human Resource Development	Rs. 12,00,000.00	ALOK RANJAN RAY	01-Mar-04	31-Aug-07
Development of polymer matrices from renewable resources for enzyme linked immunosorbent assay	Department of Science & Technology (DST)	Rs. 25,50,000.00	HARPAL SINGH	31-Mar-04	31-Mar-08
Failed Implant Testing and Research Engineering Laboratory [FITREL]	World Health Organisation	Rs. 7,18,500.00	PRASHANT MISHRA	01-Mar-04	31-Dec-06
Smart Macromolecular Therapeutics Design Synthesis and Evaluation of Tailor made Anti-cancer drug Conjugates and local Hyperthermia for Selective lysis of Cancer Cell	LIFE SCIENCES RESEARCH BOARD, GOI, DRDO,7TH FLOOR,	Rs. 18,76,800.00	VEENA KOUL	09-Dec-04	31-Oct-08

Development of Artificial Bone Material	Indian Council of Medical Research	Rs. 13,61,874.00	ALOK RANJAN RAY	01-Mar-05	29-Feb-08
Development of Biocompatible Adhesive	Department of Science & Technology (DST)	Rs. 18,82,500.00	ALOK RANJAN RAY	04-May-05	03-May-08
Pre-clinical Trial of a Portable Device for Electrically Enhanced Transdermal Drug Delivery	Department of Science & Technology (DST)	Rs. 29,55,000.00	SNEH ANAND	05-Sep-06	04-Mar-10
To Develop an External Counter Pulsation (ECP)	Ministry of Information Technology	Rs. 57,60,000.00	SNEH ANAND	30-Nov-06	30-Nov-10
Development of Low Cost Biosensor for Rapid Detection of Pathogenic Bacteria	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 39,19,000.00	HARPAL SINGH	13-Jul-07	31-Aug-10
Stanford India Biodesign (SIB) Programme	Department of Biotechnology,GOI	Rs. 7,10,61,000.00	ALOK RANJAN RAY	14-Aug-07	13-Aug-17
Phytochemical Based Multifunctional Polymeric Hydrogel Dressing for Superficial Burn Wounds.	Council of Scientific & Industrial Research	Rs. 4,28,087.00	VEENA KOUL	01-Oct-07	30-Sep-09
Clinical Trail of Hb-AGE as a Novel Long term Glycemic Index Using its Auto fluorescence	Department of Biotechnology,GOI	Rs. 37,44,000.00	NIVEDITA KARMAKAR GOHIL	19-Dec-07	28-Oct-11
Development of Implants and Medical Devices	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 37,00,000.00	ALOK RANJAN RAY	01-Dec-07	17-Dec-12
An Intuitionistic Fuzzy Approach to Medical Image Segmentation and Classification	Department of Science & Technology (DST)	Rs. 15,30,870.00	SNEH ANAND	09-Jul-08	31-Aug-11
Development of Biodegradable Polymeric Dendrimers/Nanoplastics for cancer Diagnostics and Treatment	Lock Heed Martin Corporation, USA	Rs. 42,72,633.00	HARPAL SINGH	24-Jun-08	31-Jul-10

Development of Polymeric Dendrimers/Nanoparticles for Detection of Pathogenic Bacteria	Lock Heed Martin Corporation, USA	Rs. 45,85,077.00	HARPAL SINGH	24-Jun-08	31-Jul-12
Development of Instant ECG (I-ECG), A Low Cost 12-Lead ECG with Telemetric Capacity (Tele-ECG), Mobile ECG (m-ECG) and a software for ECG Analysis (ECG-soft)	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 33,21,600.00	SNEH ANAND	12-Sep-08	11-Mar-11
Interaction of Endothelial Cells with Advanced Glycation End Products	Council of Scientific & Industrial Research	Rs. 12,57,584.00	NIVEDITA KARMAKAR GOHIL	27-Mar-09	30-Sep-11
Transdermal Delivery of Drug Loaded Nanoparticles for the Treatment of Rheumatoid Arthritis by Electroporation:A Combinational Approach.	Department of Science & Technology (DST)	Rs. 19,40,500.00	VEENA KOUL	16-Nov-09	15-May-13
Augmented Medical Diagnosis Using Laptop based Wireless Real Time Ultrasonic Scanning Machine	Department of Science & Technology (DST)	Rs. 20,92,839.00	SNEH ANAND	11-Dec-09	10-Dec-12
3D-expansion and differentiation of Mesenchymal stem Cell into Osteoblast for Bone Tissue engineering on Biocomposite scaffold	Indian Council of Medical Research	Rs. 27,73,000.00	ALOK RANJAN RAY	30-Mar-10	29-Mar-13
Multi-disciplinary Approach to Combat cancer by Targeted Drug Delivery using Intelligent Polymeric Nanoparticles	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 37,58,000.00	VEENA KOUL	22-Jul-10	17-Jul-14
Preclinical Trial of a Portable Device for Electrically Enhanced Transdermal Drug Delivery-Phase-II	Department of Science & Technology (DST)	Rs. 15,25,200.00	SNEH ANAND	02-Aug-10	30-Apr-12
Feasibility study and development of autonomous cancerous cell detection in pap smear using cellular level electrical response characteristics	Department of Science & Technology (DST)	Rs. 25,10,100.00	ASHUTOSH MISHRA	27-Oct-10	26-Oct-12
Development of Multifunctional Biodegradable Nanoparticles (NPs)/Nanocrystals for Cancer Diagnosis and Treatment	Department of Science & Technology (DST)	Rs. 48,14,800.00	HARPAL SINGH	07-Jul-11	06-Jul-14

Development of Functionalized Polymeric Materials for the Rapid Detection of Food-borne Pathogens	LSRB,DRDO, Directorate of Life Sciences,	Rs. 26,20,640.00	HARPAL SINGH	06-Jun-11	05-Jun-14
Mathematical Modeling and Analysis of Medical Images Using Soft Computing	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 53,19,000.00	SNEH ANAND	13-Oct-11	12-Oct-14
Development of Low-Cost Versatile Endoscopic Equipment System for Neurosurgery (Ventricular, Intra-Cranial and Skull-Base surgery)	Department of Science & Technology (DST)	Rs. 32,10,000.00	SNEH ANAND	18-May-12	17-May-15
Development of Polymeric Absorbent Hydrogel for Absorption of Blood and Biological Fluids Containing Radionuclide in NBC Environment.	Institute of Nuclear Medicine and Allied Sciences	Rs. 15,36,800.00	HARPAL SINGH	11-Jun-12	17-May-14
Designer Biodegradable Copolymers from Renewable Resources : Evaluation of Properties and Applications	Department of Biotechnology, Ministry of Sc.& Tech	Rs. 88,02,000.00	HARPAL SINGH	11-Jun-12	10-Jun-15
Development of Novel Polymer Based Formulation for Decorporation of Heavy Metals Using Approved Chelating Agents	Department of Science & Technology (DST)	Rs. 20,10,000.00	HARPAL SINGH	07-Jun-12	06-Jun-15
Foot Pad with Embedded Fiber Bragg Grating Sensors for 3D Stress Mapping at Foot Sole of Diabetic Patients	DST	Rs. 9,18,000.00	SNEH ANAND	01-Jan-13	31-Mar-14
A Study of Neural Plasticity for Vision Cognition in Congenital Blinds after Sight Onset.		Rs. 34,03,600.00	SNEH ANAND		
Biodegradable Scaffold Designing for the Development of Dermal Substitutes		Rs. 23,29,000.00	ALOK RANJAN RAY		
Capillary Electrophoresis Amperometric Detector Microchip for in-situ Product Monitoring in Bioreactors	DBT	Rs. 69,60,000.00	Sandeep K. Jha		
Design and development of optimized electrical parameters for electrically enhanced transdermal drug delivery instrument–PI,Completed	DBT	Rs. 28,37,000.00	V. Koul		

Development of biodegradable hydrogels and controlled drug release for the treatment of Osteomyelitis	LSRB	Rs. 25,03,000.00	V. Koul	
Development of Biodegradable Plastic Composite scaffolds for Bone growth through micro cellular Injection Molding	DBT	Rs. 47,95,000.00	Alok R. Ray	Co-PI
Development of Biodegradable polymer matrices from renewable resources for ELISA	DST,New Delhi	Rs. 25,50,000.00	H. Singh	
Development of Biodegradable Scaffold for Tissue Engineering of Blood Vessels	DBT	Rs. 26,86,000.00	Alok R. Ray	Co-PI
Development of Biopolymer Based Hydrogel for Acne Treatment		Rs. 14,66,900.00	ALOK RANJAN RAY	
Development of Chitosan Hydrogel based Wound Dressings		Rs. 17,18,284.00	HARPAL SINGH	
Development of functionalized polymeric materials for rapid detection of food borne pathogens	DRDO, India	Rs. 26,20,640.00	H. Singh	
Development of Implant and Medical Devices	DBT	Rs. 22,20,000.00	Alok R. Ray	
Development of Nano-Engineered High-Life Fatigue-Proof Polymer Materials for Artificial Total Joint Replacements (TJR)		Rs. 92,17,400.00	ALOK RANJAN RAY	
Development of nanoparticular system for selective receptor specific macrophage targeting	DBT	Rs. 28,37,000.00	V. Koul	
Development of Nanosilver Nanohydrogels for Biomedical Applications	DBT	Rs. 83,11,000.00	Alok R. Ray	In Progress
Development of polymeric Dendrimers /nanoparticles for detection of pathogenic bacteria (likely to continue till 2011)	Lockheed Martin, USA	Rs. 20,00,000.00	H. Singh	
Development of polyvinylalcohol /polyethyleneoxide Aloe-vera based burn wound dressings (Co-PI)	CSIR,New Delhi	Rs. 8,62,000.00	H. Singh	
Developments & Antimicrobial Polypropylene Surgical Sutures (Co-PI)	CSIR, New Delhi	Rs. 4,77,700.00	H. Singh	

Drug Development to Improve Efficacy and Reduce Side Effect of an Injectable Intravasal Contraceptive Form the Male	MOH&FW	Rs. 2,75,000.00	V. Koul		
Technology development for Sol-Gel based fiber optic Immunosensor for measurement of Myoglobin and other blood proteins.	DST	Rs. 12,30,000	Nivedita K Gohil	2001	2004
Monitoring Cognition of Healthcare Workers in Emergency and Intensive Care Setting and Its Relation to Medical Errors		Rs. 29,42,400.00	SNEH ANAND		
Phytochemical based Multifunctional Polymeric Hydrogel Dressing for Superficial Burn Wounds		Rs. 9,00,000.00	V. Koul	CSIR	
Pre-clinical trial of a portable device for electrically enhanced transdermal drug delivery phase I		Rs. 41,00,000.00	V. Koul	DST	
Scaffold-based control of Chondrocyte phenotype: Towards Engineering of In vertebral Disk Tissue	Indo-Swiss joint Research project, DST	Rs. 27,54,000.00	Alok R. Ray (Co-PI) Dr. S. Ghosh-PI	In progress	
Stanford- India Biodesign Program	DBT	Rs. 1,00,64,000.00	Alok R. Ray	In progress	
Sustainable Urban Transport in Less Motorised Countries: Research and Training		Rs. 14,24,11,703.00	A. R. Ray/ Dinesh Mohan		
Technology development for Sol-Gel based fiber optic Immunosensor for measurement of Myoglobin and other blood proteins	DST	Rs.12,30,000/-	Nivedita K Gohil	23-Jun-05	2004
Safety Modelling and Epidemiological Research		Rs. 2,72,20,375.00	ALOK RANJAN RAY		
Safety Modelling and Epidemiological Research		Rs. 2,72,20,375.00	DINESH MOHAN		
Volvo Chair Professor Project to Prof. Dinesh Mohan		Rs. 20,00,000.00	DINESH MOHAN		
Centre of Excellence in the Area of Urban Transport.		Rs. 7,85,00,000.00	DINESH MOHAN		

Visit of Ms.Sanskrita Das, IIT Delhi for Six Months to Pohang University of Science and Technology (POSTECH), Republic of Korea under the India-Korea Research Internship Programme		Rs. 80,000.00	ALOK RANJAN RAY		
Evaluation of indigenous non-invasive blood glucose monitoring technologies	ICMR	Rs. 71390000	S. Anand	(AIIMS)	In Progress
A pilot study for efficacy for Arnica Montana in muscle fatigue using electrophysiological markers: Randomized double blind and crossover trial	CCRH	25000000	S. Anand	(AIIMS)	
Analysis of autonomous nervous system correlates and health benefits of rhythmic breathing techniques	AYUSH	29630000	S. Anand	(AIIMS)	

3.11 New areas of research which are different from the faculty's PhD thesis area

Biosensor applications, vascular cell mechanics, molecular markers in diabetes

Lab-on-a-chip; Microfluidics; Capillary Electrophoresis Microchip

Rehabilitation Engineering, Biomedical Transducers and Sensors, Controlled Drug Delivery System, technical validation of Alternate medicine, neuro endoscopy, Integrated Health Care.

Nano medicine, Drug delivery systems, Skin regeneration, Brain and cancer targeting of bioactive molecules

Food Science & technology, Chemistry

Orthopaedics, Biomechanics, Recombinant DNA, synthetic biology

Near-infrared optical imaging technology with focus on instrument development, computational analysis and software packaging, bench to bedside research from phantoms to in-vivo in the areas of breast cancer, functional brain translational mapping, and wound care healing.

3.12 Methodology for (i) identifying obsolescence in research areas, and (ii) identification of new areas for future research

(i) drop in impact factor of journal in that area (ii) New publications in high impact journals

(ii) Cancer cell mechanics; cancer cell mechanics, cancer detection and therapy (cancer theranostics); Tissue engineering and nanobiotechnology

4.2 Technology developed

- 1 Novel kit for assay of iron in biological fluids
- 2 Modulated dc Iontophoretic Device
- 3 Electro-oculogram based Multi-mode Controller
- 4 Device for External Counter Pulsation Therapy
- 5 Zig-G, A Wireless ECG system
- 6 A Pneumatic Damper Controlled AK Prosthesis
- 7 Development of a Biomedical Engineering application Toolkit (BEAT)
- 8 Contra Lateral Limb Controlled Prosthetic Knee Joint
- 9 Wireless ECG patch and system for obtaining High Definition mobile ECG
- 10 A Surgical Stapler
- 11 Bilayer dressing for wound healing

4.3 Technology transferred

- 1 Heat sealable coatings onto paper for adhesion with PVC polyester and polystyrene films for packing application (Technology transferred to Kumar Printers, Okhla, New Delhi, India).
- 2 Immobilization of aminoacylase on functionalized acrylics for production of 6-aminopenicillanic acid from penicillin (Technology transferred to Ranbaxy Ltd., Gurgaon, Haryana, India).
- 3 Antimicrobial acrylic bone cement for fixation of hip and knee joints.(Technology transferred to XLOrthobiomed , Faridabad, Haryana, India).
- 4 Polymeric nanoparticles and process of preparation thereof for delivery of peptide based anticancer agents (Technology transferred to Nanogen Pharmaceuticals Delhi).
- 5 Contra Lateral Limb Controlled Prosthetic Knee Joint, (Prof. S. Anand, U.Singh, A.Mishra, Ramandeep Singh, Rahul Rieberio)
- 6 Blow Switch (Prof. Sneha Anand, Dr. Jayashree Santosh, CSC)
- 7 Touch Pad and Word Editor (Dr. J. Santhosh, CSC, Prof. Sneha Anand)
- 8 Remote Mouse and Word Editor (Dr. J. Santhosh, CSC, Prof. Sneha Anand)
- 9 Iontophoretic Transdermal Device for delivery of Declofenac (Triokaa Pharma. Lab. Ahmedabad) (V. Koul/A. Anand)
- 10 TBIO Unit for development of opto electronic hemoglobinometer. (Wrig Nanosystems Pvt. Ltd., new Delhi) (V. Koul)

4.4: Number of patents filed and patent granted as a fraction of patents filed

No.	Status	Titile of the Patent	Patent No.	Country	Institute	Name of the Inventors
1	Registered	Biodegradable Masterbatch (Bio-D-MB) Formulation for packaging Fiber applications	787/Del/2004	Indian	IIT Delhi	J.K. Pal, H. Singh and A.K. Ghosh
2	Registered	Photobiodegradable masterbatch (Photo-D-MB)formulation for pacjkaging fiber application	788/DEL/2004	Indian	IIT Delhi	J.K. Pal, H. Singh and A.K. Ghosh
3	Registered	Antimicrobial grafted polypropylene suture.	1049/DEL/2004	Indian	IIT Delhi	Sayed Kalimul Haque Gulrez,Nishat Anjum,Nilesh Revagade, Harpal Singh
4	Registered	Improved Blood grouping cards	230/DEL/2005	Indian	IIT Delhi	Singh,H.; Tomar,L.K.; Tyagi,C.
5	Registered	Development of Contact Microbial Killer Quaternary Amine Acrylates based Hydroges for water disinfection	2525/DEL/2005	Indian	IIT Delhi	Singh,H.; Punyani,S.
6	Registered	Composition for oral delivery of therapeutic agents and processes thereof	1437/DEL/2006	Indian	IIT Delhi	Singh,H; Kumar, Amit; Lahri,S.S.
7	Filed	Tropical formulation for prevention and management of peripheral vascular diseases and a process of preparation thereof		Indian	IIT Delhi	Singh,H; Suhag, Geeta; Bhatnagar.
8	Filed	Polymeric nanoparticles and process of preparation thereof	1249/DEL/2012	Indian	Nanogen	Singh,H
9	Registered	Modulated dc Iontophoretic Device	710/DEL/06	Indian	IIT Delhi	S. Anand
10	Registered	Electro-oculogram based Multi-mode Controller	14606/DEL/2007	Indian	IIT Delhi	S. Anand
11	Registered	Device for External Counter Pulsation Therapy	2117/DEL/2008	Indian	IIT Delhi	S. Anand

12	Registered	Zig-G, A Wireless ECG system	2117/DEL/2008	Indian	IIT Delhi	S. Anand
13	Registered	A Pneumatic Damper Controlled AK Prosthesis	683/DEL/2009	Indian	IIT Delhi	S. Anand
14	Registered	Development of a Biomedical Engineering application Toolkit (BEAT)	886/DEL/2009	Indian	IIT Delhi	S. Anand
15	Registered	Contra Lateral Limb Controlled Prosthetic Knee Joint	398/DEL/2012	Indian	IIT Delhi	S. Anand
16	Registered	Wireless ECG patch and system for obtaining High Definition mobile ECG	228/DEL/2012	Indian	IIT Delhi	S. Anand
17	Registered	A Surgical Stapler	242111	Indian	IIT Delhi	S. Anand
18	Registered	Fluorescence based sensor and sensing method for invitro detection and quantitation of myoglobin	GO1N21/55-64	Indian	IIT Delhi	NK Chaudhary, BM Mohan, Nivedita K Gohil, S Anand
19	Filed	A test Kit and Method for measurement of metals in biological fluids	2713 / DEL / 2008	Indian	IIT Delhi	Nivedita K Gohil
20	Filed	A test Kit and Method for measurement of metals in biological fluids	12/998,794	US	IIT Delhi	Nivedita K Gohil

6.6.a Awards received by faculty		
2013	GANDHIAN TECHNOLOGY INNOVATION AWARD	A. R. Ray
2012	Distinguished Alumni award thapar university	S. Anand
2010	Award from M/s Intellectual Ventures Asia through FITT, for Invention/Idea	Nivedita K. Gohil
2009	Best Project Award in I ² Tech, IIT-Delhi	V. Koul
2009	Best Seminar /Project Award on National Science Day (DST, INSA and IIT Delhi)	Nivedita K Gohil/ M Sharma
2007	Shiksha Rattan Purskar for excellence in teaching from India International Friendship Society, New Delhi	S. Anand
2007	TATA INNOVATION FELLOWSHIP	A. R. Ray
2006	Silver Medal for Best innovation in India International Trade Fair, Pragati Maidan, New Delhi	S. Anand
2006	Best Project Award in EOG based Assistance device to assist severely disabled	S. Anand
2005	Best Project Award in I ² Tech, IIT-Delhi	S. Anand
2004	Institution of Engineers Lifetime Achievement Award	S. Anand
2004	Best Project Award in I ² Tech, IIT-Delhi	V. Koul/S. Anand
2004	Best Project Award in I ² Tech, IIT-Delhi	H. Singh
2002	IETE Gowri Memorial award for the best paper of general interest	S. Anand
1998	Institution of Electronics and Telecommunication Engineers Hari Ramji Toshniwal Gold Medal	S. Anand
1994	Kshanka Oration Award of the Indian Council of Medical earch for Applied Research in Technology in Health Care Res	S. Anand
1993	National Invention Award of the Ministry of Welfare for Universal Graphical and Braille Classroom Teaching Aid for the Blind	S. Anand
1992	National Invention Award of the Ministry of Welfare for Communication Aid for the Spastics	S. Anand
1990	National Best Invention Award of the Ministry of Welfare for Braille Communication System	S. Anand
1989	World Intellectual Property Organisation (United Nations) Silver Medal for work leading to blind working on machines	S. Anand
1989	National Research Development Corporation Invention Republic Day Award for Centre Lathe Operation by the Blind	S. Anand
1988	Ministry of Welfare, National Technology Invention Award On Aids for the Disabled (Blind)	S. Anand

7.3.a: Faculty Profile

Prof. Sneh Anand, graduated in Electrical Engineering from Punjab University, Patiala in 1970 and did her Masters (Control & Instrumentation) and Doctoral Research (Biomedical Engineering) at the Indian Institute of Technology, New Delhi, in 1972 and 1976 respectively. She has contributed her 43 years of her life to Indian Institute of Delhi. She optimally combines her Engineering training with biomedicine to bring in innovative concepts and give them a practical shape as products which benefit many people in need. Dr. Anand's systematic holistic approach that is well directed towards manpower training, innovative research and technology development. Her principal achievements are in the areas of transducers and biosensors, reproductive bioengineering and rehabilitation Engineering. Addressing the problem of population control she demonstrated how Electrical Engineering principles could be applied to understand the physiology of reproduction and provide an electronic reversible fertility control device. Her multiple areas of research includes General Surgery, Neurology, Anesthesiology, Cancer, mass Healthcare IT, Orthopedic, Patient Monitoring, Ophthalmology, Cardiology, Home care, Dermatology, Pediatrics, Imaging, Rehabilitation and Brain computer Interface. With her dedicated biomedical R&D efforts she has published more than 130 papers in reputed biomedical journals. She has 8 inventions and 9 patents to her credit and has transferred 6 know-hows to Indian Industries. Her pioneering contributions rehabilitation engineering that helped the blind to find Industrial placements; a universal graphic system which enabled blind to read text and diagrams via computer monitor and a very special computer based communication system for spastics are noteworthy. For these scientific endeavors National Research and Development Corporation awarded topmost invention awards for the years 1989, Ministry of welfare presented Technology Invention awards for the years 1988, 1989, 1992 and 1993 in rehabilitation engineering and the Indian Council of Medical Research conferred Kshanika oration and Citation award for the year 1993 in Healthcare technology on her. With this and others Prof. Anand stands unique in the country as an engineer who has gone beyond academics and practically helped people through biomedical technology.

Prof. Harpal Singh is a Professor at the Centre for Biomedical Engineering, IIT Delhi since 2002. He has published 90 research papers in National and International Journals of repute, presented 60 research papers in National and International Conferences and has 10 patents to his credit in the area of Polymeric Biomaterials, Nanobiotechnology, Drug Delivery Systems, Antimicrobial Polymers for Water Disinfection, Medical diagnostics & Synthesis and Modification of Polymers for Biomedical and Industrial Applications. He has supervised 25 Ph.D. projects and 25 M.Tech. projects on Synthesis & Modifications of Polymers for Biomedical and Industrial Applications & eight Ph.D. project are under progress. He has completed 8 research projects and 30 consultancy projects sponsored by various government and private organizations in biomedical (diagnostics, devices and therapy) and industrial (adhesive, packaging, coating) applications. Two sponsored research projects under progress. Current focus area of R & D is development of biodegradable nanoparticles for targeted delivery of chemotherapeutic drugs (paclitaxel, doxorubicin, pimazide etc), peptides (NUBCP9, MUC1) and DNA (TNF) using intravenous, subcutaneous and oral routes.

Prof. Veena Koul received her PhD from Kashmir University in Medicinal Chemistry in 1984. She joined as Senior Scientific officer in Centre for Biomedical Engineering at IIT Delhi in the year 1986. As scientific officer she worked on high impact projects like clinical trials on male injectable, development of chemical strip for haemoglobinometre and UNDP funded projects on female contraceptives. In the year 1997 she joined as Assistant professor in the same Centre. Currently she is a professor in the Centre. Her research interests are mainly in the area of drug delivery using polymeric systems for biomedical applications such as transdermal drug delivery, targeted drug delivery to cancer and soft skin regeneration. She has guided 9 PhD students. She has over 90 international publications and conference papers

Dr. Nivedita K Gohil obtained her Ph.D from IIT Delhi in 1988. She joined Centre for Biomedical Engineering in 1995 as Senior Scientific Officer and is currently Associate Professor in the Centre. She has acquired pre-and post-doctoral experience in the area of Vascular Physiology from Imperial College of Science Technology and Medicine, UK. Her research interest lies at the interface of fundamental chemical biology phenomena and their application to biosensor technology. The focus has been largely on molecular markers in systemic diseases like atherosclerosis, diabetes and thalassemia. A multidisciplinary approach is applied to develop novel assay systems for diagnostic purposes. The group is engaged in studies on endothelial mechano-biology of how vascular hemodynamics may be involved in the regulation of inflammation induced by pathology of diabetes leading to macrovascular complications like atherosclerosis. The outcome is a better understanding of mechanisms to enable design of therapeutic strategies. The research is supported through extra-mural funding from DBT, LSRB, DST, CSIR and Institutional grants. She has published 25 papers in peer reviewed Journals.

Mr. S. M. K. Rahman has done B. Tech. in Electronics and Telecommunication (1976) and M. Tech. (1978) from Allahabad University. He had been taking regular U. G. & P. G. classes in Electrical Engineering. Apart from teaching regular courses he supervised about 8 M. Tech and 38 B. Tech projects. He developed approximately 45 projects (Including consultancy, in house and sponsored projects). He had also taken classes in FITT courses on Embedded Systems along with many Electrical Engineering faculties. He had undergone a total of 9 months training in U. K. under T. C. T. P. He had 6 Know How transferred and 22 Papers published & presented.

Prof. Alok Ranjan Ray has devoted his research to develop biocompatible materials for medical applications, which include drug delivery devices, catheters, contact lens and other medical implants. For this, he has used locally available natural materials like chitin, Alginate, Gum Arabica and Tamarind Seed Polysaccharide and has also developed several new synthetic materials. Dr. Ray has made significant contribution to the understanding the surface interactions of biological molecules and cells with synthetic materials in the living system. Dr. Ray has developed nine biomedical products and has published over 100 articles in professional journals.

Dr. Anuradha Godavarty is an Associate Professor at the Centre for Biomedical Engineering, IIT Delhi and her research work focuses in the area of optical-based molecular imaging (fluorescence-enhanced optical imaging) and tomography. Her areas of interest include Near-infrared optical imaging technology with focus on instrument development, computational analysis and software packaging, bench to bedside research from phantoms to in-vivo in the areas of breast cancer, functional braintranslational mapping, and wound care healing.

Dr. Sandeep Kumar Jha is an Assistant Professor at the Centre for Biomedical Engineering and has been working on fabrication of biosensors (optical, piezoelectric, capacitive, electrochemical); nanoparticle sensing; microfabricated microfluidic lab-on-a-chip for PCR and flow-cytometry applications; capillary electrophoresis microchip; immobilization and stabilization of biomolecules in synthetic and natural polymers, etc. for the past thirteen years. His recent interests are in aptamers, handheld biosensor fabrication and development of POCT devices. He is a Chemistry Hons. graduate from Calcutta University and latter entered in the field of Biotechnology (M.Sc. Biotechnology, Punjabi University, Patiala; Ph.D. in Biochemistry, Bhabha Atomic Research Centre, Mumbai, India). He has served on various capacities at Banasthali University, Rajasthan, India (Associate Professor of Biotechnology); Korea University, South Korea (Research professor); Myongji University, South Korea (Research Professor); KIIT University, Orissa, India (Assistant Professor); Myongji University, South Korea (Postdoc) and Indian Institute of technology Bombay (Research Associate). He has been teaching various subjects of Biotechnology, biosensors, electrochemistry and nanoscience at undergraduate and postgraduate levels. His areas of interest include fabrication of biosensors (optical, piezoelectric, capacitive, electrochemical); nanoparticle sensing; microfabricated microfluidic lab-on-a-chip for PCR and flow-cytometry applications; capillary electrophoresis microchip; immobilization and stabilization of biomolecules in synthetic and natural polymers, etc.

Dr. Dinesh Kalyansundaram is a mechanical engineer by education (Bachelors: College of Engineering, Guindy; Masters: IIT Delhi; PhD: Iowa State University; Post-doctoral research: University of Washington, Seattle; Biomedical consultant: L&T) and strongly believes in innovation and inter-disciplinary research as a means to achieve innovation. His areas of interest include Micromachining of materials, Product Design, Solid Mechanics (Specific Areas) DNA based diagnostics, lab-on-chip device design, Orthopaedics, Orthodontics, Surface modification, laser machining

Annexure 3

BENCH MARKING OF THE CURRICULUM

Benchmarking parameters for Ph.D

	IIT Delhi	IIT Bombay	IIT Madras	IIT Gandhinagar	NIT Rourkela	Manipal Univ.	Duke Univ.	Imperial College London	Pennsylvania State University	South China University of Tech. China	Federal University of Rio de Janeiro Brazil
Course work	6 M.Tech/12 for MSc B.Tech 20 credits	B.Tech. 44~56 Credits Masters 34~46 Credits M.Tech. 16~22 Credits	12 credits (PG) 24 credits (UG)	B.tech. 64, M.Sc. 44, M.Tech. 32	26 credits per Sem 104 credits after M.Tech. and 156 credits after other degrees (B.Tech., M.Sc., MCA etc) for Ph.D.	8 – 12 credits	36 units	not credit rated	15 credits	32 Credits	30 US credits and 60 European ECTS
Publishing paper	Institute Policy	Not compulsory	Not compulsory	Not compulsory	Not compulsory	Not comp.	Not comp.	Not compulsory	Not compulsory	Not compulsory	Not compulsory
Teaching requirement	Not mandatory	Not for undergrads	Not compulsory	Not compulsory	teaching/research assistantships	teaching assistantship		Students work as Graduate Teaching Assistants	teaching and research assistantship	Not compulsory	teaching/research assistantship
Inter-disciplinary/-breadth requirement	Extensive	Multi-disciplinary	Multi-disciplinary	Inter-disciplinary	Inter-disciplinary	multi-disciplinary	only with medical industry	Extensive	Highly Inter-disciplinary	Inter-disciplinary	Highly Inter-disciplinary