Summary Report

About Department/Center/School: *The department came into existence in 1952 as the Department of Agricultural Engineering. Later in 1992, it was renamed as the Department of Agricultural and Food Engineering. The Department pioneers agricultural engineering education and research in the country. It strives for sustainable food production by improving agricultural and food processing technologies.*

1. **Academic Programs (Range of Degrees and Disciplines):**

   i) ***B. Tech (Hons.)*** *– 4 years' duration*
   ii) ***Dual Degree*** *(B. Tech (Hons.)+M. Tech in Food Process Engineering / Farm Machinery and Power / Land and Water Resources Engineering/Aquacultural Engineering / Agricultural Systems & Management / MBA / EP & FP – 5 years' duration*
   iii) ***M. Tech+Ph. D*** *in Agricultural and Food Engineering – 2 years' M. Tech followed by an optional enrolment in the Ph. D programme*
   iv) ***MS*** *in Agricultural and Food Engineering – 2 years by research.*
   v) ***Ph. D*** *in Agricultural and Food Engineering*

2. **Major Thrust Areas of Research:** a*) Food, Water and Energy Security; b) Mechanized Food Processing.*
   The specific areas are: i); Precision Agriculture ii) Climate Change Adaptation & Mitigation; iii) Bio-materials and Biofuels; iv) Nano-materials in Agriculture; v) Environmental remediation and management; vi) Novel food processing technologies; vii) Health foods and nutraceuticals; viii) Automation and control in food processing.

3. **Curriculum and Courses & Teaching Environment**

Items	**Ratio/ Number**	**Items**	**Number/%**
Teacher-student Ratio	1:18	Average No. of students motivated (%) to opt of careers Eng/ Tech. Sectors UG/PG/PhD	40/70/80
No. of Faculty members as on today	34	Average No. of students motivated (%) to opt of careers in Science sectors UG/PG/PhD	60/30/20
Average No. of Tutorial Assistants	20	No. of teaching labs	20
No. of UG/DD students	118/149	Average No. of students per experiments in core courses	60
No. of PG students/PhD students	190/145	No. of Students' workshops/``Tinkering'' Labs	5
Average no. of tutors with more than 100 students	-	No. of new courses introduced	10
Average Students placements (%) (UG/DD/PG)	88/69/52	No. of New program introduced	03
No of major curriculum review in both UG & PG level	2	Undergraduate Vs PhD strength expressed as Percentage	54
No of UG lab (teaching labs) developed/set-ups	04/05	No of PG/research labs developed/new set up	02/04/04

No of E class rooms	01	No. of lab classes per week	6
Average No. of Course done per student for B. Tech/D D/M. Tech/Ph. D	58/69/16/5	No. of core/elective/seminar/projects subjects taken for B. Tech, DD, and M. Tech respectively	48/08/00/02; 51/14/00/04; 06/06/02/02

4. Research and Development & its Environment

Items	Number	Items	Number	Items	No.
Total No. of Publications in Journals (2009-13)	509	Average no. of citation per paper	5.78	No of large interdisciplinary research projects	22
Total No. of Publications in Conference & Symposium	338	Average Journal publication per year	82	Number of Int. conf./workshops attended by students	37
Total No of Books & e-books published	08/03	h-Index of the department since 2008/overall h-index in Scopus	17/40	No. of PDF hired in the Institute	02
Total No of Edited Conference Proceedings/book chapters	6/25	Number of papers with citation more that the average no. of citation of the Journals	NA	No. of international Students as PhDs/PDFs	00
Total No. of Technology Developed/transferred	33/14	No. of recognitions & Awards, fellows etc to faculty/students (provide break up if necessary)	20/10	No. of International visiting researchers/adjunct faculty stayed here for at least a week	14/02
Total No. of Patents Filed/Obtained	25/04	Average Retention (%) of Young faculty for at least 10 years	100	No. of short courses/workshops /conf. organized with international participations	04/06/1
Total No. of Copyright Filed/Obtained	12/08	No. of Sponsored research Project /fund (lakh) generated from non-internal source	70/4000	Average No. of PhD granted per year	18
No. of Publications per Faculty/Masters/PhD students	15/01/03	No. of Consultancy /fund (lakh) generated from non-internal source	24/500	Average No. of PhD Granted per year per faculty	0.53
No. of Publications per Faculty/Masters/PhD students in Top Ten Journals as Identified by the department	07/00/02	No of Internal and external Collaborations research papers/research projects/PhD students	153/25/30	Patent granted per faculty	0.62
Average No. of Citation per faculty per year	14	No of M. Tech students motivated into pursuing PhD/PhD graduates motivated to pursue career in Academics (abroad or IIT etc)	100/50	Number of articles in collaborations with Thirteen countries*	98
Ranking of the department in terms of average	8	Ranking of the department in terms of total number of	8/15	No of articles of the dept. contributing	22

citations per paper within the Institute		Journal publications within the Institute/publications per faculty		towards h-index of the Institute since 2008	

5. External Stakeholder Engagement and others

Items	Number	Amount Lakh
No. of PhD/Master students' thesis funded by Industries	04/05	200
Total number of Industry sponsored projects and its income (Lakh)	07	280
No. of Curriculum Development Initiative for Industries	01	NA
No of Technology transfer/adopted by Industry/Labs	14/12/02	NA
No. of Nationally relevant research projects	33	2500
No of Policy inputs/consultancies provided	15	500
No. of Research grant and seed money from internal savings of the Institute per young faculty of the department and its total fund	02	33
No. of Community Relevant projects	25	

6. Vision for the Future (in brief):

(a) Departments/centers/schools should spell out its Mission and Vision Statements, (b) Plans for future to achieve the projected goals and (c) measures adopted towards above.

The Department plans to align with the Vision 2020 of the Institute. The Department has set its own Objectives, Goals and made Strategies and Initiatives for the proper propagation of Vision 2020. In line with the institutes focus of achieving excellence in (i) Teaching (ii) Research (iii) Faculty (iv) Industry Collaboration, (v) Branding and Visibility, (vi) Funding Sources, and (vii) Governance and Administration, the department is taking the following steps:

a) upgrading/ modernizing the existing research and development facilities,
b) initiating new areas of research and mega research projects in line with national and international programmes,
c) making efforts to attract bright and young faculties,
d) promoting international collaborations and enhanced industry interaction, and
e) community service through technology transfer.

The department aims at becoming one of the top 20 Agricultural and Food Engineering programmes in the world in next 20 years.

7. External peer review of the Dept./centre/schools (in brief): (a) Date: *January 22-23, 2011*

(b) Name of the Experts involved and their affiliations in short: *(1) Dr. M. M. Pandey, Deputy Director General (Engineering), ICAR, New Delhi, (2) Dr. H. S. Gupta, Director, IARI, New Delhi, (3) Dr. A. P. Mishra, Former Dean, College of Agricultural Engineering, Rajendra Agricultural University, Pusa, and (4) Mr. S. S. Bhatnagar, General Manager, Indian Dairy Machineries Corporation, Anand*

(c) Overall recommendations of the peer review committee: Strengths, weaknesses, suggestions and comments

Following are the recommendations of the Review Committee:

- *Enhanced stress on basic engineering subjects in Agricultural and Food Engineering undergraduate curricula.*
- *Deployment of mechanism for market research for curricular refinement and R & D projects.*
- *Appropriate mix of core/elective/free elective subjects to strengthen undergraduate and postgraduate curricula.*
- *For M. Tech. degree requirements the course contents be enhanced by introducing additional subjects in the third/fourth semesters.*
- *For R & D and instructional purposes, the existing agricultural farm activities/infrastructure be strengthened.*
- *Department should formulate and undertake long-term mega projects in the emerging areas of agricultural and food engineering research eg. Precision farming, climate resilient technologies, high value product based processing technologies.*
- *More interaction of faculty members with industry and R & D organization related to agricultural and food engineering research.*
- *M. Tech. programme in Applied Botany be urgently renamed M. Tech. programme in Agricultural Biotechnology.*

(d) Measures adopted/action taken at the department level to address the recommendations of the peer review report:

The department has already renamed the M. Tech. programme in "Applied Botany" as M. Tech. (Agricultural Biotechnology) to suit the recruiters. Regarding the suggestions on other curriculum refinement, it may be noted that the Institute has taken up an initiative to review its academic programme (undergraduate as well as postgraduate) wherein the issues of curricula refinement of the department will be taken care of. The department has already taken up a pilot project up in farmers' field for technology demonstration under "Food Security Project". This will strengthen the existing agricultural farm activities/infrastructure for R & D and instructional purposes. The department has already started formulating as well as undertaking long term mega projects in the emerging areas of agricultural and food engineering research like, Precision farming, Climate resilient technologies etc.

8. Strengths, Weaknesses, Opportunities & Threats (SWOT) Analysis of the Department

STRENGTHS	**OPPORTUNITIES**
Pioneering and leading Agricultural Engineering Education & Research in the Nation for the past 62 years *Global network of alumni holding responsible positions* **WEAKNESSES** *Low teacher-student ratio* *Low teacher-staff especially technical staff ratio*	*To meet the challenges of contributing significantly in emerging fields of research like Precision Agriculture, Mechanised Food Processing, Climate Change Adaptation & Mitigation, and Alternate Energy* **THREATS** *Ineffectiveness in transferring technologies from laboratories to field and industry due to lack of infrastructure*

Slow pace of penetration of graduates in the Agro-Industrial Sector	

9. Additional Information, if any

The department is organizing number of trainings to farmers and industry people to disseminate the technologies developed time to time as a part of outreach activities. Besides an 'Advanced Training in Agricultural Engineering' to final year students of Tribhuvan University, Nepal is also conducted. Several of our faculty members are associated with different tractor and farm machinery industries and food processing industries through M. Tech, doctoral research and consultancy projects. To establish linkage with academia, agricultural industries and its own alumni, the department organizes an annual event, Prakriti through Agricultural Engineering Society (AES).

*Note: Thirteen countries: US, UK, Germany, Japan, Canada, France, Italy, Australia, Singapore, South Korea, Denmark, New Zealand, Israel.

Important Highlights

The Agricultural Engineering Department was established in 1952 with the vision to impart the knowledge of engineering and technology in the field of agriculture. Subsequently, with the upgradation of its academic program over the years the department was renamed in 1992 as The Agricultural and Food Engineering Department. Among the sixteen IITs, IIT Kharagpur only has the sole distinction of having an Agricultural and Food Engineering Department. Ever since its establishment, the department remained pioneered in agricultural engineering education and related research in the country. The current focus of the department is to meet the challenges of 'Food, Water and Energy Security' and Mechanized Food Processing. It aims to strengthen its teaching and research programs with specific emphasis on areas such as i) Precision Agriculture ii) Climate Change Adaptation & Mitigation; iii) Bio-materials and Biofuels; iv) Nano-materials in Agriculture; v) Environmental Remediation and Management; vi) Novel Food Processing Technologies; vii) Health Foods and Nutraceuticals; viii) Automation and Control in Food Processing.

Academic Program

Keeping pace with the technological and agricultural developments, the department has continuously upgraded its academic programs. Today it offers a 4-year B. Tech. (Hons.) program in Agricultural and Food Engineering, 2-year M. Tech program and six-year joint M. Tech-Ph. D program in six disciplines, and 5-year integrated M. Tech. program in five specializations. In addition, the department offers M.S. (by research) and Ph.D. programs in all areas of specialization. To keep pace with rapid development in mechanized agriculture and food processing, the department has modernized its laboratories, computational and field testing facilities to support frontline research in the areas of farm machinery and power, land and water resources engineering, food process engineering, aquacultural engineering, agronomy, soil science and agricultural biotechnology. The U.G program provides enough flexibility to the students for acquiring expertise in any of the three major areas of specialization namely, Farm Machinery and Power, Land and Water Resources Engineering and Food Process Engineering.

The U.G program also provides opportunity to the students to earn a MINOR in other disciplines of the institute.

Sponsored Research, Consultancy and International collaboration

The department continues to attract a large number of sponsored and consultancy projects from different Government agencies, International Foundations and Industries. The department has 70 sponsored research projects and 24 consultancy projects with a total value of INR 45 crores in the last five years. To name a few, the department has completed several high-value, NAIP-funded projects from the Indian Council of Agricultural Research. Under the Ministry of MHRD, the department is also implementing an ambitious project on Food Security in collaboration with several other departments of the institute. International research collaborations have been established with University of California Davis, Texas A & M University, Potsdam University, Leibniz University, Technical University (TU) Dresden, TU Stuttgart, TU Braunschweig, Yamaguchi University and Wageningen University through visits of departmental faculty and students, joint sponsored projects and exchange of guest faculty and researchers. Recently, the department participated in a large international initiative on climate change (High Noon project) funded by European Union (EU). Similarly, a mega project involving scientists from several universities from India and USA has also been initiated under the Information Technology Research Academy (ITRA) recently established by Government of India.

Unique Research and Development Facilities

The department has developed several unique facilities for conducting research in various disciplines. These include controlled indoor soil bin facilities for tillage and traction studies, ergonomical laboratory, sensor-based micro-irrigation systems, green-house facility, GIS and hydroinformatics lab, high pressure food processing system, Supercritical fluid extraction system, bio electricity generating unit, tea engineering facility, lignocellulosics- and microalgae-based biodiesel production facilities, open top chamber facility for climate change adaptation/ mitigation research, diffused reflectance spectroscopy for digital earth mapping.

Human Resources Development

The department has so far produced 917 B. Tech, 100 Dual degree, 2076 M. Tech, 12 M.S. and 460 Ph. D students. The current student strength at UG level is 267 and at PG level, including Ph. D scholars is 335. The department has 34 faculty, 32 non-academic staff and 27 project staff with teacher-student-staff ratio 1:18:0.8.

Publications and Patents

The department has published 3400 research papers and 34 books. It has 64 patents and 16 copyrights to its credit with 25 patents filed during the last five years. Based on Scopus data (2008-2013), the department ranks eighth in the Institute in terms of average citations, and third in the number of research articles.

Linkage with Academia, Industries and Alumni

Several of our faculty are associated with different tractor and farm machinery industries and food processing industries through M. Tech, doctoral research and consultancy projects. To establish linkage with academia, agricultural industries and its own alumni, the department organizes an annual event, Prakriti through Agricultural Engineering Society (AES).

Vision for the Future

The Department has set its own Objectives, Goals and made Strategies and Initiatives for the proper propagation of Vision 2020 of the Institute. In line with the institute's Mission and Goals, the department is a) upgrading/ modernizing the existing research and development facilities, b) initiating new areas of research and mega research projects in line with national and international programmes, c) making efforts to attract bright and young faculties, d) promoting international collaborations and enhanced industry interaction, and e) extending community service through technology transfer.