INDIAN INSTITUE OF TECHNOLOGY, ROORKEE

DEPARTMENTAL REVIEW TEMPLATE

1. **Name of Department/Center :** Metallurgical and Materials Engineering
2. **Reviewers :** Prof. N. B. Ballal,
   I.I.T, Bombay

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3. **Date of Review: 15.3.2014**

GRID FOR ASSESSMENT

NOTE:

i. Please grade in the box provided for the following parameters in the range of 1-10 with 10 being the highest.
ii. Leave 'blank' for 'No Comment'.
iii. Kindly give your opinion on the strength and weakness of the Department/ Center and your suggestions for future growth.

I. ACADEMICS

I.1	**Undergraduate**	**Score**
1.	Curriculum	
	i. Curricular Structure	8
	ii. Course Syllabi	8
	iii. Flexibility	8
2.	Formal Academic Load on Students	
	i. Teaching	7
	ii. Laboratory/Practical	7
	iii. Projects(minor/major)	7
3.	Evaluation Process	
	i. Continuing Evaluation	
	ii. Mid-term Evaluation	

	iii. End-term Evaluation	
4.	Academic Ambience	7
5.	Opportunity for Peer-Based Learning	7
6.	Opportunity for Further Learning(Breadth and Depth) i. Elective Courses Specialization ii. Minor with Major Discipline iii. Honors Programme in Major Discipline	7 8
7.	E-Assisted Learning i. Availability of Library Resources and Major Search Engines (like Scopus, Web of Science) ii. Multi-Media Assisted Teaching	
8.	In –Curriculum Research/Exploration Opportunity to Students	6
9.	Technical Societies/ Colloquium for Students i. Departmental Society ii. Student Chapter(s) of Professional Societies	7
10.	Faculty –Student Interaction	7
11.	Faculty Mentoring of Students	7
12.	Faculty Advisor System for Students/Class of Students	7
13.	Self Study Courses for Student	
14.	Effective Teaching Mechanism for Enhanced Number of Students in Various Classes	7
15.	Effectiveness of Assisted Learning: Tutorial System for B.Tech Students/ Seminars	7

I.2	**Graduate Programmes (Masters)**	**Score**
1.	Curriculum i. Curricular Structure ii. Course Syllabi iii. Flexibility	 7 7 8
2.	Formal Academic Load on Students i. Teaching ii. Laboratory/Practical iii. Seminar/Dissertation	 7 8 7
3.	Evaluation Process i. Continuing Evaluation ii. Mid-Term Evaluation iii. End-Term Evaluation	
4.	Academic Ambience	8
5.	Opportunity for Peer-Based Learning	7
6.	Opportunity for further Learning(Breadth and Depth) Elective Courses (Specialization Electives)	7
7.	E-Assisted Learning i. Availability of Library Resources and Major Search Engines	

	(like Scopus, Web of Science) ii. Multi-Media Assisted Teaching	
8.	In –Curriculum Research/Exploration Opportunity to Students	7
9.	Technical Societies/ Colloquium for Students i. Departmental Society ii. Student Chapter(s) of Professional Societies	
10.	Faculty –Student Interaction	7
11.	Faculty Mentoring/Supervising of Students	7
12.	Faculty Advisor System for Students/Class of Students	7
13.	Effectiveness of Assisted Learning: Home Assignments/Seminars/Presentations	7

I.3	**Doctoral (Ph.D) Programmes**	**Score**
1.	Pre-Ph.D Courses and Evaluation Process	6
2.	Comprehensive Courses Examination	6
3.	Breadth and Depth of Knowledge of Students	6
4.	Seminar/ Presentations and Technical Communication	6
5.	Average No. of Research Students/Faculty	6
6.	Average No. of Research Papers of Ph.D Students	
7.	Average Duration to Complete Ph.D (years)	7

II. RESEARCH

		Score
1.	Research Ambience in the Department	7
2.	Research Awareness among Doctoral Students	7
3.	Competence Level of Doctoral Students for Research	6
4.	Quality of Research	7
5.	Quality of Publications	7
6.	Impact of Publications	
7.	Relevance of Research to Knowledge Generation	7
8.	Societal Relevance of Research	
9.	Exposure of Researchers to the International State of Art	7
10.	Student Exposure to Attending Quality Conferences/Symposia	6
11.	Growth in Ph.D Programme	7
12.	Quality of Research Infrastructure	7
13.	Utilization of Existing Research Infrastructure	7
14.	Department Initiative on Faculty Hiring	6
15.	Breadth and Depth of Research in the Department	6
16.	Research Intensity of Faculty Members	6

Futuristic areas for hiring faculty members

There is a strong need for hiring faculty in the core areas of metallurgy in view of the retirements and doubling of the class strength size. Some of the newly recruited faculty have specialization in areas which are not connected to metallurgy directly (functional materials, bio-materials, thin film research etc.). It is difficult to get faculty in the core areas of metallurgy now a days. This shortfall can be compensated by employing serving /just retired scientists of R & D centers of major steel industries, non-ferrous sector, manufacturing industries, DRDO, CSIR and DAE laboratories.

There does not seem to be a vision as to which of the futuristic areas the department will focus on. Making impact may be difficult unless the department restricts itself to a few.

Research aspects:

IITR has been known for its classical metallurgy, both in training and in research. Alumni also in these areas seem to have good visibility. This needs strengthening, especially in the context of expansion of metal and infrastructure industries in the country. Process metallurgy seems to be a weak link in the department. Though it may be difficult to find many faculty members to make this a thrust area, some expertise is necessary for the overall growth of both undergraduate and post graduate students.

Strength

At the moment the faculty is young and energetic and the time for completing Ph. D is good (4 years).

Weakness

Low faculty to student ratio, too much load on few labs/ courses and too much emphasis on research activities in Materials Science (Nano-metallurgy).

Progress in areas of materials science, other than that dealing in metals, seems to be haphazard, with no internal synergy.

Suggestions for improvement

The department seems to have made some progress in solid metal processing. This can be an area of focus. However faculty members should be encouraged to move to breakthroughs rather than take the 'follow the leaders approach'.

There is a need for foundation courses for PhD students who do not have a materials background. The

course work should have a judicious mix of core courses which strengthen the candidate's basic knowledge and electives so that he/she is able to understand his Ph. D topic better. The former is required for preparing the research scholar better for job interviews after Ph. D. The latter is required for performing better in the Ph. D defence.

In view of the long waiting times, the researchers should be encouraged to use facilities in other institutes. This has to be organized by the guide. This will reduce the waiting period.

Research activities in classical metallurgy should be enhanced. Some breakthrough area in ferrous metallurgy should be identified such as use on non-coking coal/ use of lean iron ore etc in Indian condition. It is relevant in view of national policy to produce 300MT of steel in India by 2025.

In the western countries most of the innovations which are of direct benefit to society are made in the university laboratories and not in the R&D centers of multinational companies. On this front, the record of the IITs is not very impressive. It will be good to have a center of innovations which will expedite the aforementioned.

III. Departmental Infrastructure

		Score
1.	Adequacy of Class Rooms and Multi-Media Facility	7
2.	Availability of Laboratories	7
3.	Availability of Conference/Seminar Room, etc.	8
4.	Availability of Seating Space for Research Students	6
5.	Availability of Internet Services in Research Labs and Class Rooms	
6.	Departmental Library and E-Resources	
7.	Computing Facilities and Software	
8.	Adequacy of Offices and Furnishing for Faculty	7
9.	Faculty- Student Ratio	6
10.	Support Staff (Technical/Administrative) Adequacy	5

Comments (not more than 100 words for each given below)
Comments:

Strength : Engineering content in the teaching laboratories is still being maintained, which is very good. The department seems to have made several faculty hiring in recent years, who seem to be enthusiastic about research. Department has recently acquired several advanced

characterization/processing equipments. These seem to be accessible to research students. The faculty seems to be going to the teaching labs. to interact with the students rather than leaving everything to the TAs and Lab attendants. At present research space does not seem to be a constraint.

Weakness: Some advanced facilities in the central pool seem to be working sub-optimally: waiting period seems to be so long as to be discouraging to the students.

Some of the equipments for undergraduate labs. need renewal. Moreover numbers of duplicate equipments seem to be inadequate in view of class strength. Hands-on seems to be inadequate. Ambience needs improvement. Further, technical staff for undergraduate laboratories seems to be woefully inadequate: a few of them managing several labs each.

Feedback does not seem to be taken seriously.

Suggestions for improvement

Students feel the newer faculty need to be motivated to perform good teaching. There is a need for recruitment of qualified faculty and supporting staff. There should be provision for improving the skills of the existing technical staff by giving them various types of training. The new faculties who have specialization in non-metallurgy areas should prepare well for delivering the lectures rather than giving a flavour of the subject which is closer to his/her specialization.

IV. Admissions of Ph. D Students

		Score
1.	Intake of Ph.D Students	7
2.	Admission Process	

Suggestions:

Did not have sufficient time to review the admission process.

The requirement of a comprehensive examination is good. Some general mentoring on the process of a doctoral training and research, for example on research methodology, would be beneficial.

Fundamental/bridge courses for non metallurgists pursuing Ph. D courses are essential. Course structure for metallurgist and non-metallurgist to be designed separately. Research program identification to be done with involvement of experts from leading institutes/ industries.

V. Outcomes

		Score
1.	Placements i. Placement of B.Tech/IDD Students ii. Placement of Masters Student iii. Placement of Ph.D Students	6
2.	Average No. of Ph.D.s Awarded per Year	6
3.	Publications per Faculty in ISI Indexed Journals/Year	6
4.	Average Citations per Faculty/Year (Last-Three Years) (Web of Science/Scopus)	6
5.	Recognitions; Awards(National/International) to Faculty/Students	5
6.	Consultancy and Projects	
7.	No. of Ph.D. graduates who took Academics as Career (Based on Data of Last 5 Years)	

Comments and Suggestions for improvement:

The core sector companies should be encouraged to come for campus selection. This will be possible if the core courses have metallurgy orientation. Industry visit should be made compulsory. More emphasis should be given on the summer training and B. Tech project. B.Tech students and Ph. D s should be encouraged to look into possibilities of employment in R& D sector of private and Govt. owned industries/ research laboratories.

The faculty should try to publish in higher impact factor journals. There is a need for enhancement in quality as well as quantity of publications. The faculty should aim at getting awards given by IIM, MRSI and CSIR. They should also try to get the fellowships of the Academies of engineering and sciences. This will not only enhance the prestige of the department, but will also motivate the faculty to do better. The faculty should put effort in making the department of good standing in the country first and then work for its standing in Asia and finally for world ranking. It may be better to restrict to a few areas where number of faculty in each can be sufficient for cooperative growth.

At least in some areas, the faculty should make a mark and try to bring the reputed international conferences in those areas to India. This can be done only if the faculty has some standing in their field.

Date:

(Signature of the Reviewer)

(Name and Address of the Reviewer)