

INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR

### **Proposal for introducing a new subject**

1	Name of the Department	Mathematics
2	Name of the Subject	Commutative Algebra
3	LTP and Credit	3+1+0 (4 credit)
4	Status of the subject	
	(a) Specify the Session, Semester, from which the subject is going to be offered (b) Please Specify the Level of the Subject (c) Whether the subject will be offered as compulsory or elective (d) The semester in which the subject will be offered (e) Name(s) of the Programme(s) in whose curricula this subject will be included	Spring 2015-2016  B. Tech, M.Sc (Mathematics), Integrated M.Sc, Ph. D.  Elective  Spring  (1) 4 <sup>th</sup> semester of 2 year M.Sc. (2) 8 <sup>th</sup> semester of 5 year integrated M.Sc. (3) Research scholars (4) 4 <sup>th</sup> year of B.Tech
5	Prerequisite(s) for the subject, if any (Please give the subject numbers and names)	(1) Linear Algebra (MA30103) (2) Modern Algebra (MA41002)
6	Objective and Contents	
	(a) Objective      (b) Contents (in 100 to 150 words)	To study commutative rings and modules over them. This course will be compulsory to students who would like to specialize or pursue research in the field of pure mathematics (for example: Algebraic Geometry, Number theory, Representation theory).  Commutative algebra: Basics of commutative rings, prime ideals, maximal ideals, primary ideals, nilradical, Jacobson radical, theory of modules: Noetherian rings, Artinian rings, Chinese remainder theorem, modules over PID, localization, tensor products, Noetherian/Artinian modules, modules of finite length, Primary Decomposition , Hilbert basis theorem, Nakayama lemma, integral extensions, going up/going down theorems, Hilbert's Nullstellensatz, Noether normalization theorem.
7	Names of the faculty members of the Department/Centers/School who have the	(1) Dr. Ramakrishna Nanduri (Mathematics) (2) Dr. Vasudeva Rao Allu (Mathematics)

	necessary expertise and will be the willing to teach the subject (Minimum two faculty members should be willing to teach the subject)	
8	Do the contents of the subject have an overlap with any other subject offered in the Institute?	No
9	Recommended Text books/References	
	<p>a) Theory (Text Books)</p> <p>b) References (Literature)</p>	<p>[1] Atiyah, M. F., and Macdonald, I. G., Introduction to Commutative Algebra, Addison- Wesley Publishing Co., Reading, Mass.- London-Don Mills, Ont., 1969.</p> <p>[2] D. S. Dummit and R. M. Foote, Abstract Algebra, 2nd Edition, John Wiley, 2002.</p> <p>[3] Gopalakrishnan, N. S., Commutative Algebra, Oxonian press, 1984.</p> <p>[1] Matsumura, Hideyuki, Commutative Ring Theory, Cambridge University Press.</p> <p>[2] Matsumura, Hideyuki, Commutative Algebra, second edition, Mathematics Lecture Note Series, 56, Benjamin / Cummings Publishing Co., Inc., Reading, Mass., 1980.</p> <p>[3] Zariski, O. and Samuel, P., Commutative Algebra, Vol. I, GTM No.28, Springer-Verlag, New York, 1958.</p>
10	Names of Departments/Centers/Schools/Programmes whose students are expected to register for this subject	Mathematics, CSE, ECE, EE, PHY

Lecture-wise Topics:

Number of Lectures	Topics
3 Lectures	Basics of commutative rings, prime ideals, maximal ideals, primary ideals
1 Lecture	nilradical, Jacobson radical
6 Lectures	theory of modules: Noetherian rings, Artinian rings
3 Lectures	Chinese remainder theorem, modules over PID

4 Lectures	localization
5 Lectures	tensor products, Noetherian/Artinian modules, modules of finite length
4 Lectures	Primary Decomposition
2 Lectures	Hilbert basis theorem
2 Lectures	Nakayama lemma
3 Lectures	integral extensions
2 Lectures	Hilbert's Nullstellensatz
2 Lectures	Noether's normalization theorem

Total: 37 Lectures  
and 10 tutorials.