B.E Semester: 5 Mechanical Engineering
Subject Name: Analysis of Metal Machining Process (ME505-N-E)
[Dept. Elect.-1]

A. Course Objective:

• Basic principles of metal cutting. Mechanical analysis and modelling, cutting resistance, load functions and variation numbers.

• Cutting force measurement and development of equipment for cutting force measurements. Thermal analysis and modelling. Stress analysis of cutting tools.

B. Teaching / Examination Scheme:

Teaching Scheme				Total Credit	Evaluation Scheme					
L	T	P	Total		Theory		Mid Sem Exam	CIA	Pract.	Total
Hrs	Hrs	Hrs	Hrs		Hrs	Marks	Marks	Marks	Marks	Marks
3	0	2	5	4	3	70	30	20	30	150

C. Detailed Syllabus:

Unit No.	Details
1	Fundamental introduction to industrial development and the connections between technology and economy. Focus on the machining process technical results that affect manufacturing economy and how these results are analyzed industrially.
2	Overall material classification from a general perspective. Materials technology from a machining perspective, the influence of the material selection on the machinability and the interaction with other method groups such as casting, forging and joining (welding).
3	Fundamental principles and definitions: Classification of cutting processes., Cutting- and process data., Tool geometries, Application areas for metal cutting, Theoretical surface roughness during machining processes, Chip thickness parameters., Stagnation point and minimum chip thickness, Maximum chip thickness.
4	Mechanical analysis of the machining process: Static cutting forces and their measurement, Modeling of cutting forces, Cutting resistance and specific cutting force, Dynamic cutting forces,
5	Mechanical analysis of the machining process: Intermittent machining processes, Dynamic effects during intermittent machining, Tool stresses Thermal analysis of the machining process: Energy development during the machining process, The adiabatic temperature, The temperature of the machining process, Introduction to time dependent temperature fields.
6	Tribological analysis of the machining process: Contact conditions during the machining process, Built-up edges, layers and TPL-principles Tool wear models and tool life models Introduction to Archard's wear model, Taylor's equation, Colding's equation.
7	Workpiece materials and their machinability: Machining process related classification of materials, Machinability of a workpiece material, Polar diagrams for describing the potential machinability, Machinability of selected workpiece

	materials, Introduction to surface integrity, Introduction to burr formation.

Total hours (Theory):48
Total hours (Practical):32
Total hours:80

D. Lesson Planning:

Sr. No.	Date/Week	Unit	Weight age	Topic No
1	1^{st} ,2^{nd} ,3^{rd}	Unit 1	20%	1
2	4^{th} .5^{th} ,6^{th}	Unit 2	20%	2
3	7^{th} , 8^{th} ,9^{th}	Unit 3	20%	3
4	10^{th} .11^{th} . 12^{th}	Unit 4	20%	4
5	13^{th} , 14^{th} ,$15^{th,}$,16^{th}	Unit 5	20%	5

E. Instructional Method & Pedagogy

1	At the start of course, the course delivery pattern , prerequisite of the subject will be discussed
2	Lecture may be conducted with the aid of multi-media projector, black board, OHP etc. & equal Weight age should be given to all topics while teaching and conduction of all examinations.
3	Attendance is compulsory in lectures and laboratory, which may carries five marks in overall evaluation.
4	One/Two internal exams may be conducted and total/average/best of the same may be converted to equivalent of 30 marks as a part of internal theory evaluation.
5	Assignment based on course content will be given to the student for each unit/topic and will be evaluated at regular interval. It may carry an importance of ten marks in the overall internal evaluation.
6	Surprise tests/Quizzes/Seminar/Tutorial may be conducted and having share of five marks in the overall internal evaluation.
7	The course includes a laboratory, where students have an opportunity to build an appreciation for the concept being taught in lectures. Suggested list of experiment is given below

G. List of Particles:

1	Determination of the cutting resistance and specific cutting force.
2	Study of intermittent machining in respect to engagement and exit while using different tool micro geometries.
3	Measurement of accelerations and dynamic cutting forces.
4	Measurement and modelling of tool wear.
5	Measurement of the nano hardness of both work piece and tool materials and its implications on the machining process.

F. Students Learning Outcomes:

1	Be able to describe the basic principles in metal cutting.
2	Be able to evaluate and describe the acting tool-loads with respect to mechanical, thermal and tribological effects.

G. Text Books & Reference Books:

1	Manufacturing technology by PN Rao
2	Production technology by RK Jain
3	M. C. Shaw, Metal cutting-Principles and Practices, Cambridge University press. 2005
4	Bhattacharya A, Metal Cutting: Theory and Practice, New Central Book Agency, Kolkata, 2007
5	Winston A. Knight and Geoffrey Boothroyd, Fundamentals of Machining and Machine Tools, 3/e, Taylor & Francis Group, 2005.